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ONE HUNDRED YEARS OF
AMERICAN COMMERCE

John Jay

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1795-1895

ONE HUNDRED YEARS OF AMERICAN COMMERCE

CONSISTING OF

ONE HUNDRED ORIGINAL ARTICLES ON COMMERCIAL TOPICS DESCRIBING THE PRACTICAL DEVELOPMENT OF THE VARIOUS BRANCHES OF TRADE IN THE UNITED STATES WITHIN THE PAST CENTURY AND SHOWING THE PRESENT MAGNITUDE OF OUR FINANCIAL AND COMMERCIAL INSTITUTIONS

A History of American Commerce by One Hundred Americans

WITH A

CHRONOLOGICAL TABLE

OF THE IMPORTANT EVENTS OF AMERICAN COMMERCE AND INVENTION WITHIN THE PAST ONE HUNDRED YEARS

EDITED BY

itchell

CHAUNCEY M. DEPEW, LL.D.

ISSUED IN COMMEMORATION OF THE COMPLETION OF THE FIRST CENTURY OF AMERICAN COMMERCIAL PROGRESS AS INAUGURATED BY THE TREATY OF AMITY, COMMERCE, AND NAVIGATION NEGOTIATED BY CHIEF JUSTICE JAY AND APPROVED BY PRESIDENT WASHINGTON IN 1795

Illustrated

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EDITOR'S PREFACE

THIS volume illustrates the dignity of labor, the beneficence of liberty, and the triumphs of invention. It is an epic on the marvels of intelligent work. The wonders of the material development of the most remarkable of the centuries of recorded time are exhibited in this gallery of pen-pictures. They are the word-paintings of artists, each eminent in his own department of beneficent industry. It is an American story; but the United States is the most conspicuous illustration and example of the nineteenth century and its results. Peace and free institutions have furnished the opportunity for individual efforts. States constructed, cities founded, wildernesses settled, and vast populations prosperous in varied industries are the rich contributions of our country to the world's progress in the past hundred years. Capital and labor have caused and shared this creation of power and production, and this volume, which is an encyclopedia of industrial development for a century, written by business men, is appropriately dedicated to the business men of America.

C. M. D.

PUBLISHERS' INTRODUCTION

THE evolution of an idea is always interesting. In submitting to the public this history of American commerce, an explanation of the causes in which it had its inception may most properly premise a review of the finished work. The present year marked for the oldest commercial paper in America, the "Shipping and Commercial List and New York Price Current," the completion of one hundred years of useful existence. In seeking some method of celebrating the centennial in a manner worthy at the same time of the paper and of the business interests of the country, the present idea was evolved. It was decided that in no better way could service be rendered to the American commercial community than by gathering together in compact form the interesting facts of its remarkable development. At first the intention was to present this history in a centennial edition of the paper, and upon this plan the work was begun. Then, as in the end, the plan contemplated the publication of one hundred chapters, written by one hundred men representing the great lines into which our trade and industries had been developed and specialized in recent years. The suggestion of such a work met with most generous welcome in the business world. Its need was recognized at once, and its novelty and value elicited eminent aid. The very success of the idea compelled the changing of the original plan. In the form of a newspaper publication the work would have lacked permanence and breadth of scope. It seemed almost unfair to interest representative men throughout the country, who would bring enthusiasm, ability, and experience to the work of describing the industries of the country, and then to place upon them limitations of space within which they could do justice neither to themselves nor to their subjects. Moreover, it was not solely as a newspaper centennial that the event was of importance; it had a deeper and more extended historical significance. Like the "Shipping and Commercial List" itself, the centennial to be celebrated was but the natural outcome of a great event in the history of our establishment as a nation.

In the year 1795 there was ratified by the Senate of the United States, and formally approved by President Washington, a treaty of amity, commerce, and navigation with Great Britain. This treaty, negotiated by John Jay, of New York, as envoy extraordinary, secured to this country a commercial liberty commensurate with its position of national independence, as recognized in the treaty of peace twelve years before. It conceded the actuality of the national existence, and implied conviction as to its permanence. Above all, it averted the almost certain disaster of a war, then imminent, between the two countries. The confidence it inspired in the business world by its recognition of this country as a treaty power, and the immediate advantages it brought to our commerce, are shown in the fact that the foreign trade of the United States almost doubled in the single year following its making. Arranged at a time when the American people were smarting under a sense of bitter wrong inflicted by Great Britain, the many advantages obtained by the Jay treaty were not, at first, fully appreciated. Political partizanship attacked it blindly, and the great party then clamoring for an alliance with France denounced it fiercely. In its support, the calmer counsels of such great statesmen as Washington and Hamilton, representing the conservative and substantial elements of the nation, finally prevailed, and the treaty was adopted. Time has too fully demonstrated the wisdom of this action to make necessary a further discussion of the long-since-refuted arguments by which the consummation of the treaty was opposed. The era it ushered in was for the nation one of progress and prosperity unprecedented.

The opportunity to celebrate the centennial of our oldest commercial paper as well as that of our country's commercial progress naturally spurred us on to the highest possible attainment. It was determined to have nothing ephemeral or meretricious about the publication, and to make it, not a newspaper issue, but a standard book of reference, prepared under the best literary guidance and made with the best mechanical skill. The opportunity was in every way worthy of the undertaking, for in addition to the commemoration of commercial liberty there was demanded a permanent and authentic record of the results accomplished through this liberty. Properly produced, such a history of American commerce would not only do long-delayed justice to the memory of the patriots of one hundred years ago, but would appreciatively recognize the men who by their industry and genius have aided in the industrial advance of this country, and would provide for the present and the future a source of inspiring and stimulating knowledge of the grandeur of American achievement. It was to this end that this history of American commerce, as it now appears, was undertaken, and in this spirit the work has been carried on throughout. The incentive and the material were at hand, and the men whose influence had directed our commercial activities in the crowning years of the century were still here to aid in making the work authentic and complete.

These considerations were presented to Hon. Levi P. Morton, Governor of the State of New York, and to Dr. Chauncey M. Depew. Governor Morton at once accepted the assignment of "American Banking," and Dr. Depew generously consented to edit the entire work. From this time the success of the undertaking was assured. The merits of the plan impressed the leaders in other lines of industry, and the most generous coöperation followed. In choosing the men to contribute the various articles, the editorial committee, to whom was delegated the authority of selection, considered but one question: Was each fitted by ability and experience to represent the industry with which he was identified? No other question entered into the matter. Political considerations were especially avoided. The work was to be simply a magazine of facts collated by men who knew their significance, and made interesting with the vitality of actual experience,—a book about business, by business men, for business men,—a record of events in the departments of enterprise and production, with such reference to causes and conditions as should be necessary to describe intelligently those events.

If the need of such a history was understood before, it certainly became more impressive as the work upon the book progressed. For a century the commercial history of the United States had remained unwritten, and records such as the compiler of political and universal history finds preserved for his reference, were not obtainable for a work of this character. They were scattered, incomplete and often conflicting, through every conceivable channel, from the old ledger entries of long-forgotten firms to the modern monographs in the files of periodical publications. The wisdom of dividing the work into one hundred chapters written by one hundred contributors now received corroboration anew. Upon no other plan could the data essential to the work have been gathered; nor by any other means could the publication have obtained that historical accuracy and standard of authenticity which a work of this kind must possess to have permanent value. No one historian, however industrious or versatile, could have written "One Hundred Years of American Commerce." Only by the coöperation of the leaders in every branch of industry treated could the desired results have been obtained, and it is here due to the writers of this book to state that, chosen as they have been from the ranks of the busiest men of to-day, they have still found time cheerfully and ably to coöperate for the patriotic purposes of this history of American commerce. In order that the reader may understand something of the plan upon which the work was written by these contributors, we quote from the first letter of suggestions sent out by the editorial committee in charge of the work:

"As to the character of the work. In the varied individuality of style, naturally resultant upon so many contributors, we hope to escape that dullness of machine-made history which keeps so many otherwise useful volumes unread. Therefore upon every contributor we would impress the fact that he should not sacrifice his personal style or preferences. It is not the encyclopedic knowledge of the pedant that the world wants to-day. It is the living acquaintance with men and things, causes and effects, that shall show what is and the promise of what is to be. The information that every successful man has of his own business is of greater value than the statistics of the records. In our work we desire to bring the man and the records together, and to have him show the meaning of the records in the light of his personal and practical knowledge. Is this to be a statistical or a descriptive work? is an important question that has been asked. Are the articles to be nearly all statistics, and is the progress in the various lines to be shown by figures or by words? The answer is that this is to be both a statistical and a descriptive work; but the statistics are to be subordinated to the description, or not used at all unless they are necessary to the description. Description without statistics would have no force; statistics without description would be meaningless to many. The union of the two in the hands of men who know the significance of the statistics they cite will give these articles their interest and weight. In dealing with branch or allied subjects pertinent to the article under discussion, contributors are recommended merely to summarize the cognate subject briefly and with special reference to its application. There are so many ramifications of every great industry that to attempt to follow more than the main story would be impossible. To conform to the centennial feature of the work, it has been decided to limit the number of chapters to one hundred. A history of 'one hundred years of American commerce, in one hundred chapters, by one hundred Americans,' has the ring of a slogan of success. And the men in charge of this work will keep constantly before their minds not only the making of the work, but the making it of such a nature that business men will not only *need* but *want* it. A strong, accurate, and true record, as well as an attractive one, is the aim."

The policy persistently observed has been studiously to refrain from interfering with either the style or method of treatment by which each writer has stamped his own individuality upon his work. The editors have attempted no greater uniformity than that which was necessary to prevent extended and useless duplication in allied subjects. If, therefore, the reader of this book finds that its chapters are not always uniform in length or treatment, he is but noting the differences which must exist in literary work among one hundred men. In these very differences exists one of the most interesting and most effective phases of the history. In presenting the book herewith it is only necessary to add that each article bears the trade-mark of its quality in the signature of its contributor. When it is further recalled that actual personal knowledge covering from one half to two thirds of the century under discussion, and directly received but hitherto unpublished oral tradition concerning the remainder, are possessed by the majority of the relators, the present work has had sufficient testimony to its worth. The figures accompanying each article are such as are deemed the most authentic, and have been derived from every available source. In the frequent preference given to the reports of the United States census the writers have taken the stand that, however imperfect these may have been found in certain particular instances, they are still, taken collectively and with due regard to their official nature, the soundest basis for comparisons covering extended periods. Where particular trades have preserved their own records, and these have been considered reliable, figures have been based upon them, while in other instances special statistics personally compiled by the writer have been given. In all these cases the figures given are considered the most authentic by the writers, and this judgment by them must be the support for their accuracy.

The method pursued in dividing the work into its one hundred chapters so as both to comprehend and to distinguish all the great factors in the industrial activities of the country will be apparent upon examination of the Table of Contents. Beginning with great national interests, as banking and interstate commerce, the classification follows through the great corporate subdivisions of industry,—as the telegraph, ship-building, newspapers,—then through the products of the earth — as cotton, rice, and sugar — and our natural resources,— as mines, live stock, etc.,— and so on down through the long list of manufactures in which the genius of America has been shown, to the mercantile activities comprised under the various trades. The chapter numbered XCIX, "Other Industries," was introduced to provide representation for other more or less important industrial factors not elsewhere treated.

The editorial management of the history, under Dr. Depew, has been conducted by Mr. Thomas C. Quinn. Of the associate editors whose work deserves mention are Mr. Wesley W. Pasko, Mr. William Douglas Willes, and Mr. Charles Frederick Stansbury. Mention should be made also of the work of Mr. John Winfield Scott, whose wide acquaintance and patriotic labors did much toward making possible the final successful result. For the typographical excellence of the book-maker's art evidenced in this volume, credit is due to the De Vinne Press, to whose reputation for elegance and fine work little can be added. The art work of the history was placed in charge of the artist William C. Smith, of whose skill many of the portraits in this work give evidence. The engraving of the portraits drawn by Mr. Smith, as well as the reproduction of the other portraits, was done by the Gill Engraving Company. Words of recognition are also due to the L. L. Brown Paper Company, of Adams, Mass., for their care in the manufacture of the hand-made paper for the authors' edition of the history.

One result of the work upon this history which was not directly foreseen when the project was conceived has been the setting aside of December 19th as "Commercial Day," in honor of the centennial of American commercial liberty, and in recognition from year to year hereafter of the beneficent results of American industry and enterprise which this history of American commerce both demonstrates and commemorates. The idea of this celebration came to Dr. Depew through his editorial work on this history. His suggestion of Commercial Day has already been taken up throughout the country. The Chamber of Commerce and the Board of Trade of New York led off in the movement. In the resolutions passed by the Chamber of Commerce their leadership in the promotion of Commercial Day was most strikingly justified by allusion to the fact that it was the solid men of New York, as represented by the Chamber of Commerce one hundred years ago, who, uninfluenced by partizan clamor, came to the assistance of President Washington in securing calmer consideration for the Jay treaty. Commercial Day this year will be celebrated with a banquet in New York at Delmonico's, given under the auspices of the editors and contributors to this history of American commerce, and to which have been invited representative business men in all lines of industry and from all sections of the country. Chambers of Commerce and Boards of Trade throughout the country, following the example set by New York, will commemorate the day with appropriate exercises. From 1895, the centennial of American commercial liberty, will date Commercial Day, devoted to the interests of American trade and to renewing from year to year the vigor of our national patriotism and enterprise.

In the closing days of the work on this history the painful news of the death of Mr. Frederic Gunther was received. Only a few days before his death Mr. Gunther had revised the proof of his article on the fur trade for the history. This contribution from his experience will remain to testify to his ability and the success of his business career.

We must finally express our deep sense of obligation to the one hundred Americans who have coöperated in the production of this history, and to whose enthusiasm, experience, and ability it is a lasting monument. That our part has been done in a manner which shall be considered worthy of them and of the commercial interests of our country is the highest praise for which we hope.

THE PUBLISHERS.

December 10, 1895.

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THE CHRONOLOGY OF AMERICAN COMMERCE AND INVENTION

WITH OTHER IMPORTANT HISTORICAL EVENTS

1795.

Second Year, President Washington's Second Term.

President, GEORGE WASHINGTON, Virginia.
Vice-President, JOHN ADAMS, Massachusetts.
Secretary of State, EDMUND RANDOLPH, Virginia.
Secretary of the Treasury, ALEXANDER HAMILTON, New York.
Secretary of War, HENRY KNOX, Massachusetts.
Postmaster-General, TIMOTHY PICKERING, Massachusetts.
Attorney-General, WILLIAM BRADFORD, Pennsylvania.
Speaker of the House of Representatives, F. A. MUHLENBURG, Pennsylvania.

Secretary Hamilton annonnced his redemption policy, Jan. 15.

Jacob Perkins, of Newburyport, Mass., patented a machine for cutting and heading nails, Jan. 16.

Secretary Hamilton resigned, and Oliver Wolcott, of Connecticut, sncceeded him, Jan. 31.

Federal money first reckoned by decimal system of dollars, cents, and mills, Feb. 5.

Joseph Habersham, of Georgia, appointed Postmaster-General, in place of Timothy Pickering, resigned, Feb. 25.

National flag established with fifteen alternate red and white stripes, and a blne nnion with fifteen white stars, May 1.

Jay Treaty ratified by the Senate, Jnne 24; ratifications exchanged between the two countries, Oct. 28; formally announced by President Washington to the House, December.

The United States agreed to pay annual tribute to the Dey of Algiers to secure exemption from pirates, Sept. 5.

Spain conceded the free navigation of the Mississippi River, and the Florida bonndaries were established, Oct. 27.

Charles Lee, of Virginia, appointed Attorney-General, in place of William Bradford.

Timothy Pickering appointed Secretary of State vice Edmund Randolph, resigned, Dec. 11.

First issue of the New York Prices-Current, now the Shipping and Commercial List and New York Price-Cnrrent, Dec. 19.

Étienne Boré developed an improved method for the extraction of sugar from the cane.

1796.

Tennessee admitted to the Union, June 1.

John Fitch ran the first screw boat nsing steam power on the Collect, New York, Angust.

French Directory refused to recognize the United States Minister, Charles C. Pinckney, of South Carolina, Sept. 11.

Washington issned his farewell address, Sept. 17.

Binny & Ronaldson established in Philadelphia the first permanent type-foundry.

New York Insnrance Company, the second in the conntry to take marine risks, incorporated.

Major Isaac Craig and Colonel James O'Hara established the first glass-works in Pittsbnrg.

1797.

John Adams inangurated, March 4.

Thomas Newbold of New Jersey patented first cast-iron plow, June.

Yellow fever epidemic at Philadelphia and New York, Ang.

French Directory issned decree against American commerce.

Philadelphia Qnakers petitioned Congress against slavery.

1798.

Navy Department created. George Cabot first secretary, May.

Congress suspended commercial relations with France, June.

Alien and Sedition laws passed, Jnly.

First salt manufactory established in Ohio.

Joseph Hopkinson wrote "Hail Colnmbia."

Imprisonment for debt to the United States abolished.

First machine for making combs patented by Isaac Tryon.

First American vessel launched on Lake Erie.

First merino sheep bronght from Spain by Hon. William Porter.

1799.

Napoleon overthrew the French Directory, and commercial relations with this conntry were restored, Angust.

George Washington died at Monnt Vernon, aged 67, Dec. 14.

The government paid 8 per cent. for a $5,000,000 loan.

Yellow fever epidemic in New York.

The Manhattan Company chartered in New York.

First shipment of ice from New York to Charleston, S. C.

Eliakim Spooner took ont first patent for a seeding machine.

1800.

Epidemic of yellow fever at Baltimore, August.

War office and Treasnry bnilding at Washington bnrned, September.

Congress first assembled at Washington, Nov. 22.

General bankrnptcy law passed, December.

The Second Census gave the popnlation of the conntry as 5,308,483.

United States first imported india rnbber at Boston.

1801.

John Marshall chief justice of the United States, Jan. 20.

Thomas Jefferson inangurated, March 4.

Tripoli declared war against the United States, June 10.

The federal judiciary reorganized.

Quarantine established on Staten Island.

First sheet-copper turned out from Panl Revere's mill at Canton, Mass.

Congressional Library established.

1802.

West Point Military Academy established, March 16.

Ohio admitted to the Union, Nov. 29.

Process for making potato starch patented by John Biddis, of Philadelphia.

First important powder-works established by Eleuthère I. du Pont.

Philadelphia Chamber of Commerce established.

Abel Porter & Company commenced the manufacture of gilt bnttons in Connecticut.

1803.

Lonisiana pnrchased from France for $15,000,000, Apr. 30.

Richard French and J. T. Hawkins patented the first contrivance for reaping machines, May 17.

First cotton mill established in New Hampshire.

Crawford built the first tavern in the White Mountains for summer tourists.

First bank established in Cincinnati.

1804.

Lewis and Clark started to explore the Northwest, March.

Machine-embroidering introduced by John Duncan, May.

New Jersey's slaves freed, July 4.

The Burr-Hamilton dnel at Weehawken, N. J., July 11.

Chicago first settled as a trading post by John Kinzie.

National Bankruptcy Act repealed.

Middlesex Canal completed between Boston and the Concord River.

The manufacture of white lead begun by Samnel Wetherill in Philadelphia.

Captain John N. Chester imported the first bananas.

Almy & Brown of Providence, R. I., made first consignment for sale of American cottons to Elijah Warren of Philadelphia.

1805.

Peace with Tripoli, June 3.

Robert Fulton originated the marine torpedo.

First cargo of ice for export shipped to Martinique by Frederick Tudor.

First drove of cattle on the hoof for the Eastern market crossed the Alleghanies.

Printers' ink first manufactured here.

1806.

England proclaimed the blockade of the European ports, June 16.

France by Berlin decree proclaimed the blockade of English ports, Nov. 21.

The first cargo of anthracite coal shipped to Philadelphia from the Pennsylvania mines.

First confectionery factory established in New York by Ridley.

David Melville, of Newport, R. I., made earliest use of gas to light his house.

First American saws manufactured by William Rowland, of Philadelphia.

1807.

Aaron Burr's trial for treason began, May 22.

Fulton's first steamboat, the *Clermont*, made the trip from New York to Albany, Ang. 11.

Aaron Burr acquitted, Sept. 1.

The Embargo passed by Congress, Dec. 22.

Patent shot-tower of Paul Beck built on the Schnylkill.

Eli Terry, of Plymouth, Conn., began the manufacture of clocks by machinery.

Machine for the simultaneous cutting and heading of tacks patented by Jesse Reed, of Bridgewater.

Shipment of ice from Boston to Havana commenced.

Anthony Tiemann introduced the manufacture of colors.

First wheat-starch factory started at Utica by Edward and John Gilbert.

1808.

Importation of slaves forbidden, Jan. 1.

The *Phœnix*, built by John Stevens, of Hoboken, made first sea trip by steamboat, between New York and Philadelphia.

American Fur Company fonnded by John Jacob Astor.

First patent for stoves to warm by rarefied air granted to Daniel Pettibone, of Philadelphia.

Bakewell and Page inaugurated the mannfacture of flint-glass at Pittsburg.

First queensware made by Columbia Pottery Company at Philadelphia.

1809.

James Madison inaugurated, March 4.

Embargo removed except to French and English ports, March 15.

Cotton duck for sail-cloth first made in the United States.

Abel Stowell, of Worcester, Mass., patented a machine for cutting screws.

Discovery of Manhattan Island celebrated by a banquet at the old City Hotel, New York.

1810.

The Third Census gave the population of the country as 7,239,881.

Peregrine Williamson, of Baltimore, made the first metallic pens.

Astoria, Oregon, founded by the Pacific Fur Company and John Jacob Astor.

Kaolin discovered at Monkton, Vermont.

Plan for cantaliver bridge across East River proposed by Thomas Pope.

George Frederick Cooke, the English actor, inaugurated the star system in American theatres.

Simmons and Rundel, of Charleston, S. C., patented a process for saturating water with "fixed air," producing a sort of soda water.

1811.

The first steamboat left Pittsburgh for New Orleans via the Ohio and Mississippi rivers, Oct. 27.

Gen. Harrison defeated Tecumseh at Tippecanoe, Ind., Nov. 7.

Congress refused to recharter the Bank of the United States.

First steam ferry-boat ran between Hoboken and New York.

Wooden shoe pegs invented.

Exports of flour exceeded 1,000,000 barrels for the first time.

1812.

A ninety days' embargo proclaimed, Apr. 4.

Louisiana admitted to the Union, Apr. 30.

War declared against England, June 18.

Engagement between the Constitntion and the Guerrière, Aug. 19.

The first pin factory was established in New York.

Pittsbnrgh started the first rolling-mill.

1813.

Engagement between the Chesapeake and Shannon, June 1.

Commodore Perry's great Lake Erie victory, Sept. 13.

Two New York men began the manufactnre of hair-cloth at Rahway, N. J.

First Brooklyn ferry ran.

Stereotyping and printing from stereotype plates was introduced.

First complete mill in the world for turning out raw cotton as finished cloth, established at Waltham, Mass.

Illnminating gas apparatns patented by David Melville.

Francis C. Lowell brought out the power-loom.

1814.

Washington captured by the British, and public bnildings and records bnrned, Aug. 25.

Specie payment suspended, Sept. 1.

Delegates from New England States convened at Hartford, Conn., to devise defense against the British independently of the National Government, Dec. 15.

Treaty of peace with England signed at Ghent, Dec. 24.

Steel plate engraving invented by Jacob Perkins, of Newbnryport, Mass.

1815.

Gen. Jackson defeated the British at New Orleans, Jan. 8.

War against the United States declared by the Dey of Algiers, March.

Commercial convention with England signed, Jnly 3.

Secretary of the Treasury Dallas proposed a protective tariff.

Steam-power first applied to machinery for cabinet-making.

The first steamboat ascended tbe Mississippi to Louisville.

1816.

First savings-bank opened in America, at Philadelphia, November.

Indiana admitted to the Union, Dec. 11.

Lighting the streets with gas introduced at Baltimore.

First Seminole war.

Concessions granted by the Spanish government allowing shipment of ice to Cnba.

Black-Ball packets, the first line, established between New York and Liverpool.

1817.

United States Natioual Bank opened again at Pbiladelpbia, Jannary.

James Monroe inangurated, March 4.

Ground broken in construction of Erie Canal, July 4.

Mississippi admitted to the Union, Dec. 10.

Steam-power first applied to paper-making at Pittsburgh.

Work begun by the United States Coast Snrvey.

First Deaf and Dumb Asylum established at Hartford, Conn.

Harper's publishing house founded.

Gas employed in ligbthouse illumination by David Melville.

Thomas Gilpin & Co. operated the first cylinder machine for making paper at Wilmington, Del.

Steam navigation began on Lake Erie.

1818.

Congress established the flag with thirteen stripes, and a star for each State, Apr. 14.

Illinois admitted to the union, Dec. 3.

Western State banks suspended.

Reed principle for mnsical instruments patented by Aaron Merrill Peasley.

First line of steam packets on Long Island Sound between New York aud New Haven.

Elisha Mills began the packing industry at Cincinnati.

First stage-coach over the Cumberland road to Wheeling.

The internal revenue tax on whisky abolished.

Du Pont powder-works destroyed by terrific explosion.

First drove of western cattle bronght to New York.

1819.

Florida purchased from Spain for $5,000,000, Feb. 22.

The first paper devoted to agricultnral interests pnblished at Baltimore, Apr. 2.

The Odd Fellows organized at Baltimore, Apr. 26.

Steamship Savannah started on first trans-Atlantic trip of steam-vessel, May 21, and arrived at Liverpool, Jnne 20.

Alabama admitted to the Union, Dec. 14.

Seth Boyden began the manufacture of patent leather at Newark.

The manufacture of porcelain from domestic materials was begun in New York by Dr. H. Mead.

Great financial depression existed.

First savings-bank opened in New York.

John Conant of Vermont invented his cooking-stove.

Plow with interchangeable parts patented by Jethro Wood.

Ezra Daggett and Thomas Kensett pnt np the first canned goods in New York.

1820.

Thomas Blanchard patented the gun-stock lathe, Jan. 20.

Maine admitted to the Union, March 15.

The Fourth Census gave the population of the conntry as 9,633,822.

Anthracite coal first used snccessfully for the generation of steam at Philadelphia.

The first steamboat ran on Lake Michigan.

First rubber shoes imported from Sonth America.

Daily meeting with regular call of stocks begun on "Change."

The United States Pharmacopœia established.

1821.

Missouri Compromise adopted, Feb. 26.

General Jackson took possession of Florida on behalf of tbe United States, July 1.

Missonri admitted to the Union, Ang. 10.

New York quarantine station and hospitals established at Castleton, S. I., September.

Sophia Woodhouse, of Wethersfield, Conn., patented the straw hat, Dec. 25.

American Colonization Society secnred Liberia, December.

Bronze printing patented by George J. Newbnry.

Remains of Major André removed from Tappan, N. Y., to Westminster Abbey, London.

The rotary steam-engine patented by Mr. Ward, of Colnmbia, S. C.

The first college of pharmacy established at Philadelphia.

1822.

Treaty of commerce and navigation conclnded with France, Jnne 24.

The Merrimac Manufacturing Company started the city of Lowell, Mass., Sept. 3.

Mason and Baldwin of Philadelphia began engraving cylinders for calico printing.

First patent of artificial teeth secured by C. M. Graham.

Iron conduit pipes were first used in the Fairmount Water Works at Philadelphia.

Thomas Skidmore of New York introduced India rubber tnbes for gaseous fluids.

Naval expedition sent against the West Indian pirates by United States.

Lock conlter for plows patented by David Peacock of New Jersey.

Depan's line of Havre packets established.

The first wheel mill for incorporating powder erected on Brandywine Creek, Del.

Luke Davies opened the first store distinctively for men's fnrnishing goods.

1823.

Monroe Doctrine promulgated, Dec. 2. European powers not to be permitted to interfere with the independent States of America, or to acquire dominion on this continent.

First steam-power printing-press set up in Albany by a printer named Van Benthnysen.

Champlain Canal, connecting the Hudson at Albany with Lake Champlain, opened.

Manufacture and tin-plating of lead pipe for stills was begun in New York by Thomas Ewbank.

The first smelting-works in the lead region of the npper Mississippi erected by Col. James Johnson of Kentucky.

Nicholas Longworth of Cincinnati commenced the making of wine with the muscatel grape.

First corporation for the manufacture of gas started as the New York Gas-Light Company with a capital of $1,000,000.

1824.

Lafayette arrived at Staten Island on his visit to the United States, Aug. 15.

The geological survey of North Carolina was begun by Denison Olmsted.

Zadoc Pratt established a great hemlock tanning factory in Greene Co., New York.

Cape Cod began to manufacture isinglass from hake.

The first juvenile reformatory established in New York.

Glazed-ground wall-papers were first made.

1825.

John Quincy Adams inaugurated, March 4.

Corner-stone of Bunker Hill Monument laid by Lafayette, June 17.

Isaiah Lukins of Philadelphia patented the lithotritor in England, Sept. 15.

First boats left Buffalo by the Erie Canal, Oct. 26.

De Witt Clinton and the first boats arrived in New York via the Erie Canal, and a grand celebration took place in this city, Nov. 4.

First performance of Italian opera at New York, Nov. 29.

Isaac Babbitt, of Tannton, Mass., invented Babbitt metal and commenced the manufacture of Britannia ware.

William Ellis Tucker commenced the manufacture of porcelain at Philadelphia.

The so-called labor movement first came into prominence.

The circular saw brought out by Mr. Richardson of Philadelphia.

Taylor & Rich erected the first mahogany mill.

1826.

Eli Whitney, inventor of the cotton gin, died, Jan. 8.

New England Society for the Promotion of Manufactures and the Mechanic Arts chartered, March 3.

Death of John Adams and Thomas Jefferson, July 4.

First railroad with metal rails from Quincy, Mass., to tide water, three miles away, Oct. 7.

James Oram, founder of the Shipping List and New York Price Current, died Oct. 27; born May 10, 1760.

National Academy of Design founded in New York.

Power-loom for weaving wire invented by John S. Gastrin, of New York.

Manufacture of palm-leaf hats begun in Massachusetts.

Ice first cut on Rockland Lake and retailed in New York.

Failures of the great tea importers cansed a heavy loss to the Government in customs duties.

Composition rollers for printing presses first used.

W. Kendall patented the insertable tooth for rotary saws.

1827.

Switchback Railroad operating by gravity opened at Mauch Chunk, Pennsylvania, Jan. 8.

First general convention of the manufacturing interests of the country held at Harrisburg, Pa., July 30.

English artists introduced lithography at Boston.

James McClintin of Chambersburg, Pa., invented the first practical contrivance for mortising and tenoning.

The manufacture of wood type was begun at New York by Darius Wells.

The first bell made from blistered bar steel in New York.

Rope factories first applied steam as power at Wheeling.

Sandwich Glass Company made first pressed glass.

First drove of hogs entered Chicago.

Stone for Bunker Hill monument qnarried at Quincy.

Harrison Gray Dyar constructed an electric telegraph on Long Island.

Jacob Perkins built a compound stationary engine, using steam of 1400 ponnds pressure.

1828.

The American Institute organized, Feb. 19.

Heavy duties laid on imported fabrics of cotton or wool, May 15.

The first wool sale was held at Boston and brought $300,-000, Jnne 10.

First edition of Webster's American Dictionary published, June.

First American power-loom for weaving checks and plaids patented by Rev. E. Burt, of Conn., August 19.

Franklin Institute medal awarded Seth Boyden for first buckles and bits made of annealed cast iron, Oct. 16.

First patent for locomotive issued to William Howard of Baltimore.

Manufacture of varnish begun in New York by P. B. Smith.

William Woodworth of Hudson, N. Y., invented the first machine for planing, cutting, tonguing, and grooving boards.

Sea Island cotton first appeared in the market.

The first trip-hammer shop for the manufacture of axes built by Samuel Collins, at Collinsville, Conn.

Mannfacture of horse collars begun by Timothy Deming at East Hartford, Conn.

Carbondale Railroad, the first on which a locomotive was used, built.

1829.

Andrew Jackson inaugurated, March 4.

Safety Fnnd Banking Act passed in New York State, April.

First annual fair at Castle Garden of the American Institute of the State of New York, Nov. 1.

Hamilton Stewart began in Philadelphia the manufacture of damask table linen, December.

Tin ore discovered at Goshen, Conn., by Prof. Hitchcock.

The manufacture of sewing silk by machinery begun by James Conant at Mansfield, Mass.

Dr. John M. Revere of New York perfected the process of galvanizing iron.

First paper from grass and straw fiber made by machinery by G. A. Shryock, of Philadelpbia.

The *Stourbridge Lion*, the first locomotive ever run in this country, arrived from England.

First American locomotive constrncted by Peter Cooper for the Baltimore and Ohio R.R.

1830.

Joseph Smith organized the first Mormon Church at Manchester, N. Y., Apr. 6.

The Welland Canal between Lakes Erie and Ontario completed, Aug. 3.

The City of Chicago was laid out, Aug. 4.

The Fifth Census gave the population of the conntry as 12,866,020.

The first astronomical telescope was erected at Yale.

Josepb Dixon began the manufacture of lead-pencils at Salem, Mass.

First native Georgia gold came to the United States.

The omnibns first appeared in the streets of New York.

Windbam, Conn., turned ont the first Fourdrinier machines.

Tbe Baltimore and Ohio Railroad opened its first section operated by horse power.

Holmes, Hotcbkiss, Brown & Elton commenced the manufactnre of sbeet brass at Waterbury, Conn.

First locomotive constrncted in the United States for actual service, the *Best Friend*, built at West Point Fonndry Works for the South Carolina Railroad.

1831.

The first train drawn by a locomotive ran on the South Carolina Railroad, Jan. 15.

The Mohawk and Hudson Railroad opened in September.

Discovery of chloroform announced by Samnel Guthrie, of Sackett's Harbor, N. Y., Oct. 12.

The first four-wheel car trucks used on the South Carolina Railroad.

Timothy Bailey of Albany invented the power-loom for stocking knitting.

The Morris Canal opened, connecting Newark with the Delaware river.

The West Feliciana Railroad, the first west of the Alleghanies, incorporated in Louisiana.

The Baldwin Locomotive-Works established in Philadelphia.

Pennsylvania inaugurated a system of internal improvements, consisting of 292 miles of canal and 126 of railroad.

1832.

Asiatic cbolera made its first appearance in New York, June 21.

Commercial and financial distress, July to October.

The first street-railway in tbe country opened in New York between City Hall and Fourteenth street, November.

Davis & Gartner, of York, Pa., built three locomotives of tbe grasshopper pattern for tbe Baltimore and Ohio Railroad.

The Nullification Ordinance passed by Soutb Carolina.

First hogs packed in Chicago by George Dole.

Egbert Egberts, of Cohoes, brought ont the power knitting-machine.

First cargo of Sicily oranges and lemons imported.

Mannfacture of table cntlery begun in this conntry.

Use of tan-bark in manufacture of white lead introduced.

First soda water apparatns manufactured by John Matthews of New York.

Trowbridge, Dwight & Company established the wholesale clothing manufacture at New Haven.

First shirt factory established by David & Isaac Judson in New York.

Swiveling fore-end truck for locomotives introduced to general use.

1833.

The first cargo of American ice was exported to India by Frederick Tudor, May.

The "New York Sun" founded, Sept. 3.

Government funds withdrawn from tbe Bank of the United States, October.

The first company to import and brced cattle organized, Nov. 2.

Commercial treaties were entered into with Austria, Turkey, and the Two Kingdoms of Sicily.

Treasury Building at Washington was burned.

Obed Hussey patented and exhibited in Ohio the first practical reaping-machine.

Ross Winans built the first typical American passenger cars.

The Roxbury India-Rubber Company, tbe first in the business, organized.

Samuel Preston invented tbe pegging-machine.

The crossbead pump for snpplying feed-water to the boiler in locomotives introdnced.

1834.

New York National Guard called out for the first time in suppressing tbe anti-abolition riots, April.

Cornelins M. Lawrence first mayor chosen by vote of the people in New York, May.

Cyrns Hall McCormick patented his reaper, June 21.

The first vessel arrived at Chicago from the lower lakes, July 12.

Lathe for tnrning lasts patented, Dec. 25.

First attempt at crusbing the oil from cotton-seed made at Natchez.

Screws were first made entirely by machinery.

Rope-yarn spinner invented in New York.

The first saw-mill in the Saginaw valley built by Harvey Williams.

Half-crank locomotive driving axles introduced.

The manufacture of door locks begun in Connecticut.

1835.

New York voted to begin the Croton Aqnednct, March.

Solyman Merrick, of Springfield, Mass., patented the first practical screw wrench, Aug. 17.

Texas declared independence, Nov. 7.

Great New York fire. Loss $20,000,000, Dec. 16.

Cbicago opened her first bank and organized a fire department.

The first house was built on tbe site of San Francisco.

Samuel Colt began the manufacture of the revolving pistol.

The circular web knitting-machine invented in Connecticut.

Horseshoes were first made by machinery by Henry Burden, at Troy.

Improved methods of minting introduced from Europe by Franklin Peale.

Pins first made by machinery in New York.

Gas companies organized in Philadelphia and New Orleans.

The "New York Herald" established.

The first furnaces made in New England by William A. Wheeler, of Worcester, Mass.

Professor Morse exhibited his telegraph in the University of New York.

First link in rail connection of New York and Boston formed by the opening of the Boston and Providence Railroad.

1836.

President Nicholas Biddle secured, on Feb. 13, a charter from the State of Pennsylvania for the Bank of the United States, tbe Federal charter of whicb expired March 30.

Arkansas admitted to the Union, June 15.

Specie Circular issued, July 11.

First patent of friction match granted Alonzo D. Phillips, of Springfield, Mass., Oct. 24.

United States Patent Office and contents burned, Dec. 15.

The manufacture of fine-cut cbewing tobacco by macbinery commenced at Centreville, Miss.

Brigham Young was elected president of the Mormons.

First sleeping-car ran on the Cumberland Valley Railroad.

First transatlantic cotton freigbt steamship built for Savannab merchants.

The first cargo of wheat shipped on Lake Michigan for Buffalo.

Astor House opened in New York.

First American patent issued for a typewriting machine.

E. R. Campbell patented the coupling together of two pairs of locomotive driving-wheels.

Rubber belting patented.

Power presses introduced for magazine and newspaper printing.

James Atwater, of New York, brought out the illuminated case stove.

J. & L. K. Bridge imported from Sicily the first cargo of flaxseed.

1837.

Fire at Charleston, S. C., Apr. 27, destroyed 1158 buildings.

Michigan admitted to the Union, Jan. 26.

Martin Van Buren inaugurated, March 4.

Suspension of banks and general panic, May 10.

Sub-treasuries recommended by President Van Buren, Sept. 4.

Pitts Brothers patented tbe combined threshing and cleaning-machine, Dec. 29.

Chicago incorporated as a city.

Capt. John Ericsson successfully applied tbe screw propeller to steam vessels.

The fancy weaving loom was patented by William Crompton.

Canning of corn commenced at Philadelphia by Thomas B. Smith.

Counterbalance weights introduced for locomotive driving-wheels.

1838.

Fire at Charleston, S. C., Apr. 27, destroying 1158 buildings.

The Specie Circular repealed, May 31.

Congress constituted every railroad a postal route, July 7.

Capt. Charles Wilkes started on his South Sea explorations, Aug. 18.

The National Silk Society organized at Baltimore, Dec. 11.

First New Jersey zinc ores smelted at Washington.

Branch United States mint established at Dahlonega, Ga.

The Smitbsonian Institution founded in Washington.

Solid pin heads first manufactured at Birmingham, Conn.

Dimond Chandler began tbe manufacture of gold spectacles and silver thimbles at Longmeadow, Mass.

Elisba H. Root, of Collinsville, Conn., invented the first machine for punching and making the eyes of axes, hatchets, and hammers.

First shipment of wbeat from Chicago.

David Bruce Jr., invented the type-casting machine.

First tiles made by Abraham Miller at Philadelphia.

Steam introduced in beating processes in sugar-refining.

1839.

The first express started by W. F. Harnden between New York and Boston, March 4.

The United States Bank, rechartered by the State of Pennsylvania, failed, Oct. 10.

John William Draper, professor of chemistry in University of New York, took the first photograph from life, November.

Hot-water heating introduced at Niblo's conservatory.

The ice-plow invented.

First pottery built at East Liverpool, O.

1840.

Adams Express commenced between New York and Boston, May 4.

First successful iron-furnace witb anthracite and hot-blast fired by David Thomas at Catasanqna, Pa., July 4.

Steamship *Britannia*, the first Cunard liner, left Liverpool for New York, July 4.

The Sixth Census gave the population of the country as 17,069,453.

The first castings for structural iron made.

John Ames, of Springfield, Mass., patented tbe first machine for making, ruling, and cutting paper.

Henry Disston commenced the manufacture of saws.

Patent for the electric telegraph issued to Professor Morse.

Jonas Chickering patented the grand piano with full iron-frame.

First advertising agency opened in Philadelphia by Volney B. Palmer.

The manufacture of blasting-powder begun.

Edwin Hodges bnilt first brass-wire-drawing mill at West Torrington, Conn.

The American bnggy first came into general use.

A walking-beam electric engine constructed by Davis & Cooke.

1841.

William Henry Harrison inaugurated, Marcb 4.

President Harrison died and Vice-president Tyler succeeded him, Apr. 4.

First edition of Horace Greeley's *Tribune*, Apr. 10.

First steam fire-engine completed and used in New York, July.

President Tyler vetoed a bill for a United States Bank, Aug. 16.

A second bill for a United States Bank vetoed, Sept. 9.

The india-rubber ball patented by Edwin Chaffee, of Cambridgeport.

Congress passed a general bankruptcy law.

Samuel Slocum, of New York, invented a machine to stick pins in paper.

The manufacture of the metal stencil was begun in Boston by John Pope.

First electrotypes appeared in "Mapes' Magazine."

Frederick E. Sickles invented the drop cut-off valve gear for steam-engines.

Tbe first mercantile agency established.

Making of Connellsville coke commenced.

Canning of Maine salmon begun.

The city of Philadelphia acquired its own gas plant.

1842.

Dorr's Rebellion in Rhode Island, May 18.

Fremont's first western expedition, June 10.

Croton water was let into the Fifth Avenue aqueduct, July 4.

Professor Morse laid first submarine telegraph wire between New York and Governor's Island, Oct. 18.

President proclaimed treaty settlement with England of the Northwestern Boundary question, Nov. 10.

The first attempt at a machine for sewing was made by J. J. Greenough, but proved impracticable.

Reuben Partridge patented the match-splint machine.

John Ryle built the first silk piece loom at Paterson, N. J.

Walworth & Nason introduced the Perkins hot-water heater.

Thomas Kingsford discovered and perfected a process for making starch from corn.

American ice first exported to London.

First factory for pocket-knives established in Connecticut.

1843.

Ericsson built the *Princeton*, the first screw war vessel in the world.

Napoleon E. Guerin introduced hatching of eggs by artificial heat.

The manufacture of manilla grass paper was begun in Boston by Lyman Hollingsworth.

Improvement in pills patented by Benjamin Brandreth.

Patent issued to Enos Wilder for the first fire-proof safe.

Congress voted an appropriation of $30,000 to Professor Morse for an experimental telegraph line between Washington and Baltimore.

1844.

Prof. Morse sent a telegraphic message from Baltimore to Washington, May 27.

Treaty with China opened several ports there to trade and residence, July 3.

United States recognized the independence of the Sandwich Islands, July 6.

U. A. Boyden built the first turbine water wheel for a Lowell cotton mill, August.

Williams & Ketcham patented the first mowing-machine, Nov. 18.

Copper mining was commenced in the Lake Superior region.

Patent granted to Charles Goodyear for the vulcanization of rubber.

First wall-paper printing-machine imported from England.

Leverett Candee made first boots and shoes from vulcanized rubber.

Power-loom for ingrain carpets invented by Erastus B. Bigelow.

A. D. Puffer, of Boston, secured a patent for the first soda-water cooler.

1845.

President Tyler authorized the annexation of Texas, Mar. 1.

Florida admitted to the Union, March 3.

James K. Polk inaugurated, March 4.

Telegraph line between Baltimore and Washington opened for the public business, April 1.

Fire did $10,000,000 damage in Pittsburg, Apr. 10.

Naval Academy founded at Annapolis, Oct. 10.

Texas admitted to the Union, Dec. 29.

Anti-rent riots in New York State.

Borings in Tarentum, Pa., struck petroleum.

E. B. Bigelow invented the carpet-loom.

The mannfacture of files was commenced at Matteawan, N. Y., by John Rothery.

Eastwick & Harrison invented the equalizing beams connecting locomotive driving-wheels.

First shipment of apples from Boston to Glasgow.

Sebastian Chauveau, of Philadelphia, introduced the use of machinery in making confectionery.

First slate quarry in Vermont opened by Colonel Allen and Caleb Ranney at Scotch Hill.

Lowest price on record for cotton.

1846.

Magnetic Telegraph Company organized Jan. 14, and line completed between New York and Philadelphia, Jan. 18.

War declared against Mexico, May 11.

California declared independence from Mexico, July 5.

New Mexico annexed by the United States, Aug. 22.

Elias Howe, Jr., patented the first sewing-machine, Sept. 10.

The anesthetic property of ether discovered by Dr. William T. G. Morton, of Boston, Sept. 30.

Iowa admitted to the Union.

Mormons selected site of Salt Lake City.

Japan refused to open commercial relations with this country.

The "ten-wheel" locomotive introduced.

Oliver R. Chase, of Boston, built first machine for making lozenges.

Eastern Hotel, in Boston, the first public building to be heated by steam.

First iron furnace using raw bituminous coal erected at Lowell, Mahoning County, O.

1847.

Commodore Shnhrick proclaimed the annexation of California by the United States, Feb. 8.

G. Page patented the revolving-disk harrow, August 7.

The City of Mexico fell to General Scott, Sept. 14.

Zinc was discovered in paying quantities in Lehigh County, Pa.

Pig iron decarbonized by an air-current into steel by William Kelly, of Kentucky.

Richard M. Hoe patented the type-revolving press.

Farmer constructed an electro-magnetic locomotive which drew a car containing two persons.

Use of adhesive postage stamps first authorized.

Auction sales of plants and flowers begun in New York.

1848.

John M. Marshall discovered gold in California, Jan. 18.

Treaty of peace with Mexico signed at Guadalonpe Hidalgo, Feb. 2.

Astor Library founded, May.

Wisconsin admitted to the Union, May 29.

First meeting of the American Association for the Advancement of Science held at Philadelphia, Sept. 20.

Cochituate water introduced into Boston, Oct. 25.

Machine for punching and pointing wooden pegs patented by Henry P. Westcott.

Suspension bridge completed across the Ohio river at Wheeling.

Rogers Locomotive Works shipped locomotives to Cuba.

First cast-iron-front building in the world erected in New York.

Erastus B. Bigelow invented the power-loom for weaving Brussels and tapestry carpets.

1849.

First diploma to woman physician granted at Geneva, N. Y., to Elizabeth Blackwell, January.

First bank established in San Francisco, Jan. 9.

Zachary Taylor inaugurated, March 5.

Great inundation at New Orleans, March.

Astor Place Opera House riots, May 10.

Asiatic cholera epidemic in New Orleans, New York, St. Louis, Philadelphia, Nashville, Buffalo, Chicago, and Boston, Angust.

Connecticut river successfully dammed for utilization of water-power, Oct. 22.

Overland rush for California commenced.

The improved steam-engine valve patented by George H. Corliss.

Department of the Interior organized with Thomas Ewing as first Secretary.

New York Associated Press founded.

Henry Evans of Newark introduced the pendulum press for can tops.

1850.

The first meeting of influential men was held at Philadelphia to consider the question of a transcontinental railroad, Apr. 1.

First number of *Harper's Magazine* was published, June.

Clayton-Bulwer Treaty promulgated, July 4.

President Taylor died, July 9.

Vice-president Millard Fillmore succeeded to the chair, July 10.

The manufacture of watches by machinery was commenced in Boston by Dennison, Howard, and Davis, July.

Fugitive Slave Bill passed, Aug. 23.

California admitted to the Union, Sept. 9.

The Seventh Census gave the population of the country as 22,191,876.

S. S. Putnam, of Neponset, Mass., began the manufacture of nails for horse shoes by machinery.

Collins Line, the first American line of steamships to Liverpool, established nnder government subsidy.

Export of coal first attained commercial importance.

First ice machine patented.

Thomas Kingsford discovered the food properties of cornstarch.

Machinery first came into use in the boot and shoe shops.

The manufacture of reed organs commenced.

Page, of Washington, constrncted an electro-magnetic locomotive of sixteen horse-power.

1851.

Minot's Ledge Light carried away, Apr. 16.

Fire did $3,000,000 damage at San Francisco, May 3.

Southern Rights Convention held at Charleston, May 8.

New York and Lake Erie Railroad completed from Piermont to Dunkirk, May 14.

A second fire destroyed $3,000,000 more property in San Francisco, June 22.

Nicaragua ronte between New York and San Francisco opened, Aug. 12.

Hndson River Railroad completed from New York to Albany, Oct. 8.

Louis Kossuth arrived on his visit to this country, Dec. 5.

Principal room of the Library of Congress destroyed by fire, Dec. 14.

The canal from Evansville, Ind., to Lake Erie completed.

Postal rate established at three cents per half onnce for distance less than 3000 miles.

Nelson Goodyear patented process for making hard rubber.

A. C. Gallahue, Elmer Townsend and B. F. Sturtevant patented a pegging machine which cut and drove.

Western Union Telegraph Company established.

Electric locomotive taking its power from a stationary battery constructed by Thomas Hall, of Boston.

Cyrus H. McCormick wins a great victory with his reaping-machine at the World's Fair in London.

1852.

Fisheries dispnte with England, May 26.

Fire did $5,000,000 damage at Sacramento, Nov. 2.

Commodore Perry started for Japan on his special mission to open up commerce there, Nov. 24.

United States refused to join England and France in a perpetnal renunciation of annexation designs on Cuba, Dec. 1.

The electric telegraph fire-alarm introduced in Boston.

American Pharmaceutical Association organized.

First paints ready mixed for nse, made.

Maker's stamp on boiler-plate first demanded by law.

Tilton, Pepper & Scudder start the first plate-glass works in Brooklyn.

First pottery in Trenton built by Speeler, Taylor & Bloor.

Lamp chimneys first manufactured by Christopher Dorflinger in Brooklyn.

1853.

Ericsson's caloric ship made its trial trip, Jan. 11.

Franklin Pierce inaugurated, March 4.

Capt. Ringgold's South Sea expedition sailed, May.

World's Fair opened at the Crystal Palace, in New York, July 14.

Commodore Perry presented to Japan the President's desire to establish commercial relations, July 14.

Purchase of Central Park authorized, July 23.

New York Clearing Honse established, Oct. 11.

The first paper collar was seen in New York.

Lumber-rafting inangurated by Schulenberg & Borckler.

United States Pottery Company of Bennington made first inlaid-flooring tiles.

Steam fire-engines put into permanent service in Cincinnati.

Yellow fever epidemic at New Orleans caused 7848 deaths.

1854.

Cyrns Field, Peter Cooper, and others organized the New York, Newfoundland and London Telegraph Company, Mar. 1.

The Homestead Bill passed by Congress to encourage settlement on the public lands, March 3.

Treaty with Japan signed, March 31.

Kansas Nebraska bill passed, May.

Reciprocity Treaty conclnded with England concerning the Newfoundland fisheries, June 7.

Otis Tufts patented an elevator for hotels, Aug. 9.

The steamship *Arctic* lost at sea and 350 people perished, Sept. 27.

The Pennsylvania Rock Oil Company, the first petrolenm company, incorporated in New York, Dec. 30.

Registry system established by the post-office.

The first merchant flouring-mill started in Minneapolis.

Mellier process for straw-paper brought out by A. C. Mellier.

G. D. Dows introduced in Boston the first marble soda fountain.

1855.

The first bridge across the Mississippi river completed at Minneapolis, Minn., Jannary.

The railroad between Panama and Colon completed, Jan. 28.

Suspension bridge at Niagara completed, March.

Cotton-seed oil first successfully made by Panl Aldige at New Orleans.

Hugh Burgess patented chemical wood pulp.
Year of the country's greatest maritime construction.
Vacuum pan introduced in the sugar refineries.
Yellow fever ravaged Norfolk and Portsmouth, Va.

1856.

First telegraph cable laid across the Hudson at New York, Feb. 12.
The first railroad in California was completed, Feb. 22.
Central Park purchased for $5,398,695, February.
The first street-railroad in New England began running be-between Boston and Cambridge, March 26.
George Esterly patented a corn cultivator, April 22.
New York, Newfoundland, and London Electric Telegraph Company organized, May 6, and cable laid to Newfoundland.
Statue of George Washington was unveiled in Union Square, July.
Gail Borden patented condensed milk, Nov. 4, and its manufacture commenced at Litchfield, Conn.
Bessemer steel first made at Phillipsburg, N. J.
Cyrus W. Field established telegraphic communication with Newfoundland.
Sorghum was introduced.
The first vessel made the passage from Milwaukee to Europe via the Welland Canal, Great Lakes, and St. Lawrence river.
First refined spelter made at Bethlehem, Pa.
Borax discovered in California.
Use of the adhesive postage-stamp made compulsory.

1857.

James Buchanan inaugurated, March 4.
Dred Scott decision, March 6.
First great strike and railroad riots commenced on the Baltimore and Ohio, Apr. 27.
Pennsylvania Railroad bought for $7,500,000 the railway and canal system built by the State, June 25.
Police riots began in New York, July 3.
Ohio Life and Trust Company suspended, and a financial panic followed, Aug. 24.
First and unsuccessful attempt to lay a transatlantic telegraph cable, August.
Specie payment suspended, Oct. 15.
Resumption of specie payment, Dec. 4.
General Rodman began his experiments to discover pressures in the bores of guns at the moment of firing.
The Steamship *Central America*, having on board $7,800,000 of treasure from California, foundered off the Cuban coast.
The manufacture of straw-paper begun by J. B. Palser at Fort Edward.
Japan teas appeared in the market.

1858.

Minnesota admitted to the Union, May 11.
First transatlantic cable successfully laid, Aug. 4.
First message sent over the transatlantic cable, Aug. 16.
Peter Cooper presented Cooper Union to the public.
Gold was discovered at Pike's Peak, Colorado.
Wells, Fargo & Company established the Overland Mail Company.
First cut loaf sugar made in this country.
Creasing-machine patented by W. K. Thornton, of Michigan.
E. S. Drake sank the first petroleum well at Titusville, Pa.

1859.

Oregon admitted to the Union, Feb. 14.
Treaty with China, Aug. 16.
John Brown's Raid on Harper's Ferry, Oct. 16.
Début of Adelina Patti in opera in New York, Nov. 24.
The improved grand piano patented by Steinway, Dec. 20.
Photolithography for maps in colors was introduced.
First shipment of flour from Minneapolis to the East.
Farmer invented the self-exciting dynamo to take the place of the galvanic battery.

1860.

117 operatives killed and 312 injured by collapse of the Pemberton Cotton Mills in Lawrence, Mass., Jan. 10.
The chain of railroads was completed from Bangor, Me., to New Orleans, January.
The Japanese ambassadors to ratify Perry's Treaty arrived at San Francisco, March 27.
The *Great Eastern* arrived at New York, June 28.
Colonel William Walker, the famous filibuster in Central America, was shot at Truxillo, Sept. 12.
The Prince of Wales arrived at Washington and visited the President, Oct. 3.
South Carolina seceded from the Union, Dec. 20.
Central Park was opened to the public.
The Eighth Census gave the population of the country as 31,443,321.
The "oil fever" broke out in the Alleghany River valley.
American merchant marine at the point of its greatest prosperity.
First importations of Sisal hemp.
Salt first attained commercial importance in Michigan.
The transcontinental telegraph sanctioned by Congress.
First wrought-iron I-beams rolled by Peter Cooper at Trenton.
Alexander Smith and Halcyon Skinner of Yonkers secured a patent for power-loom to weave Axminster and Moquette carpets.
Centrifugal machine introduced in the sugar refineries.

1861.

First shot of the Rebellion was fired in Charleston harbor against *Star of the West*, Jan. 9.
Mississippi seceded, Jan. 9.
Florida seceded, Jan. 10.
Alabama seceded, Jan. 11.
Georgia seceded, Jan. 19.
Louisiana seceded, Jan. 26.
Kansas admitted to the Union, Jan. 29.
North Carolina seceded, Jan. 30.
Texas seceded, Feb. 1.
First flowing oil-well struck in Pennsylvania, Feb. 1.
Provisional Confederate Government organized at Montgomery, Ala., Feb. 9.
Jefferson Davis inaugurated president of the Confederacy, Feb. 19.
Abraham Lincoln inaugurated, Mar. 4.
Fort Sumter fell, Apr. 14.
Virginia seceded, Apr. 17.
Stephen A. Douglas died, June 3.
First balloon reconnaissances, June 23.
Battle of Bull Run, July 21.
Telegraphic communication opened between St. Louis and San Francisco, Oct. 25.
Capt. Wilkes boarded British steamship *Trent* and seized Mason and Slidell, Nov. 8.
First message sent over the transcontinental telegraph line, Nov. 15.
Banks suspended cash payments, Dec. 30.

Stereotyping for newspapers introduced by the "New-York Tribune" and "New-York Herald."

The McKay sewing-machine patented.

1862.

Mason and Slidell released and sail for Europe, Jan. 1.

First legal tender act passed, Feb. 25.

Battle between the *Monitor* and the *Merrimac*, March 9.

The National Guard created by New York, April.

Farragut captured New Orleans, Apr. 24.

Revenue tax imposed on spirits, July 1.

Union Pacific Railroad chartered, July 1.

Postage stamps used for fractional currency, Jnly.

Announcement of tbe Emancipation Proclamation, Sept. 22.

Dr. R. J. Gatling completed the first Gatling gun at Indianapolis, Ind., Nov. 4.

Lockhart & Company export first shipment of American oil.

Chicago became the recognized center of the packing industry.

Confederate cruiser *Alabama* captured and burned ten merchantmen in two weeks.

Brewers' Association organized.

1863.

3,120,000 slaves freed by the Emancipation Proclamation, Jan. 1.

The National Academy of Science created by Congress, March 3.

West Virginia admitted to the Union, June 19.

Certificate of authority of the Comptroller of the Currency issued to the first of the present national banks, June 20.

Battle of Gettysburg, July 1–3.

Draft Riots in New York, July 13–17.

Habeas corpus suspended, Sept. 15.

Distance limit for letter postage in the United States removed.

First harness-thread factory established at Paterson, N. J., by Barbour Brothers.

Henry Disston built first crucible-steel melting plant for saw steel.

The channeling-machine invented by George J. Wardwell, of Rutland, Vt.

The so-called musical telepbone brought out by Reis.

1864.

Funding of the greenbacks in the six per cents. stopped, Jan. 21.

Sanitary Fair opened at Philadelphia, June 7.

Battle between the *Kearsarge* and *Alabama*, June 19.

Gold dollar was worth $2.85, July 11.

Nevada admitted to the Union, Oct. 31.

From Dec. 1861 to October 1869, the advance in the price of cotton goods had been 1000 per cent.

Columbia College School of Mines organized, Nov. 15.

General Sherman left Atlanta for the Sea, Nov. 16.

Northern Pacific Railroad chartered.

Postal money-order system established.

George M. Pullman built the "Pioneer," his first car.

1865.

Union troops entered Richmond, Apr. 2.

Lee snrrendered, Apr. 9.

President Lincoln assassinated, Apr. 14.

Andrew Jobnson succeeded to the presidency, Apr. 15.

Johnston snrrendered, April 26.

Jefferson Davis captured, May 11.

First rail laid on the line of the Union Pacific, July.

Capt. Wirz, jailer of Andersonville Prison, hanged, Aug. 21.

All restrictions removed from Southern ports, Sept. 1.

Martial law ended in Kentucky, Oct. 12.

Habeas corpus restored in the Northern States, Dec. 1.

National Wool Growers' Association organized, December.

The Bullock perfecting press bronght out.

Polisbed plate glass first made at Lenox, Mass.

New York Stock Excbange moved into its present building, Broad and Wall streets.

1866.

France acceded to request of United States to witbdraw troops from Mexico, Jan. 9.

President Johnson publicly denounced the Reconstrnction Committee, Feb. 22.

The President proclaimed the Rebellion at an end, Apr. 2.

Civil Rights Bill passed over President's veto, Apr. 9.

Jefferson Davis indicted for complicity in the assassination of Lincoln, May 8.

Fenian invasion of Canada, June 1.

Commercial convention concluded with Japan, June 25.

Fire did $10,000,000 damage at Portland, Me., July 4.

Tennessee restored to the Union by Congress, July 23.

The second Atlantic cable snccessfully laid, Aug. 16.

Convention of workingmen at Baltimore made first demand for an eight-hour working day, Aug. 21.

The lost Atlantic cable of 1865 brought np, spliced, and laid, September.

Congress established the elective franchise witbout respect to race or color in the District of Colnmbia, Dec. 14.

Daniel G. Chase, of Chicago, patented a machine for making conversation lozenges.

National Board of Fire Underwriters organized.

Salmon canning on the Columbia river begun.

Steinway & Son perfected and introduced the upright piano.

Tallemont & Carrol patented the velocipede with two wheels.

1867.

Frencb troops evacuated the City of Mexico, Feb. 5.

Nebraska admitted to the Union, March 1.

Military Reconstruction Bill passed, March 2.

National Bankruptcy Bill, March 2.

Jefferson Davis released on $100,000 bail, May 13.

The President removed Secretary of War Stanton, Aug. 12.

First steel rails rolled by Cambria Iron Company of Johnstown, Pa., August.

Tbe President proclaimed general amnesty to all wbo took part in the Rebellion, Sept. 7.

Alaska pnrchased from Russia for $7,200,000, Oct. 9.

Convention of the manufactnrers of the country at Cleveland, O., demanded the full payment of the national debt, Dec. 18.

Pullman Palace Car Company organized.

First consignment of California green fruit received in New York.

Ground wood pulp first put into printing paper.

Hard-rubber-covered harness trimmings patented by Andrew Albright, of Newark.

American Institute of Architects fonnded.

Master Car Builders' Association organized.

1868.

The non-concnrrence in removal of the Senate returned Secretary Stanton to the War Department, Jan. 13.

Fire did $3,000,000 damage in Chicago, Jan. 28.

House resolved that President Johnson be impeached, Feb. 22.

Race riots between Irish and German immigrants on Ward's Island, March 5.

Impeachment trial of President Johnson begun, March 7.

Memorial Statue of Abraham Lincoln unveiled at Washington, Apr. 15.

Secretary Stanton finally retired and succeeded by Gen. John M. Schofield, Apr. 26.

North Carolina, South Carolina, Louisiana, Georgia, Alabama, and Florida again admitted to representation in the Union, June 12.

Arkansas readmitted to the Union, June 20.

New treaty with China, July 4.

A majority of the States adopted the Fourteenth Amendment to the Constitution, July 20.

Congress passed bill providing for the payment of the national debt, July 25.

Gen. Grant abolished by proclamation the military districts as authorized by the Reconstruction Act, July 28.

President Johnson acquitted on impeachment proceedings.

First Westinghouse air-brake used on the Pittsburg, Cincinnati and St. Louis.

Improved typewriting machine patented by C. Latham Sholes.

First Siemens-Martin open-hearth furnace built at the New Jersey Steel and Iron Company's works at Trenton.

1869.

Great Niagara Suspension Bridge opened, Jan. 1.

Improvements to East River channel began at Hell Gate, Jan. 11.

Ulysses S. Grant inaugurated, March 4.

First transcontinental railroad completed by the junction of the Union and Central Pacific, May 15.

United States end of first Franco-American cable landed at Duxbury, Mass., July 23.

Ground broken in the construction of the New York Post-Office by Col. Joseph Dodd, Aug. 9.

Black Friday in Wall Street, Sept. 24.

Treaty negotiated for the annexation of San Domingo, but rejected by Senate, Nov. 29.

Cable screw-wire machine for boot and shoe manufacture invented.

System of traveling theatrical companies introduced.

1870.

Hiram R. Revels of Mississippi, the first colored man elected to the United States Senate, Feb. 25.

President proclaimed Fifteenth Amendment ratified by the States, March 30.

Attorney General Hoar and Secretary of the Interior Cox resigned, June 20.

Kansas Pacific Railroad opened to Denver, Aug. 15.

President proclaimed neutrality in Franco-Prussian troubles, Aug. 22.

General Robert E. Lee died, aged sixty-three, Oct. 12.

The Ninth Census gave the population of the country as 38,558,783.

Mississippi, Texas, and Virginia restored to the Union.

Terra-cotta first generally used for building purposes.

Soleil's polariscope introduced into this country.

Single or continuous process for making wall-paper introduced.

Bigelow attacher and heeling machine introduced in shoe factories.

Granger movement began in Illinois.

Rhode Island passed first of the drug laws.

Chicago-Omaha railroad pool.

Advertisements in magazines first largely published by Scribner's Monthly.

1871.

Income-tax law repealed, Jan. 26.

To relieve the destitution in France caused by the Franco-Prussian War, A. T. Stewart, the New York merchant, sent a $50,000 cargo of flour to Havre, Feb. 25.

Congress passed the bill for a centennial celebration in 1876, March 3.

The first Civil Service Commission was authorized, March 3.

Charles Sumner was removed from the chairmanship of the Senate Committee on Foreign Relations, March 9.

United States and England agreed to submit Alabama claims to arbitration, May 8.

Ship canal across the Isthmus of Darien reported feasible by Commander Selfridge, United States Navy, July.

Anti-Tweed mass meeting in New York upon the discovery of his gigantic frauds, Sept. 24.

The great Chicago fire destroyed $200,000,000 worth of property in that city, and 250 lives were lost, Oct. 8.

The Post-Office extended its money-order system, making it international, October.

R. Hoe & Company complete the perfecting press.

Texas Pacific Railroad incorporated.

1872.

Yellowstone National Park created by Congress, Feb. 27.

Amnesty Bill passed by Congress completed the political reorganization of the country, and filled every seat in the national legislative body, May 22.

Geneva Tribunal met, and $15,500,000 awarded the United States on the Alabama claims, June 15.

Import duties on tea and coffee abolished, July 1.

Great fire in Boston; damage $75,000,000, Nov. 9.

The Bonanza mines on the Comstock Lode discovered.

First iron oil-tank cars used.

Water-gas process patented by Lowe.

Cable grip patented by Andrew S. Halliday.

Hoffman Brothers made first practical application of the band saw.

National Stove Manufacturers' Association organized.

Carriage Builders' National Association organized.

1873.

Political riots in New Orleans, March 1.

The annual salary of the President of the United States fixed at $50,000, March 4.

Chicago celebrated the rebuilding in nineteen months of the entire section laid waste by the great fire, June.

Congress abolished the franking privilege, July 1.

Jay Cooke & Co., the New York bankers, failed, and a financial panic ensued, Sept. 18.

Acquittal of Mayor A. Oakey Hall of New York on charges of corruption, Dec. 24.

Westinghouse automatic air-brake introduced.

First Lowe apparatus for water-gas erected at Philadelphia.

Apparatus for hot soda water patented.

First East and West trunk line agreement made at the Saratoga Conference.

1874.

Mill River dam in Massachusetts burst, destroying four villages and causing the loss of over 200 lives, May 16.

The great steel bridge across the Mississippi at St. Louis completed by James B. Eads, July 4.

Fire did $4,000,000 damage at Chicago, July 14.

Shore end of a new Atlantic cable landed at Rye Beach, N. Y., July 15.

The Lincoln monument at Springfield, Ill., dedicated, and the remains of the martyred President placed in the crypt prepared, Oct. 15.

Bradford oil field discovered, Dec. 6.

King David Kalakaua of the Hawaiian Islands arrived in Washington on a visit to the United States, Dec. 12.

James Lick, of San Francisco, deeded millions to a board of trustees to be used in benevolent undertakings.

Massachusetts passed a ten-hour law.

First trunk pipe-line from oil regions to Pittsburgh.

Barbed-wire manufacture began at De Kalb, Ill.

First fast mail on the New York Central Railroad.

1875.

Bloody political riots in New Orleans, Jan. 4.

Senator Sherman's bill for the resumption of specie payment passed to take effect Jan. 1, 1879, Jan. 14.

Hoosac Tunnel completed, Feb. 9.

Oshkosh burned, Apr. 28.

Bank of California in San Francisco suspended, Aug. 26.

Vice-president Henry Wilson died and was succeeded by Thomas N. Ferry, President *pro tem.* of the Senate, Nov. 22.

William M. Tweed escaped from his Ludlow Street jailers, Dec. 4.

Secretary Benjamin H. Bristow exposed the whisky frauds.

First use of natural gas as a fuel in glass-making by Rochester Tumbler Works.

The Palace Hotel opened in San Francisco.

First typewriting machine offered for sale.

1876.

Great forgeries by E. D. Winslow, of Boston, discovered, Jan. 24.

Gen. O. E. Babcock, private secretary to the President, acquitted of complicity in the whisky frauds, Feb. 7.

Secretary of War Belknap resigned, under charges, March 2; was impeached and arrested, March 8, and acquitted, Aug. 1.

Bell secured his first patent for the telephone, March 7.

A. T. Stewart died, aged seventy-three, Apr. 10.

Dom Pedro, Emperor of Brazil, arrived in New York on a visit to the United States, Apr. 15.

President Grant opened the Centennial World's Fair in Philadelphia, May 10.

Peter Cooper was nominated for the presidency by the National Greenback party, May 18.

James Bailey, the first of the A. T. Stewart cousins, commenced a contest over the will, June.

Secretary of the Treasury Bristow resigned, June 17.

The Custer Massacre, June 25.

Colorado admitted to the Union, Aug. 1.

William M. Tweed re-arrested at Vigo, Spain, and returned to New York, Sept. 6.

Hallett's Point Ledge removed by dynamite, Sept. 24.

The first cremation furnace completed at Washington, Pa., Oct. 1.

President declared South Carolina in a state of insurrection, and Federal troops were stationed at the polls, Oct. 17.

The famous Hayes-Tilden presidential election, Nov. 7.

The Brooklyn Theater fire, 300 lives lost, Dec. 5.

Exportation of dressed beef begun.

Power-loom for hard-drawn wire cloth invented by Wickwire, of Cortlandt, N. Y.

1877.

Commodore Cornelius Vanderbilt died, aged eighty-two, leaving an estate of $100,000,000, Jan. 4.

The Special Commission announced Hayes elected president by the Electoral College with 185 votes; Samuel J. Tilden, the Democratic candidate, received 184, March 2.

Rutherford B. Hayes inaugurated, March 5.

Alexander Graham Bell successfully tested the telephone between Boston and Salem, Mass., March 15.

United States troops withdrawn from New Orleans, Apr. 24.

The great Railroad Strike commenced in and about Pittsburgh, July 1.

Moons of Mars discovered by Asaph Hall, Aug. 11.

Canal at Keokuk on the Mississippi completed, Aug. 22.

Brigham Young died, aged seventy-six, Aug. 29.

Bell's improved telephone put into general use.

Goodyear welt machine brought out.

Col. A. A. Pope has the first bicycle built in this country.

1878.

Gold quoted at 101¼ on Wall street, being lower than it had been since 1862, Jan. 23.

Bland Silver Bill passed over President's veto, February.

William M. Tweed died in Ludlow Street Jail, Apr. 12.

The first train ran on the Gilbert Elevated Road on Sixth Avenue, Apr. 29.

Chin Lan Pin, the first regularly accredited resident ambassador from the Chinese Empire arrived in San Francisco, July 25.

The first train on the New York Elevated Road on the East side, Aug. 15.

The repeal of the National Bankruptcy Act became effective, Sept. 1.

Subdivision of the electric current accomplished by Edison, and incandescent lights introduced, October.

The Manhattan Savings Institution in New York burglarized to the extent of nearly $3,000,000, Oct. 27.

A. T. Stewart's body stolen, Nov. 8.

Yellow fever epidemic in the South. Memphis almost depopulated.

Wall Street quoted gold at par, Dec. 17.

Knickerbocker Ice Company inaugurated long-distance shipments of ice by rail.

Blake transmitter for telephones brought out.

1879.

The Government resumed specie payments, Jan. 1.

A National Board of Health established, March 3.

The United States Geological Survey created, March 3.

Beef-canning on a large scale introduced by the packing houses.

1880.

Ferdinand de Lesseps entertained by the American Society of Civil Engineers at New York, Feb. 26.

The Metropolitan Museum of Art opened in New York, March 30.

The First National Meet of American bicyclists was held at Newport, R. I., May 31.

The Egyptian obelisk arrived in New York, July 19.

Dr. Henry S. Tanner of Minneapolis ended a forty days' fast, Aug. 7.

The Tenth Census gave the population of the country as 50,155,783.

Germany prohibited the importation of American pork.

Knickerbocker Ice Co. imported first Norwegian ice.

Edison built the first electric road at Menlo Park.
California State Board of Viticulture created.
Dougola kid put on the market.

1881.

Representatives from nineteen governments met at an International Sauitary Conference in Washington, Jan. 5.
James A. Garfield inaugurated, March 4.
Star Route frauds discovered, March.
The *Jeannette* Arctic Expedition lost iu the ice, June 11.
President Garfield assassinated by Charles J. Guiteau, July 2.
Presideut Garfield died, Sept. 19.
Chester A. Arthur succeeded to the presidency, Sept. 20.
Cases against Star Route principals dismissed, Nov. 10.
France prohibited the importation of American pork.
Mouroe doctrine emphasized by Secretary Blaine.

1882.

Congress increased the nnmber of representatives in the House to 325, by a new apportionment based on the census of 1880, February.
Fire did $2,250,000 damage at Haverhill, Mass, Feb. 17.
James G. Blaine's famons eulogy on Garfield delivered in the House of Representatives, Feb. 27.
Congress passed the first Chinese Restriction bill, May 6.
Guiteau hanged, Jnne 30.
Bill passed to extend the charters of the national banks, July 12.
Natioual Wholesale Druggists' Association organized.
Mississippi floods rendered 85,000 people destitute.

1883.

The National Civil Service created, Jan. 16.
Revised Tariff adopted, March 3.
Taxes on capital and deposits of the national banks abolished, March 30.
Peter Cooper died, aged ninety-two, Apr. 4.
S. G. W. Benjamin appointed first miuister resident to Persia, May.
Treaty concluded with Corea, May 15.
The Brooklyn Bridge opened, May 24.
Gen. Brady and ex-Seuator Kellogg, of Louisiana, finally acquitted on charges connected with the Star Ronte frauds, June 14.
Last spike driven in the Northern Pacific Railroad, Sept. 8.
Letter postage reduced to two cents, Oct. 1.
Centenary of British evacuation of New York celebrated.
First canneries for Alaska salmon established.
Machine for stuffiug horse-collars patented by William Foglesoug, of Dayton, O.

1884.

Commercial Convention with Spain signed, Feb. 13.
Treaty with Mexico ratified, March 1.
Mob riots iu Cincinnati, March 28–30.
Mariue Bank and Grant and Ward failures, May.
Corner stone of pedestal for Statue of Liberty laid, Aug. 5
Treaty of Reciprocity with San Domingo signed, Dec. 4.
The New Orleans Exposition opened, Dec. 16.
National Confectioners' Association of the Uuited States organized.
Telephone wires first put under ground.

1885.

Washington Monument dedicated, Feb. 22.
Grover Cleveland inaugurated, March 4.
President James D. Fish of the Marine Bank sentenced to ten years at Sing Sing, June 27.
Gen. Grant died, aged 63, July 23.
Anti-Chinese riots in the West, Sept. 2.
Flood Rock in the East River blown up by dynamite, Oct. 10.
Ferdinand Ward sentenced to ten years at Sing Sing, Nov. 1.
Fire did $2,500,000 damage at Galveston, Texas, Nov. 13.
Vice-president Thomas A. Hendricks died at Indianapolis, aged sixty-six, Nov. 25.
Ohio oil field discovered at Lima.
Long-distance telephone introduced to use.

1886.

Senator Hoar's Presidential Succession Bill passed, Jan. 19.
Commission appointed to investigate Jacob Sharp and the New York "Boodle Aldermen," Jan. 26.
General strike on the New York street-railroads, March 4.
Boycott by Knights of Labor begun on the Gould railroad system iu the West, March 6.
Anarchist riots and bomb throwiug in Chicago, May.
The great Charleston earthquake, Aug. 31.
The Statue of Liberty dedicated, Oct. 28.
Steamship *Oregon* was sunk off the Long Island coast.
Wire nails first manufactured.
First oil-tank steamers built.
Experiments made with electrical locomotives by Frauk J. Sprague on the elevated road in New York.

1887.

Senator Edmund's Retaliatory Bill in the Canadian Fisheries dispute passed, Jan. 19.
The courts twice declared boycotting illegal, February.
The Trade Dollar Bill passed, Feb. 19.
Strike of the Massachusetts shoe factory operatives, February.
Inter-State Commerce Commission created, April 3.
Buildiug trades' strike in Chicago, and stove molders' strike in St. Louis, April.
Lehigh Valley coal miners went out, Aug. 30.
First vestibule Pullman train in service.
Experiment stations established by the government.
Beet sugar first successfully produced at Alvarado, California.

1888.

Bell telephone patents confirmed by the United States Supreme Court, March.
Fisheries treaty negotiated with England but rejected by the Senate, August.
The first electric street-railway was built by Frank J. Sprague at Richmond.

1889.

Strike on New York street railroads, Jan. 28.
Department of Agriculture created, with Norman J. Coleman secretary, Feb. 11.
Benjamin Harrison inaugurated, Mar. 4.
U. S. men-of-war *Vandalia*, *Nipsic*, and *Trenton* wrecked at Apia, Samoa, Mar. 16.
Centennial of President Washington's inauguration celebrated at New York, Apr. 29.
Johnstown, Pa., inundated by bursting of a reservoir, May 31, 3000 lives lost.
Seattle, Wash., swept by a fire which destroyed $5,000,000 worth of property, June 6.
New York naval militia created, June 14.
North Dakota admitted to the Union, Nov. 1.
South Dakota admitted to the Union, Nov. 2.

Montana admitted to the Uuion, Nov. 8.

Washington admitted to the Uniou, Nov. 11.

Fire did $4,000,000 damage at Lynn, Mass., Nov. 26.

Jefferson Davis died at New Orleans, Dec. 6.

Tanks for the making of window glass introduced by J. Chambers at Jeannette, Pa.

1890.

The United States recognized the Repnblic of Brazil, Jan. 29.

The Lenox Hill and Sixth National Bank, of New York, suspended, Jan. 30.

The Centennial of the United States Supreme Court celebrated, Feb. 4.

President Harrison sigued the World's Fair Bill, Apr. 25.

Idaho admitted to the Umon, July 3.

Wyomiug admitted to the Union, July 11.

William Kemmler, the first murderer killed by electricity, was execnted at Auburn Prison, N. Y., Aug. 6.

Great strike on the New York Central Railroad, Ang. 8.

President Harrison signed the McKinley Tariff Bill, Oct. 1.

Several heavy failures occurred in Wall Street, Nov. 10.

The Eleventh Censns gave the population of the country as 62,662,250.

National Wholesale Saddlery Association of the United States organized.

1891.

Proclamation of Reciprocity Agreement with Brazil, Feb. 5.

International Copyright bill passed, March 4.

Italy recalled Baron Fava owing to troubles over the New Orleans race riots, March 31.

The centennial of the patent system was celebrated in Washington by a Congress of Inventors, Apr. 8.

Treaty of Reciprocity with Spain, Apr. 20.

The first railroad passenger train ran to the summit of Pike's Peak, June 30.

Commencement of rain-making experiments in Texas, Aug. 10.

First armor-plate supplied to the government by the Bethlehem Iron Company and Carnegie, Phipps & Company.

1892.

Chilian outrages on American seamen, Jan. 18.

Constitutionality of the McKinley Tariff affirmed by the United States Supreme Court, Feb. 29.

The Standard Oil Trust dissolved by consent of the shareholders, March 21.

$3,000,000 cotton fire in New Orleans, Apr. 3.

Platinum discovered in South Dakota, Apr. 30.

Homestead Steel Works closed, June 30.

Attempted landing of a Pinkerton force precipitated the bloody Homestead riots, July 6.

Work resumed at Homestead, Aug. 3.

Railroad strike at Buffalo called out the militia, Aug. 13.

The Atlantic liner *Moravia* arrived in New York with cholera on board, Aug. 31.

Fire did $7,000,000 damage at Milwaukee, Wis., Oct. 28.

Discoveries of gold in Colorado, Dec. 21.

Long-distance telephone line between New York and Chicago formally opened.

A Vauclain compound-locomotive attained a speed of 97 miles an hour, being one mile in 37 seconds.

1893.

News received of the Hawaiian revolution, Jan. 28.

Annexation of Hawaii recommended by President Harrison, Feb. 15.

The President raised the Stars and Stripes on the *New York* of the new American line, Feb. 22.

Grover Cleveland inaugurated, March 4.

President Cleveland withdrew the Hawaiian treaty from the Senate, March 9.

Fire did $4,500,000 damage in Boston, March 10.

The World's Fair opened at Chicago by President Cleveland, May 1.

Locomotive No. 999, of the New York Central, covered one mile in 32 seconds, May 10.

Chinese Exclusion Act confirmed, May 14.

Wide-spread distrust breaks out in a terrible financial panic, June 20.

$8,000,000 Clearing House Certificates issued to give relief, June 30.

Congress met in special session, Aug. 7.

The panic had passed, but confidence was not restored, September.

Mayor Carter H. Harrison, of Chicago, assassinated, Oct. 28.

World's Fair closed, Oct. 30.

The Silver Repeal Bill passed, Nov. 1.

The last outstanding Clearing House Loan Certificate retired, Nov. 1.

1894.

World's Fair Buildings burned with a loss of $2,000,000, Jan. 8.

Decision of Court of Appeals allowed foreign corporations to buy and sell New York real estate, Jan. 16.

$50,000,000 of 5 per cent. bonds issued, February; second issue of $50,000,000, November.

Coxey's Commonweal Army arrived in Washington, Apr. 29.

Boycott on the Pullman Works began the great Chicago railroad strike, June 25.

The Hawaiian Republic proclaimed, July 4.

Chicago railroad strike ended, July 13.

Fire did $3,000,000 damage in Chicago, Aug. 1.

The United States recognized the Hawaiian Republic, Aug. 9.

The Wilson Tariff Bill passed, Aug. 27.

Launch and christening by Mrs. Grover Cleveland of steamship *St. Louis*, largest vessel built in America, November 12.

1895.

The Bond Syndicate took an issue of $62,317,500 of government "coin" bonds, February.

The Empire State Express on the New York Central covered a distance of 436½ miles in 407⅔ minutes, Sept. 11.

The New York, New Haven and Hartford Railroad equipped its Nantasket Beach branch to operate by electricity.

Steamship *St. Paul*, the second great American liner, launched.

The Baldwin Locomotive Works consummated a working agreement with the Westinghouse Electric and Manufacturing Company for the prodnction of electric eqnipment for railway service.

Great activity in the iron and steel industries.

Message by President Cleveland to Congress on Venezuela, emphasizing the Monroe Doctrine.

"Commercial Day," December 19, observed in New York, and by commercial organizations generally throughout the country. The American Commerce Banqnet at Delmonico's, New York.

The New York "Shipping and Commercial List and New York Price Current" attains its hundredth year.

ONE HUNDRED YEARS OF
AMERICAN COMMERCE

CHAPTER I

AMERICAN BANKING

BANKS and banking, taken of themselves, constitute a chapter of first importance in American records. To the national life the banking system is as the arterial system to the animal life. Through it circulates the vitalizing current which sustains the brain of business and statecraft, and strengthens the arm of labor. It facilitates all commercial transactions, and utilizes all the resources of trade, gathering together the surplus capital of the country, each depositor affording comparatively little, but collectively producing a sum immense in quantity, which can be loaned in portions to those who may need it. No part of the uninvested capital then remains unused; what is not required by one can be used by another.

In this country the existence of banks dates from the time of the Revolutionary War. Since then the methods pursued to attain the ends proper to the banking function have been frequently and often radically changed. They have always been, however, more or less sound, considered with regard to their adaptation to the times they served and the needs they had to supply. In the history of their variations, therefore, we must see the effect of changed conditions, rather than assume the downfall of early error. One century ago the fiscal affairs of America rested in the hands of a great national bank, the Bank of the United States. The institution was modeled almost exactly upon the plan of the Bank of England, then, as now, one of the greatest financial factors in the world. For forty years, with a brief lapse of between four and five years, just before and during the War of 1812, this institution continued to be the dominant power in the financial affairs of America. Its passing away was marked by one of the bitterest political fights known to history, waged by that doughty old partisan, Andrew Jackson, and his successor, Martin Van Buren. The next quarter of a century saw the so-called State-bank system in full control. Many of these State banks were, undoubtedly, as sound and solvent as any of the great institutions to-day. Others, it is equally true to say, were not. The condition of affairs which resulted from their operation, as a whole, however, can scarcely be said to have been of the best. With no uniform basis for their government, the prosperity of the time had constantly to struggle under the disadvantage of a demoralized currency, discounted in direct proportion to the number of miles it traveled from home.

The Civil War, with its terrible demands upon the country, found this system unable to respond as fully as was needed, and a new system, the one under which we have remained until to-day, was devised. It avoids the centralization of power in any one great chartered institution, and distributes it at large among the banks of the country. It places the pledge of our government behind every bank-note issued in the United States. Around this national system has grown up the financial world of to-day. Among these facilities are banks of discount and deposit, which furnish their conveniences to the mercantile world; great private houses, with branches reaching to every other country, and furnishing a medium of foreign exchange which renders possible the extended commercial enterprises which now characterize America; and savings institutions, trust companies, and financial engines without number, all furnishing the power to drive the great business machines of to-day.

The beginning of American banking is so indissolubly linked with the name and fame of Alexander Hamilton, first Secretary of the Treasury of the United States, that many have forgotten the fact that Robert Morris, the Philadelphia merchant, was the first great American banker. He it was who, in company with George Clymer and a few other gentlemen, taking as their sole security bills drawn in desperation by the Continental Congress on John Jay, then in Spain negotiating a loan, established on their own personal credit in 1780 the Pennsylvania Bank, in Carpenters' Hall, Philadelphia. This was the first bank established in the United States. Its only object was to aid, with all its resources, the government in transporting and maintaining the army, then in the most desperate need. This patriotic end it accomplished, and to its aid, given at a most critical time in the national history, it is scarcely possible to ascribe too great an importance.

Robert Morris having been appointed Superintendent of Finance, the Bank of Pennsylvania went out of existence in the following year, and Congress, acting by Mr. Morris's advice, granted in December to him and his associates a charter for the Bank of North America, and in January, 1781, the new bank began business in Philadelphia. Thomas Willing was its first president, and there were twelve directors. While this bank was, like its predecessor, designed to give aid to the government, then in those desperate financial straits which marked the closing years of the war, it was also intended to furnish its facilities to individuals and to carry on a general banking business. Its capital was $400,000, and it was conducted on a specie basis, its notes being declared legal tender. It also secured a charter from the State of Pennsylvania, and as it was the only bank in the country at that time, it soon began to roll up large profits. The years 1783 and 1784 saw this prosperous institution declaring dividends of 14 per cent. Such success immediately produced emulators, and a corporation was formed to start a rival bank. Before its charter had been secured, however, its leading projectors were pacified by being allowed to obtain large blocks of a new issue of $500,000 worth of stock. This preserved its field undivided, and its prosperity continued. In 1787 it was rechartered by the Pennsylvania legislature as a State bank, and with renewals from time to time, has since continued.

New York, having seen the success of the Bank of Pennsylvania, and her merchants, appreciating the facilities afforded by such an institution, began agitating the question of the establishment of a bank in their city. A number of prominent men assembled, and a plan was proposed which was at once called by its opponents the "land" bank. It provided for paying in but a small proportion of the capital in specie, the balance to be secured by land accepted at two thirds of its appraised value, and against which notes, payable in specie, could be issued for one third of its value. Of this plan Chancellor Livingston was the great supporter, and his influence had nearly carried it through the legislature when it applied to be chartered. Its adversaries, prominent among whom was Alexander Hamilton, managed to defeat its passage, however, and it was never revived. Much more serious was the experience of a modified form of "land" bank which convulsed the colony of Massachusetts a number of years before, and was finally established after the deposition of an opposing governor. In a short time, however, the British government dissolved it, and placed some severe restrictions upon banks in that particular colony.

The demand for a bank continued to be made by the New York merchants, and on February 23, 1784, a call was issued for a meeting which was held at the Merchants' Coffee House and General Alexander MacDougal occupied the chair. It was then decided to start a bank with a capital of $500,000, either gold or silver, divided into 1000 shares. On March 15th, 500 shares having been taken, the stockholders organized by the election of General MacDougal as president, and Samuel Franklin, Robert Bowne, Comfort Sands, Alexander Hamilton, Joshua Waddington, Thomas Randall, William Maxwell, Nicholas Low, Daniel McCormick, Isaac Roosevelt, John Vanderbilt, and Thomas B. Stoughton, as directors. William Seton was elected cashier, and so unused were New York business men of that day to banks and banking methods that Cashier Seton was immediately sent to Philadelphia, with letters of introduction to the Bank of North America, to learn how such affairs were properly conducted. The stockholders, in the interim, urged on by the hopes of large profits, hastened all their arrangements, and as a charter had not been secured from the legislature, the bank started without one, opening its doors June 9, 1784.

This bank, known as the Bank of New York, had for its original location the old mansion of William Walton, at No. 67 St. George's (now Franklin) Square. Three stories high, and built of the old yellow Holland brick with hewn stone lintels, this ancient house, erected in 1752, remained standing until 1881.

But even at this early day, it appears, there were many people who believed that banks were antagonistic to the interests of the community, and in 1785 and 1786, currency becoming scarce, a cry went up that these institutions were hoarding specie, and in some States, notably New York, where the feeling was greatest, issues of paper money were put out by the legislatures. Financial affairs were in this condition, general confidence being shaken, when, the Constitution having been adopted and General George Washington elected to the presidency, Alexander Hamilton, the first Secretary of the Treasury, came forward with his famous financial policy. The nation assumed and bonded the debt incurred by the Continental Congress and the various colonies in carrying on the war, and, going further, established in 1791 the Bank of the United States. This bank, which was chartered by Congress for twenty years, was established to act as the fiscal agent of the government and to be the depository for the public moneys. It was also authorized to issue its notes, payable in specie, and was made in every way possible the agent of the United States Treasury and the great power in the financial affairs of the country. Its capital was placed at $10,000,000, divided into 25,000 shares of $400 each, payable one fourth in specie and three fourths in 6 per cent. stocks of the United States. It was allowed to hold property of all kinds up to the value of $15,000,000, inclusive of its capital stock, and further to establish branch banks in the various cities. In accordance with this last provision it at once opened in New York a branch known as an office of discount and deposit. The prosperity of the Bank of the United States began at once, and during its whole career it averaged annual dividends of 8 and 10 per cent.

The influence of Hamilton's policy was immediately felt, and prosperity speedily returned. The spirit of speculation was let loose in the land and a stringency resulted in the currency that seemed likely to have serious consequences, and was only averted by Alexander Hamilton and the United States Treasury coming three times to the relief of the straitened business community. After this little set-back, which was of short duration, business continued steadily to improve. In New York, where political influence had prevented the granting of charters for new banks, a corporation known as the Manhattan Company, and headed by Aaron Burr, succeeded in 1799 in getting a charter, ostensibly to provide New York with pure water. The capital of the company was placed at $2,000,000, and, unnoticed by the politicians in power, the charter contained a clause which, after reciting that the capital was to be devoted to establishing a water-supply, declared that the surplus should be "employed in the purchase of public or other stocks or any other moneyed transactions or operations not inconsistent with the laws and constitution of the State of New York." It is needless to say that with such a clause in its charter $500,000 was quickly found, and the money, after fulfilling the object for which the charter was granted, was devoted to the establishment of a new bank. In 1803 no less than forty banks were open and doing business throughout the country.

The expiration in 1811 of the charter of the Bank of the United States, which had failed of renewal, followed by the war declared in 1812 against England, placed the country in a most unsatisfactory position. Having little or no credit, it found itself forced to fall back in great measure on the banks. These were all institutions under State charters, no less than 123 new ones having been created in the four years following the closing of the United States Bank. These had an aggregate capital of $40,000,000 and emitted notes to the face value of $200,000,000, a large portion of which, in the Middle States especially, were issued as loans to the government.

As might, perhaps, have been expected in view of the prostration of the public credit, the strain upon the banks speedily became too great, and September 1, 1814, specie payment was suspended. It was during this period that the private banker first assumed the importance in the commercial world that he has to-day. Stephen Girard, the great Philadelphia merchant, purchased in 1811 the building and stock of the late Bank of the United States, and then began carrying on a banking business himself, with a capital of $1,200,000, which he shortly increased to $4,000,000. While private bankers had, of course, existed, there had been none in America on such a grand scale, and it marks the beginning of the era of great houses whose names are associated with money the world over. Girard's patriotism was, too, quite equal to his sagacity, and in the closing years of the war, after the Treasury had vainly tried to float a loan of $5,000,000, but had only been able to secure a total subscription of $20,000, Girard took the whole amount. The assistance thus furnished undoubtedly had its effect in bringing about the successful peace. This was accomplished in December, 1814, and one of the acts of Congress soon after was to grant a new charter for twenty years to the Bank of the United States. This institution accordingly resumed business in January, 1817, and speedily became one of the greatest financial institutions in the world. Its capital was fixed at $35,000,000, divided into 350,000 shares. Of this, $7,000,000 was held by the United States. Of the remainder a great amount, as much as 84,000 shares at one time, was held in foreign countries, and the stock was quoted at 50 per cent. above par. This bank issued notes, none being less than five dollars, payable in specie on demand, and did a general banking business, discounting notes and making advances on bullion at the rate of 6 per cent.

Its government was entrusted to twenty-five directors, five of whom, being holders of stock, were appointed by the President of the United States. From these directors was chosen a board of seven which, headed by the president, had active control of all its operations. It rapidly established branch offices in all the cities of any importance, and in 1830 there were twenty-seven of these branch banks in existence and doing a thriving business.

One of the first effects of the rechartering of the Bank of the United States was to force the large number of State banks either to resume specie payments or to wind up their affairs. Many were forced to the latter alternative, and of the 446 State banks then existing, there were 165, including those ruined by the war, which went out of business. From the aggregate State banking capital of $90,000,000, in the whole country, these suspensions withdrew $30,000,000. Of this amount, $5,000,000 was an actual loss and was distributed between the government and individual holders. For some time after this the State banks can scarcely be said to have increased, although they continued in existence and legislative provision for them and their government was made in many of the States.

In New York a general banking law, known as the Safety Fund Act, was passed in April, 1829. Under it banks were allowed to issue circulating notes up to twice the amount of their capital, and their loans were limited to two and a half times their capital. A guarantee fund was created by the annual payment of one half of one per cent. on the capital stock to the State Treasurer. This payment was only to continue until three per cent. had been paid, and the fund thus created was to go to making good the payment of the circulation and other debts of any such banks as might become insolvent. Other States had different regulations, not all of them as wise as New York, perhaps, but each one establishing certain precautions.

Coincident almost with the rechartering of the United States Bank was the introduction of banks for savings. These institutions are a branch of banking that, while deserving an extended mention, must fall, under the lines of this article, within a brief space. Benevolent in conception and designed to afford the poor an opportunity to save in small amounts, their plan is simply one of deposit, on which the bank, as borrower, pays to the depositors a fair rate of interest, and with the advantage of a large capital, the aggregate of many small deposits, makes advantageous investments unattainable to small capitals such as the individual depositor could control. They differ from regular banks because of their philanthropic purposes, in being exempt from taxation, and in not loaning or investing their funds on personal security.

The first American savings bank was opened in Philadelphia in 1816 and was called the Philadelphia Savings Fund Society. The same year one was established in Boston, New York following in 1819, and in 1820 there were ten in the country, having 8635 depositors and $1,138,570 in deposits. They have increased with the country, and in 1890 there were 921 with 4,258,893 depositors, and having placed to their credit the enormous sum of $1,524,844,500.

For many years the Bank of the United States continued to grow more and more powerful. Its resources increased, its business extended, and it became a factor in the industrial and commercial life of the nation, such as had not been dreamed possible. On the first of November, 1832, it was according to its own showing one of the richest institutions in the world. Its total liabilities, including the notes it had in circulation, its deposits, and the debts owing to holders of public funds, were $37,296,950.20; while its assets, including specie, cash in Europe, and debts from industrial and banking companies, were $79,593,870.97. This left the enormous surplus of $42,296,920.77. It seemed as stable as any institution of its kind in the world, not excepting the famous Bank of England, and it afforded a currency for general circulation that was freely accepted everywhere. But the great power of the Bank of the United States had made it enemies, and a demand arose, upon General Jackson's election to the presidency, that it should not be rechartered. The officers were chiefly of the party opposed to him. Immediately upon entering office the President announced that he would refuse to sign any bill extending the life of the Bank of the United States. He declared that it was dangerous to the liberties of the United States, and that it was unconstitutional. Shortly after this, the public funds were withdrawn from the bank. So great had been the prosperity of the country during the twenty years this bank had operated, however, that the war debt of the nation had been completely paid and a surplus of $40,000,000 remained. This surplus, upon its withdrawal from the Bank of the United States, Congress voted to distribute among the States. The blow dealt to the great bank by this withdrawal was a terrible one, and with the loss of its charter impending and the unrelenting enmity of the Administration, it was thought it must close. Nicholas

Levi P. Morton.

Biddle, its president, determined not to give up, however, and on February 18, 1836, he stole a march on President Jackson by having it incorporated by the State legislature as the Pennsylvania Bank of the United States. In this form, as a State bank, it continued to exist, but it never assumed the importance it had had before. It finally closed in 1840.

All this, however, took years to work itself out, and in the meantime much was happening in the financial world. The demise of the Bank of the United States as a national institution left the field to the banks chartered by the States. These at once made the most of their opportunity; and helped, as they were, by receiving on deposit large sums of the distributed public moneys, they increased rapidly, and 1837 saw 634 of them in the country, having an aggregate capital of $291,000,000. With the great prosperity which, in the shape of State bank-notes, came over the country with these financial changes, arose also a spirit of the wildest speculation. Public lands were the chosen field of the operators, and the dealing ran into millions. It was all based, though, on the current notes, many of these being issued by "wildcat" banks, and worthless. Trouble seemed certain, and President Jackson, in trying to establish our finances on a sound basis, issued his famous Specie Circular, ordering all agents to accept nothing but specie in payment for the public lands. This precipitated the crash. The banks were called upon at once to redeem all their circulation in specie, and after vainly attempting to do so, they suspended payment on May 9, 1837. Six months later, no relief having come, a meeting of 136 delegates from banks all over the country was held in New York to consider whether means could be devised for resumption, but no relief at that time was found possible.

It was during this unlucky year that, at President Van Buren's suggestion, the sub-treasury plan as it now exists was brought forward as a measure to prevent the loss of the public moneys by the failure of banks. It was defeated at this time, but three years later passed, only to be repealed in the succeeding year. Five years afterward, however, it was finally reënacted.

In May, 1838, the New York banks resumed payment. They were followed in August by the Philadelphia and Southern banks, but these only held out for a little over a year, and on September 9, 1839, suspended again. Despite all the trouble in which the banks were involved, they increased almost as rapidly as before. In 1840 their number had swelled to 901, with a total capital of $358,000,000. The system of State banks, nevertheless, had grown unpopular, and the suspensions of 1837 and 1839 and the continuing uncertainty and lack of confidence caused a strong demand for a return to the old national banking system. At this time the presidential campaign in which General Harrison was elected came on. One of the great issues on which this campaign was fought and won was that a new national bank should be established at once, and immediately upon his inauguration General Harrison called a special session of Congress to consider the matter. But he was destined never to carry out the wishes of his party, for he died before Congress had convened, and his successor, President Tyler, twice vetoed the measure when it was passed and presented to him,—as a bill to establish a "Financial Agent of the Government" "to act for it in all fiscal matters, and to facilitate mercantile exchanges throughout the country." This action on the part of the President settled the question of banks acting under the authority of the United States for many years thereafter, and until 1864 all banks of issue and deposit were operated under charters obtained in their various States. The effects of the lack of uniformity in the system were soon visible, not only in the stringency from 1840 to 1843, and the later suspension of 1857, but in the generally demoralized currency, which, with the exception of specie, had its standard of par only in its own neighborhood, and could be passed at any considerable distance only at a great discount. The farther away it went from the bank of issue the less it was worth. The State banks continued to put forth as many notes as they could pass. Many of these banks were perfectly solvent institutions, and were wisely conducted upon a sound basis; but truth compels the statement that many others were not, while at the root of the whole system was the lack of an essential uniformity. Bank failures were very common. It is worthy of mention here that throughout all the vexations and inconveniences caused by the State banks in their day, New England was little affected. What was known as the Suffolk Bank System was there in use; by this the Suffolk Bank of Boston redeemed and collected for all New England banks, each of which had a stipulated deposit, the whole aggregating $300,000, with the Suffolk Bank for this purpose.

The stringency of 1840–43 having been safely tided over by the banks, better times appeared, and a still further impetus was given to our national prosperity in 1849 by the discovery of gold in California, developing great activity both industrially and commercially. In the next four or five years the one event which stands out conspicuously in American banking was the establishment on October 11, 1853, of the New York Clearing House Association. This association, of the utmost importance in expediting and giving security to the great banking interests of the country, began with a membership of fifty-two banks. Its system, so simple and yet so effective that it seems almost impossible its origination and establishment could have been so long delayed, is that by which each bank, instead of presenting separately to the other banks for payment such of their checks as it holds and in its turn paying cash to all the other banks for such of its own checks as they hold, sends them all at a certain hour to the Clearing House. Here all the checks are assorted, a clerk being present from each bank having a membership; and the sum total of the checks each bank presents, compared with the sum total of the checks presented against it, gives a balance for which the Clearing House draws its check, and transactions that would have taken many clerks and messengers a whole day to complete, are finished in an hour or a little more. In addition to the convenience of this system, its beneficial effect in economizing currency is immense. When it is remembered that the great banking interests which center in New York have transactions daily involving exchanges of from $100,000,000 to $200,000,000, it will be readily understood what a vast loss such an amount of idle money would entail under the old system of separate clearance payments. The Clearing House, with its system of balances, is able to settle it all by the use of from 3½ to 4 per cent. of the total currency amount involved.

In addition to these advantages, the Clearing House is an assurance of protection for its members, and in its more extended operations of issuing loan certificates at critical times has been a bulwark of safety to the banking interests of the whole country. By its help, at the outbreak of the Civil War, the New York banks were enabled to come instantly to the assistance of the government with large sums, which they could scarcely have commanded otherwise; and later, in the panics of 1873 and 1893, the issuance of $25,000,000 in loan certificates on the first occasion, and nearly $50,000,000 on the second, again did much toward enabling the banks to withstand the terrible pressure of those times. Between these years the average daily exchanges of the Clearing House were $105,964,277 and the average daily balances $3,939,265. At present sixty-six banks are members of the Clearing House Association. Besides these, eighty-one other banks and trust companies which are not members are cleared here through the banks which belong to the association. A sixty-seventh member of the Clearing House Association is the Assistant Treasurer of the United States, at the sub-treasury in New York. Almost 90 per cent. of the government expenditures being made in New York by check, the membership of the Assistant Treasurer greatly facilitates clearance.

The advantages of the clearing-house system were immediately recognized when the New York association started, and Boston, Philadelphia, Chicago, St. Louis, and other cities soon adopted it.

Returning to 1853, the banking interests of the country continued much in the same condition, but trouble was already brewing from over-speculation, and in 1857 the great financial and industrial depression, which was fortunately as short as it was sharp, struck the country. The great storm broke on August 24th of that year, when the Ohio Life and Trust Company suspended with liabilities of $7,000,000. It was a terrible failure, and on September 25th and 26th the Philadelphia banks were forced to suspend; a general suspension in Virginia, Maryland, Rhode Island, and the District of Columbia soon following. The trouble increased in New York, and a run on the banks threatening serious consequences, the legislature on October 14th authorized a suspension of specie payments for one year. The banks accordingly closed, but on December 24th, after only two months, the city banks resumed. The Massachusetts banks also suspended, and the panic became general in New England, factories being shut down, banks closed, and troops held in readiness to suppress anticipated riots among the great crowds who were thrown out of work. Fortunately the trouble did not last long, but while it existed there were 5123 failures, with total liabilities of $291,750,000.

The resumption of banks and renewal of business was general early in the succeeding year, and that the banks of the country suffered as little as any of the great interests affected is shown by the fact that in 1860, one year prior to the long suspension of specie payments caused by the war, there were in the country 1562 banks, with an aggregate capital of $422,000,000 and a circulation of about $207,000,000. They held in specie at the time $83,594,537, and were credited with deposits of $254,000,000.

During the next four years the part played by the banks was loyal and patriotic, but the history of that time with its government issues of "legal tenders" comes more properly within the domain of national finance. The national banking law, which regulates the banks to-day, was passed June 3, 1864. Its provisions are simple and eminently secure, and in their operation have proved most satisfactory. They require a company of five persons or more and a fully paid-up capital. As a security for their notes of issue they are obliged to hold the government's pledge in the form of United States bonds, on which they are allowed circulation by the Comptroller of the Currency up to 90 per cent. of their par value. Shortly after this law was passed, Congress placed a prohibitive tax of 10 per cent. on the circulating notes of the State banks, so that for the first time since 1836 the currency of the country returned to the original basis of the national credit, where it has since remained.

The national banking law had no sooner passed than many of the old State banks began changing to the new system. While the war lasted the number of the national banks was about 500. Those that remained under the old State charters continued to do, as they are doing to-day, a general banking business of discount, loan, and deposit, but the circulation of their notes became impossible owing to the tax. When the national banks were first organized Congress had provided that the total circulation to be allotted them by the Comptroller of the Currency should not exceed $300,000,000. So rapid was their increase, however, that four years later the full amount of these notes had been issued, and there were 1629 national banks with a paid-in capital of $426,189,111. Of these banks Massachusetts had 207; New York, 299; Pennsylvania, 197; and Ohio, 133. Two years later, inconvenience being experienced because the limit of circulation had been reached, Congress authorized an extra issue of $54,000,000, which was almost immediately taken up.

The following year (1873) saw the disastrous ordeal of panic and distress through which it was inevitable the nation should pass on its return from the inflation caused by the great war loans to the sound and normal basis of peaceful prosperity. It was passed without wreck, although commercial and financial interests suffered heavily. In 1875 Congress removed all restrictions upon the total amount of notes the national banks might issue. It also voted the resumption of specie payment, which had been suspended since 1861, and decreed that it should take place January 1, 1879. This resumption, it may be said, to the undying credit of the American nation, was accomplished without the slightest disturbance of business. Since then, the number of national banks in the country has increased steadily each year. With 2047 banks, having an aggregate capital of $497,864,833 and a total surplus of $134,123,649 in 1875, the next ten years showed, in 1885, the existence of 2665, with capital amounting to $524,599,602 and a surplus of $146,903,495, making an increase of 618 banks and a gain of $26,734,769 capital and $12,779,846 surplus. Still growing and prosperous, the country continued to call for the further extension of the banks with their facilities and assistance, and in 1892 their number had become 3701, having an aggregate capital of $679,076,650 and a surplus of $237,761,865. These banks in their average daily deposits took over $300,000,000, which shows the enormous part they play in the business world. Of this, about 90 per cent. is in the form of the almost universal check.

In this year (1892) came upon the country the beginning of the depression of business and financial stringency that is now so happily showing signs of abatement. It came more gradually than such crises usually come and has been more persistent. Without actual panic the country verged perilously near to disaster. The money-broker, who had almost disappeared since the days of the war, reappeared and secured premium for currency of any sort. The banks had very little money of any kind, and for a time payments were almost wholly in certified checks. This showed that the trouble was not really organic, and vast sums of idle money, hoarded and withdrawn from circulation, further attested that the country was not impoverished. But confidence was lacking, and it operated as a check on enterprise which, reacting industrially as it always does, reached all classes and caused much suffering. It also gave rise to the great danger of a run being commenced on the savings-banks. In the West, indeed, this did happen; and many perfectly solvent institutions were forced to the wall, being unable to realize quickly enough on their securities to meet demands. In New York, when the trouble became threatening, and a rush of eager, excited depositors was to be expected at almost any moment, the savings-bank officials met, and taking advantage of the law, declined to pay any accounts without three months' notice. This saved the banks, but it was the nearest approach to suspension that had been known since 1873.

The causes of the trouble have been matter for much discussion and difference of opinion during the past two years; and a belief that its roots lay in certain fallacies of national finance has caused action by Congress, which has undoubtedly been beneficial in its effect. Still, it is questionable whether the true seat of the difficulty has been, or will be, reached by any of these measures or plans of alleviation. An overreaching speculation, which had locked up resources that should have been available, coupled with great uncertainty and some apprehension, perhaps owing to political events and the commercial and industrial changes they might be expected to bring with them, had much to do with it. To-day, it is pleasant to believe we have passed beyond it.

In this brief résumé of a century of banking in America, the vastness of the present interests has been already foreshadowed. How enormous these interests are and of how general usefulness, words alone can convey no adequate idea. In figures only can expression be found for the financial magnitudes that make up the American banking interests of to-day. From the $400,000 capital represented by Robert Morris's bank in Philadelphia a little over 100 years ago, the aggregate capital of the banks of the United States is now, according to the latest available statistics, the tremendous sum of $1,069,826,555, while one person in every seven or eight in the whole country patronizes the banks as a depositor and thus gains the privilege of their conveniences and economy. Against the above aggregate of capital the banks hold aggregate resources amounting to $7,342,397,052, and of the 12,000 banks in existence, exclusive of loan and trust companies, in the year ending July, 1894, only seventy-nine failures occurred. The solvency of the system is well evidenced in this, and safeguarded as the banks are by Federal and State legislation, with regular examinations by experts and sworn reports from officials, it is fair to say that no community enjoys greater security for its funds of deposit or exchange.

The very foundation of the American system for the past thirty years has been the national bank, which has opened its doors in nearly every town and hamlet of the country where the common business of life is transacted. It is a well-organized, carefully supervised, uniform system, which renders its benefits to the individual directly and indirectly, as well as in the revenue it affords the government. The latest statistics give the number of national banks in the country, October 31, 1894, as 3756, in which there were 287,842 shareholders. Their aggregate capital was $672,671,365, and their total surplus and undivided profits $334,121,082. Of these banks and their capital, Pennsylvania led with 406 within her borders, but her capitalization was but $74,168,390, or less than that of New York with 334 banks and $87,346,060 capital, or than Massachusetts with 267 banks and $97,992,500. In the importance of its national banks Ohio ranks fourth, with 246 institutions having a capital of $45,240,100.

The total resources of the national banks on October 2, 1894, were $3,473,922,055, and on October 31st of the same year they had a total circulation of $207,472,603 outstanding, as security for which there were United States bonds on deposit to the value of $199,706,200, and $28,071,239 lawful money reserved on deposit to redeem circulation. Their total loans and discounts were $2,007,122,191. In individual deposits the national banks held on July 18, 1894, $1,647,017,129, and the number of depositors was given as 1,929,340.

Under the latest statement of the condition of the national banks, based on Comptroller Eckels's call of July 11th last, the figures show the aggregate of resources and liabilities to have been $3,410,002,591 each. The whole number of national banks was 3715.

As the national banks do not usually pay interest on current balances, the fact that they are utilized as banks of deposit to such a great extent shows the appreciation in which the facilities afforded by them for the transaction of business are held by the public at large. Since the national banking system started, upward of thirty years ago, the aid rendered through it to the business world in carrying on its undertakings has come to be fully recognized. The ruinous rates of exchange prevailing under the old State-bank system, prior to the war, are happily forgotten. A check or draft can be bought from a bank in New Orleans or San Francisco, drawn on its New York correspondent, which will cost but the smallest fraction of 1 per cent., or nothing at all, according to the time of year and the direction in which money is moving. For this same exchange in 1859 the average rate was from 1 to 1½ per cent., a tax upon the extension of business that could not be borne in the present era of close competition and narrow margins. Again, on the total issue of about $200,000,000 of State bank-notes in circulation prior to 1860, a loss of from 1 per cent. to 10 per cent. was entailed upon the holders in any but the most restricted local transactions. The advantage of replacing this circulation of discount by a bank-note of uniform appearance, with value fixed by law and ordered receivable at par by every other bank in the system, was speedily apparent. Furthermore, behind this uniformity lies as security the quickest asset known, in the shape of the United States bond fully covering the circulation. Lawful money reserves further provide for the redemption of circulating notes by these banks, and a further reserve of deposit funds is ordered not alone to secure depositors, but to still further hedge about the reserves from possible impairment. In all these ways, as well as by the reductions achieved in rates of interest on loans and discounts, through making available a largely increased capital, together with lessened charges for collection made possible by thorough organization, the people have directly felt the benefits of improved banking methods. The immense aggregate saving that is accomplished annually along these lines can be gathered from the fact that the clearing houses of the United States in the single year of 1894 had clearings amounting to over $45,000,000,000. With such great sums as these, the smallest fractional charge possible becomes heavy in the aggregate of transactions.

Of the relation of the national banks to the government there is but little dispute, and practically but one opinion — that it is mutually beneficial. Until March 3, 1883, both capital and deposits of the national banks were taxed, and a further tax of 1 per cent. on their circulation has been continued from the first. From these three items of taxation, the first two discontinued since 1883, an aggregate amount of $144,660,952 had been yielded up to July 18, 1894. In addition to this a conservative estimate allows two fifths per cent. of revenue to government on the national bank-note circulation, through failures to redeem, which forces the banks to make the full amount good before taking down their deposit of United States bonds against which the notes were issued.

As government depositories the national banks further perform without charge duties that annually save the government a great deal of money. Since their inauguration the national banks have received and stored in their vaults, at various times, $3,500,000,000, a service of great value. As a governor of the national currency, operating to keep it within controllable bounds, the national banks have also been of the greatest assistance through the facilities they afford for the issue of instruments of credit. The depositors in the national banks in 1894 outnumbered by 492,702 those in all the State and private banks and loan and trust companies combined. As these, together with the national banks, are utilized for checking against balances on deposit rather than on those in banks for savings, it is readily seen that the check is more largely employed at the national banks than at the other institutions, and inasmuch as at least 53 per cent. of even the retail, and consequently more largely cash, business of the country is transacted through the medium of these small pieces of paper, while from 90 to 92 per cent. of the total business is thus transacted, the important part they play will be likewise readily understood. The circulating medium which, in a relative sense, these instruments of credit supply, is perhaps a relief that should counterbalance the complaint sometimes made regarding the non-elasticity of issue under the present national banking system. The average annual circulation of the national banks between 1864 and 1894 was $282,801,252, and the security of the notes is absolute. A fluctuating market for bonds, against which only a percentage of issue is allowed, has undoubtedly made the lines of issue a little rigid, but whether more so than is consistent with proper precautions against possible manipulation or inflation is a matter of extreme doubt. In fact, so far as the system goes, it is the most perfect yet devised, and in its operation has united uniformity and stability with great facility of adaptation to the constantly arising needs of the commercial and financial interests.

On the national banks as a foundation, then, rests the great superstructure of State, private, and savings-bank institutions, which, together with the building and loan associations and the loan and trust companies, constitute the remainder of the money-managing world of this country. Of the State banks there were in the United States 5033 on July 1, 1894, with an aggregate capital of $244,435,573 and resources amounting to $1,077,164,813. These banks held a surplus of $74,412,319. The aggregate deposits were $658,107,494, and the loans and discounts $665,988,823. Of United States bonds these banks held but $604,055, as against $10,662,200 held as investment by the national banks in addition to those deposited as security. The business is profitable, but in the average rather less so than that of the national banks. In all the respects of general banking the State banks transact the same kinds of business as the national institutions, with the exception of the issuance of circulating notes and the performance of those functions of a governmental nature entailed by a Federal charter.

The savings-banks in existence in July, 1894, were 1024 in number and in two classes, the mutual and the stock. The latter class, of which there were 378, is of comparatively slight importance, not more than 15 per cent. of the total figures of this branch of banking being accredited to it. The capital stock of the savings-banks of the country is about $30,000,000, and their total resources are $1,980,744,189. The total amount of the deposits of individual savings is $1,747,961,280, while about $30,-

000,000 more is held subject to check. The loans of these banks amount to $1,026,622,425, of which but a very small percentage relatively is secured on other than real or intrinsic values.

The private banks, while neither so numerous nor so heavily capitalized as the branches just mentioned, are a most potent factor in the commercial world, by their especial prominence in the field of foreign exchange. Their number in 1894 was 904, and their total capital $26,652,167, with resources of $105,379,051. Their surplus was placed at $6,005,126. The total of the loans and discounts was $66,596,017, being $521,468 in excess of deposits.

The 224 loan and trust companies have a total capitalization of $97,068,092 and a surplus of $57,663,599. Their total resources are $705,186,944, of which loans and discounts are $374,421,713. With the exception of the national and savings-banks, these companies are the heaviest holders of United States bonds among the banks, $13,449,411 being accredited to them.

These five branches constitute, properly speaking, the American banks. The building and loan associations are a species of coöperative banking, savings, and loan business, and, since they started in 1840, have grown rapidly. The statistics of 1894 gave 5838 of them in operation in the United States. These wonderfully fast-spreading institutions, deriving their capital from dues assessed on their members and loaning it again to those giving real security, had in 1894 the enormous sum of $470,142,524 loaned on real estate alone. As nearly all the loans are small in amount, being simply enough to build a home for some comparatively poor person, the extent of this coöperative undertaking is readily seen. In addition to these loans on real estate, the associations have combined resources sufficient to bring the total to $528,852,885, against which the heaviest items are $370,003,478 for dues paid in, and $35,775,366 on paid-up stock.

Under these various heads, then, the banking interests of America have grouped themselves in the closing years of the nineteenth century. Beneath them all are the broad, strong shoulders of the United States government, bearing the final responsibility. In the magnitude of the interests now represented in the bank, all branches of industry and commercial activity have at last come to see their share. In the statistics of the annual report is told each year the story of what America has achieved. In the extension of the bank to the remoter districts are carried the same improvements to the every-day business conditions of the community that the waterworks brings to the sanitary conditions, or the public school to the educational conditions. The bank is the agent of civilization in its advance, whether in new countries or new fields of human endeavor. In the city it is the great driving engine furnishing the power for the machinery of affairs. The few brief figures of the dry and business-like report, giving the resources of the banks of the United States at $7,342,397,052, tell most eloquently the commercial and industrial achievements of the American people. To this success the banking interests have contributed in no scanty measure, and in it they, in common with all the people, share to-day.

One very prominent feature in the history of banking has been the part played by private banks. It has been seen that Stephen Girard was very important in the history of Philadelphia banking; and later, Prime, Ward & King, bankers in New York, were enabled to perform eminent services for their country by loans negotiated in England. It was not, however, till about the time that the supply of gold from California raised the prices of commodities all over the globe, that many important American houses in banking circles became prominent. Every great city now has its private banks and bankers, who exercise an important part in the economy and distribution of wealth. They are able to handle business without making it known to the whole world; they can afford instant aid, without appeal to a board of directors, and everywhere they have proved of value. Such names as those of the Drexels, the Morgans, the Peabodys, and the Browns, will instantly occur to every one as household words in the realm of finance.

Levi P. Morton

CHAPTER II

AMERICAN LABOR

ACCORDING to the census of 1890, the total number of people engaged in gainful occupations of all kinds was 22,735,661, of which number 18,820,950 were males and 3,914,711 females. These figures include all engaged in any gainful occupation, whether wage-earners or wage-payers, whether employers or employees, and whether engaged in manual or professional service. Eliminating the wage-earners from this vast number, it is found that they constituted 15,099,901, of which number 11,802,540 were males and 3,297,361 were females. If we classify this large number of wage-earners, we find that 3,639,437 were engaged in agriculture, fisheries, and mining; 4,153,385 in domestic and personal service; 2,364,661 in trade and transportation, and 4,942,418 in manufacturing and mechanical industries. These statements are general, and that more specific information may be at hand the table on the next page has been made, giving the number of males and females and the total employed in specific occupations where more than 50,000 were engaged.

It would be exceedingly interesting if the growth of this great body of working-people, numbering over 15,000,000 at the present time, and the influences which have brought it into existence, could be traced step by step during all the past 100 years. It is impossible to give statistical statements of the number of persons employed in any industry, or otherwise, until the census of 1850, so we cannot ascertain what the strength of the body of working-people was in 1795. A fair calculation, based on relative statistics at different periods, would indicate that it was less than 500,000. Calculations in this respect are not satisfactory, however, because labor at the beginning of the 100-year period of which we are treating was engaged in domestic manufactures, of which no general account exists.

Four fifths of the population of the United States at the close of the Revolutionary War was, according to Mr. Bancroft, the historian, of English descent. He states that in 1775 the colonies were inhabited by persons one fifth of whom had for their mother tongue some other language than the English. At the present time careful consideration would indicate that only about one half of our population can claim the English as their mother tongue; and yet, during the first quarter of the present century, immigration could not have affected the nationality of our working-people to any great extent, the accepted estimate of the total number of immigrants between 1790 and 1819 being placed at 250,000. Prior to this year (1819) no account was taken of the number of immigrants settling in the country, but since that year the Federal government has taken account of immigration. In no year between 1820 and 1824, inclusive, did the number arriving in this country reach 10,000. In 1833 the largest number in the first third of the present century arrived, when 58,640 immigrants were registered. In only two years, 1835 and 1838, has the number been less than that just given, but with these two exceptions, the annual immigration has been progressive, although varying in volume. Great impetus was given in the forties, the movement being accelerated by the famine in Ireland in 1846 and 1847, and by political causes in Germany. The total immigration since the Revolutionary War and up to July 31, 1895, was 17,731,678, while the foreign-born residing in this country at the census of 1890 was 9,249,547, being 14.77 per cent. of the whole population.

These large additions to our population must have had a marked influence upon our industrial conditions. In 1880 30.63 per cent. of all persons engaged in manufacturing and mechanical industries were foreign-born, while in 1890 31.56 per cent. of those so engaged were born abroad. In

1880 12.52 per cent. of the foreign-born were engaged in agriculture. It is seen, therefore, that the manufacturing and mechanical industries have absorbed a much larger proportion of the new element than has agriculture. The tendency of our immigrants is to assimilate with our mechanical industries. This, of course, increases the supply of labor in comparison to the demand, and may have at times lowered wages and crippled the consuming power of the whole body of the population. I am satisfied that this has not been serious, and it may have been imperceptible, for at the time of the accelerated movement of immigration there was a vast development of the railroad interests of the country, which development could not have been carried on so extensively and completely as it was without a large body of common laborers. Immigration supplied this labor, but it soon began to find its way into organized industry. As the tendency of wages has been constantly upward since the close of the last century, it cannot be argued that the assimilation of immigrants with our own native labor has reduced wages, but it can be assumed—without the possibility of proof, however—that such assimilation may have retarded their increase beyond what was experienced.

During the past few years the industrial depression has checked immigration, but with renewed prosperity the movement may assume its normal proportions. The character of immigration has changed, and this change has not been for the better. If immigration could be left entirely to natural motives it is quite evident that the movement would be retarded gradually, but it is stimulated by transportation companies, in their desire to secure business, to such an extent that a large body of objectionable immigrants has been brought to the country during the past ten years. When it is known that an immigrant can be transported from Italy to Chicago for less money than a first-class passenger can travel from New York to Chicago it is not strange that people flock to the United States; and during this past decade it is quite certain that labor in America has suffered through this class of immigration, especially in mining districts, where wages have been kept down and much distress has prevailed through

NUMBER OF MALE AND FEMALE WAGE-EARNERS REPORTED FOR OCCUPATIONS IN WHICH 50,000 OR OVER WERE EMPLOYED IN 1890

Occupations.	Males.	Females.	Total.
Agriculture, Fisheries, and Mining:			
Agricultural laborers	2,556,930	447,085	3,004,015
Fishermen and oystermen	59,887	263	60,150
Lumbermen and raftsmen	65,829	28	65,857
Miners (coal)	208,330	219	208,549
Miners (not otherwise noted)	140,906	133	141,039
Stock-raisers, herders and drovers	70,047	687	70,734
Domestic and Personal Service:			
Barbers and hair-dressers	82,151	2,825	84,976
Bartenders	55,660	147	55,807
Engineers and firemen (not locomotive)	139,718	47	139,765
Housekeepers and stewards	6,008	86,802	92,810
Laborers (not specified)	1,858,504	54,813	1,913,317
Launderers and laundresses	31,816	216,627	248,443
Nurses and midwives	6,688	51,402	58,090
Servants	237,523	1,205,876	1,443,399
Watchmen, policemen, and detectives	74,350	283	74,633
Trade and Transportation:			
Agents (claim, commission, real estate, insurance, etc.) and collectors	169,704	4,875	174,579
Bookkeepers and accountants	131,602	27,772	159,374
Clerks and copyists	492,852	64,048	556,900
Draymen, hackmen, teamsters, etc	368,265	237	368,502
Hostlers	54,005	24	54,029
Locomotive engineers and firemen	79,459	4	79,463
Messengers and errand and office boys	48,446	2,909	51,355
Sailors	55,875	29	55,904
Salesmen and saleswomen	205,931	58,449	264,380
Steam-railroad employees (not otherwise specified)	381.312	1,438	382,750
Telegraph and telephone operators	43,740	8,474	52,214
Manufacturing and Mechanical Industries:			
Bakers	57,908	2,273	60,181
Blacksmiths	205,256	59	205,315
Boot and shoe makers and repairers	179,838	33,609	213,447
Brick and tile makers and terra-cotta workers	60,007	194	60,201
Butchers	105,313	129	105,442
Carpenters and joiners	611,226	191	611,417
Cotton-mill operatives	80,144	92,914	173,058
Dressmakers	828	288,155	288,983
Iron and steel workers	142,087	2,449	144,536
Machinists	176,937	139	177,076
Marble and stone cutters	61,006	63	61,069
Masons (brick and stone)	158,874	42	158,916
Mill and factory operatives (not specified)	51,561	41,850	93,411
Millers (flour and grist)	52,745	99	52,844
Milliners	406	60,058	60,464
Molders	66,241	47	66,288
Painters, glaziers, and varnishers	218,622	1,246	219,868
Plumbers and gas and steam fitters	56,555	42	56,597
Printers, lithographers, and pressmen	80,889	5,565	86,454
Saw and planing mill employees	133,216	302	133,518
Seamstresses	3,988	145,716	149,704
Tailors and tailoresses	121,586	63,611	185,197
Tinners and tinware-makers	54,427	947	55,374
Tobacco and cigar factory opcratives	83,601	27,821	111,422
Wood-workers (not otherwise specified)	63,529	3,696	67,225
Woolen-mill operatives	47,636	36,435	84,071

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the influx of very cheap foreign labor. It may be said, with almost entire truthfulness, that the mining industry is the one that has chiefly suffered in various directions through foreign immigration.

In 1795 the labor of the country was, as already stated, of a domestic character. Working-people were engaged in agricultural pursuits, the fisheries, and in the clearing of the forests, while a small percentage were engaged in what is known as domestic manufacture and in commerce. The factory system, dating from 1790 as the year of its birth, did not become influential, so far as labor was concerned, until after 1820. With the complete establishment of textile factories, which occurred in 1813 at Waltham, Mass., which town has the honor of erecting the first complete factory in the world for the manufacture of finished cloth, in all the various processes, from the raw material, labor began to find new avenues of employment, and the young women of the rural districts were induced to enter factories as spinners and weavers. The growth of the textile factory was rapid after 1820, both in the New England and the Middle States. Fair wages and easy work attracted the women of our own country and English girls, and until Irish immigration commenced in earnest our textile factories were supplied with English and American girls mostly, but since their day there have been various changes. The American and the English girl stepped out of the factories and up into higher callings, and the Irish operative stepped in. The Irish operative has during the last twenty years or more, however, been giving way gradually to the French-Canadian and representatives of other nationalities. Practically during the last fifty years there have been three changes in nationalities in the operatives of our textile works. With the adaptation of steam and water-power in the textile industry other industries grew. Of course, all manufacturing received a great impetus during the Revolutionary War, when our people were obliged to furnish their own supplies. During the war the manufacturers extended their enterprises and built mills — which are sometimes called factories — but they were simple in their construction. At the close of the war all these efforts either ceased or the production of the mills was greatly reduced.

The American nation found itself independent politically of Great Britain, but still a subject of it in respect to all its manufacturing interests. The English government sought to prevent the planting of the factory system here, but through the ingenuity and perseverance of Samuel Slater, who had served his apprenticeship in the construction and management of factory machinery in England, the system was established in the United States; and then, as a result of the earlier legislation after the adoption of the Federal constitution, manufactures were stimulated and the era of industrial progress in this country was opened. It can be said that the century from 1795 to the present year has been one of constant progress in the labor world, the factory system gradually taking over to itself industry after industry, until nearly everything is now produced under it. The old domestic or hand system has passed away almost entirely, and the régime of invention and machinery holds full sway. These great industrial changes have practically wrought a revolution in this and other countries, bringing constant employment to our working-people, and resulting in a tendency all through the century to the increase of wages and a decrease in the cost of production.

Along with this change in the method of production, mining has been developed to an enormous degree, until now the United States produces as much iron as the mother country. The development of iron-mining and the manufacture of iron have brought into employment a vast body of skilled workmen, and the ramifications of the industry still greater forces. Our large towns and cities are, as a rule, thoroughly equipped with sewers, and the manufacture of pipes and mains for this purpose, as well as the manufacture of gas-pipes and mains and plumbing work generally, has been the result. These latter changes have occurred within the last fifty years.

The change in the system of work has practically done away with apprenticeships. Manual training and the work of trade schools are fitting boys and young men for skilled work in a better way than did the apprenticeship system, which was the universal rule at the beginning of our century. With the establishment of the factory system apprenticeships were less obligatory. By 1850 the resort to them was waning, while since the vast development of the factory system, especially subsequent to the Civil War, they have been still less prevalent. Another great change which has come in the way of industry is the employment of women. They were engaged only in domestic labor, except in rare instances, in 1795, but now there are few occupations in which they are not represented. The number grows from census to census. This change was brought about by the adoption of the factory system, under which women found they could attend light-running machines with skill and with fair remuneration. While their compensation is exceedingly low now in almost all industrial pursuits, yet it is something where nothing was received before. They constitute a new economic factor in industry, and being a new economic factor, they cannot as yet hope to receive liberal wages. It can hardly be said that they have displaced men, but they have displaced boys and girls to a considerable extent. The first tendency under the factory system was to employ children, and the number constantly employed increased from year to year, until during the last fifteen or twenty years, when the number has been rapidly on the decline. Public sentiment voiced by legislation, as well as the economies of production, is driving the children out of our factories: women are taking their places. In some industries men have taken the places of women, the change of the form of work resulting in such displacement. Laundry work is practically factory work now; and the old domestic hand-weavers, who were to a large extent women, have seen their work transferred to the factory.

These industrial revolutions have carried with them other changes, which perhaps are more ethical than economical in their relations. For instance, under the old system of labor, employers had a paternal relation to their employees, and even in the early cotton mills in New England the paternal system of caring for employees was adopted. This was chiefly noticeable at Lowell, and later on also in Manchester, Conn., under the Cheneys' administration of the silk-works; but as the factory system has spread this paternal care has been lessened, although during the last few years there has been a great revival in the discussion of the usefulness of such paternal oversight. The absolute necessity for the congregation of great bodies of working-people in one locality is everywhere stimulating the thought that there should be some other rule than that of entire non-interference with the welfare of employees. The public is considering this question, and great employers here and there are trying the experiment of taking an interest in the home welfare of their employees as well as in their efficiency.

The changes in the industrial system have had many ramifications. The labor movement in this country, that is, the organized attempt of labor to impress its aims upon the whole people, may be said to have begun with the century that is now closing, but it did not gain full headway until the nineteenth century was fairly on its way. This is true, notwithstanding the labor question has been present always in the development of the world; but contemporaneous with the development of the industries of the United States the movement, as it is now known, has taken place, and its speed has been accelerated as the industrial development has progressed. Prior to the establishment of the factory system there was little organization. Here and there a club of skilled workingmen existed. This was notably in the Eastern and Middle States. Since 1825, however, the movement has been rapid, and its results, while not always satisfactory, are indicative of real progress. In the early years of the labor movement many arguments were advanced against it, and the attempt made to prevent workingmen from joining in organization. The merchants and ship owners of Boston, at a meeting held in the Exchange Coffee Rooms on May 15, 1832, voted to discountenance and check what was called the unlawful combination formed to control the freedom of individuals as to the hours of labor, and to thwart and embarrass those by whom they were employed and liberally paid. This meeting was emphatic in its declaration that there was a pernicious and demoralizing tendency in combinations and an unreasonableness in any attempt made by organizations to secure more favorable conditions of work. It was held everywhere that labor ought always to be left free to regulate itself, and that neither the employee nor the employer should have the power to control the other; and the old stock argument that organization would drive trade from the country was resorted to then, as now, and a resolution was adopted at the meeting referred to, that the members of it would neither employ any journeyman who at the time belonged to a labor combination nor give work to any master mechanic who employed them while they continued pledged to their associations. These statements sound very much like those made at the present time, and yet the story of labor organization — its course, its successes, its failures, the philosophy underlying it, and the influence it has exerted in many directions — goes to prove that the world is growing better, and that the condition of labor as it now exists is a vast improvement upon its condition at any other period. This might be proved by an exhaustive citation of wages and prices during the past 100 years, were such citation necessary. It may, perhaps, be well simply to say that wages, even during the past half-century, have increased, on the whole, something over sixty per cent., while the general course of prices has been downward. This is true of other countries in which machinery performs an important part in production, but it is essentially true in America, for here, with our vast resources, our peculiar systems of education and of government, exerting great influence upon the minds of all, wages are higher than in any other country in the world. The standard of living is necessarily higher, of course, and the workingman finds that he is able not only to preserve his working condition, but to participate in other things which are essential to his spiritual development.

To-day organized labor has many defenders. It is looked upon with disfavor in some quarters, but I think, as a rule, employers are quite willing that their employees should organize, for they have their own organizations and do not feel like denying the right to others. Of course, a very large proportion of the working-people of this country are unorganized, and I presume this is true of manufacturers and employers on their side; but as the methods of production are brought to a larger and grander scale, organization in every direction will more and more prevail. At present organized labor is estimated at 1,400,000. This is the result of an estimate based on the claims of different organizations. I am inclined to think it is too liberal an estimate, and yet, placed in comparison with 15,000,000 wage-earners, it does not seem large; but, as a rule, organized labor is employed in the manufacturing and mechanical industries, and in this sense the percentage is high. The proportion of organized manufacturers to the whole body is probably much larger.

As the labor movement has grown strikes have become more frequent, and while undoubtedly the era of strikes is passing away, yet it will be some time before the downward scale is reached as to numbers and importance. The great strikes in the country have had a marked influence in many directions. They have excited working-people to undertake other strikes; they have brought bitterness between employer and employee, and yet on the whole they are bringing a new line of thought to the public mind, and their study will, I feel sure, result in good to all classes. Strikes are teaching the public its interests in industry as over against the personal and selfish interests of the two parties immediately involved.

The labor question has met with a great change as a result of the Civil War. Our negro population has lost some of the old occupations in which it was engaged in the North half a century ago, but it is gaining others. In the South the employment of the negro is becoming more varied and his condition more hopeful as one of pecuniary prosperity. Negro labor is abundant, good, and steady in certain lines. The question is often asked, whether the division of employment lessens the quality of work. I do not believe it does. The great principles of modern industry are association, concentration, and specialization. With the first the second is absolutely essential, and the third is the result of concentration. If these things lessen the quality of the work, then the opposite must be true — that without them quality is improved. This carries the argument too far. If there is much truth in it, then the simplest, humblest kind of work is best for the worker. Sawing wood and paving streets, the most ordinary manual toil, are better for the worker than the employment of his intellect in tending a machine. A study of all the facts leads to the positive conclusion that the division of employment does not lessen the quality of the worker when considered as a man.

Working-people have experimented with coöperation, profit-sharing schemes, and other methods of increasing wages. These experiments have in many instances proved failures; in others, successes. They are likely to do some good, but it will be a long time before the moral character of the men involved will permit successful management of coöperative schemes. The principle is right. The coöperative principle is that of our modern system of industry. Pure coöperation, probably, cannot succeed, from an economic point of view, but the coöperative spirit can prevail to a higher degree than it now does; and all these things — combinations of workingmen, public sentiment, economic conditions (and the latter more largely than any other) — have reduced the hours of labor from eleven, twelve, and thirteen per day to eight, nine, and ten per day. These changes, however, came gradually, and as the result of improved methods of production.

After the economic changes were assured law stepped in and made the custom the public voice. The first ten-hour law in this country, however, was not passed until 1874, when the State of Massachusetts provided that women and children should not be employed over ten hours a day in the textile factories of the State. Another specific change which has come is the frequent payment of employees for their services. The method in former times was to pay the working-people part in cash and part in goods, and settlements were made at long intervals. Now everywhere, with a few exceptions in the West, where to some extent the truck system still prevails, cash payments at short intervals are the rule. This change has been brought about both by public sentiment and by statutory enactments.

One of the greatest changes which has been wrought by the new system has come through corporations. When the century began, the workingman and his employer were practically associated;

they worked side by side; they had a personal acquaintance each with the other, and their interests were, to a large extent, practically the same. With the establishment of the factory system there came the necessity of using large capital, more than one man or a firm of men contributing; so the corporation became a necessary factor in the development of industry. Many small stockholders aggregated their means and made a large capital. The interests of the stockholders had to be administered by a corporation government, and this corporation government employed men and women. The ethical relations were changed at once. As a great capital is now the result of the aggregation of small savings in many respects — although in some instances the stockholders are heavy capitalists — the organization of labor has grown on the ground that one organization should deal with another; that if the stockholders lose their personality and are represented by a manager, the large body of working-people lose their personality, and their interests should be represented by a manager or a committee. One of the vital changes resulting from this growth of corporations is the liability of the employer to the employee for damages received while in the employment of the corporation. The old common-law rule relating to the liability of employers for accidents occurring to their employees is that a workman cannot recover damages for injuries received through the carelessness or negligence of a co-employee, although a stranger may recover for an injury following the same carelessness or negligence. This rule grew up under the domestic system, when employer and employee worked side by side, and each knew the character and skill of the other, and when several workmen working together were supposed to be acquainted with the risks of their occupation as well as with the character and skill of their co-employees. But when expanded methods are introduced this old rule becomes somewhat ridiculous; for co-employees may be a brakeman and a switch-tender, and under this rule a brakeman on a train running, perhaps, 500 miles, could secure no damages whatever from a railroad corporation employing him, in consequence of any injuries received through the carelessness or negligence of a switchman along any part of the line, although the brakeman knew nothing of the switchman, had no knowledge of his skill or capacity when he engaged with the company, and in no sense of the word, so far as risk and association of service were concerned, could be considered the co-employee of the switchman. Yet, as the common-law rule grew up before great industrial enterprises were established, courts have projected it, and have ruled that in such a case as that just mentioned the switchman and brakeman were co-employees, and that therefore the employer could not be held liable. This rule is being broken down by statutory restrictions in different parts of the world, although it has not generally been modified, and still holds good in many States.

There are very many other points where changes in relationship have been made by the change in system. Looking the field over broadly, the conclusion must be reached that on the whole the working-people have been gainers during the progress of the past century — gainers not only in wages, both real and nominal, but in their relations to society; so with the facts briefly stated we may well consider such relations and the general philosophy of American labor conditions.

De Tocqueville, when studying this country, observed that amongst a democratic people where there is no hereditary wealth every man works, or has worked, to earn a living, or is the son of parents who have worked, and that in such a community the notion of labor is presented to the mind on every side as the necessary, natural, and honest condition of human existence; that in America even a wealthy man thinks he owes it to public opinion to devote his leisure to some kind of industrial or commercial pursuit, or to public business, and would think himself in bad repute if he employed his life solely in living.

These reflections of De Tocqueville, conveying the idea of life or of actual living, are stimulated by all the elements which make up the essential characteristics of this period. Nearly all the great fortunes, as they now exist, have been built upon the actual toil of some industrious ancestor. It does not do for our wealthiest people, unless they wish to be called simply aristocratic, to look beyond a generation, or, at the most, three generations, to find their ancestry engaged in arduous labor, building from that condition to a business career, and leaving behind them at its close possessions upon which have been erected great fortunes. In some instances, to be sure, present fortunes are the result of fortunate speculation or investment in real estate, but the rule is the other way, and as first stated.

The American nation consists of workers; and at the present time more than at any previous period the younger members of very wealthy families are devoting their time and service to labor as assiduously as if their subsistence depended upon their earnings. In America, therefore, labor holds a more honorable place in the minds of all the people than it does in any other land, and individuals can look forward to the highest class of associations, both social and intellectual, as a result of their application of skill, provided always they are ruled by integrity, and shall build up a character which will sustain itself under all conditions. A workingman may not enter the highest social ranks while a workingman, especially in dense social centres, but in our country villages and large towns observation teaches that the American workingman has the *entrée* to the best society in his community, without regard to the size of his bank-account, character being the card on which he gains his admission. I have attended social functions where I have met skilled mechanics and wealthy men, and have found them meeting on an equality, each regarding the other on the basis of the personal character which he brought to the function.

There is another side to this, of course, and a picture of certain features of American labor can be drawn under which the individual feels that he must keep at the bottom, at least, of the social ladder. A study of conditions, however, proves that the base of the social structure is growing narrower as time, as education, as a wise altruism lead men out of their lowly conditions to a better plane; and the American laborer everywhere is an active, earnest, and, I believe, an honest factor in keeping up the struggle to secure a higher standard of living. If the facts were otherwise the outlook would, indeed, be a despondent one; but a glance at the facts proves the reverse, and shows that the proportion of wage-earners of the total population is constantly increasing.

Our 15,000,000, and over, of wage-earners constitute a vast body on whose prosperity, intelligence, and moral worth is based the welfare of the Republic. With their happiness goes the happiness of the whole people. When they are unhappy, disturbed, and discontented the Republic is resting upon an insecure foundation. I do not mean that discontent can or ought to be removed, it being not wise that perfect contentment should rule in all things, for perfect contentment means a stationary condition. Progress can come only when the body of workers in a community are contented because moving onward and upward. Absolute "contentment with one's lot is the virtue of the subjects of a despotically governed and non-progressive state," and this sort of contentment does not indicate happiness, but a stationary condition, which ultimately leads to retrogression, a loss of ambition, and the growing disuse of the inventive genius of man.

Our American wage-earners demand, and are entitled to, something more than is indicated by contentment, for their experience with inventions, and under our educational system, teaches them that from rude instruments of toil they have become intelligent factors, in both a social and a political sense. They are not simply animals, wanting an animal's contentment; they are something more, and they want, and are entitled to, the contentment belonging to the best environment. They are, in a sense, and a valuable sense, the patrons of all that gives character to a great nation. They believe in education, in art, in music, in the progress of the sciences, and in political purity, and are informing themselves on the great topics which engage the thoughts of our statecraftsmen. They are often able not only to present their views clearly and forcibly, but to indulge in discussions which would be a credit to any legislative body. These features constitute the American wage-earners' exceedingly active, and, in a short-sighted way, sometimes uncomfortable, elements in the great struggle that is going on to lift themselves and all connected with them to a higher plane of living. All who aid in this struggle are the friends of humanity; all who throw obstacles in its way are the enemies of humanity — not knowingly, perhaps, but because they cannot reach far enough in their comprehension of conditions, and growing conditions, too, to see that happiness and prosperity must be the result of the struggle. Selfishness and ignorance would keep men on a level; progressive movements mean more, and look to the leading forth of all the best faculties of all members of the community.

All the disturbances which we have seen during the past score of years, and which seem, superficially considered, to indicate that we are approaching an industrial war, are but protests against fixed conditions. These disturbances very often arise from unwise considerations and from ignorance of the conditions of production, but they all indicate one grand trend; and while it is to be hoped they will grow less and less as intelligence develops the unwisdom of certain forms of contest, they must be considered as a part of the progressive movements of our age, to be deprecated, to be sure, when there is an inimical animus underlying them — to be deprecated, perhaps, in most instances — and yet, out of them, American labor emerges with a clearer understanding of the inevitable conditions of life and a clearer view of the higher ethical elements essential to overcome them. These views constitute the chief elements of what is known as the labor movement, in which American labor has actively participated for a great many years — first, seeking organization; second, by organization, making its protests and issuing its demands. Philosophically, these protests and demands must be viewed as educational factors and not as war factors.

I have always liked the definition of labor which John Ruskin has given us. "Labor," he says, "is the contest of the life of man with an opposite; the term 'life' including his intellect, soul and physical power, contending with question, difficulty, trial or material force. Labor is of a higher or lower order as it includes more or fewer of the elements of life; and labor of good quality, in any kind, includes always as much intellect and feeling as will fully and harmoniously regulate the physical force." The truth of this definition must be accepted, and with its acceptance the labor movement, so-called, is at once lifted from a sordid to a high ethical plane; taken out of narrow grooves and made to become the very essence of the whole of the religious and political movements of the closing years of this century. Whether Ruskin's definition is recognized or not, the truth exists, and so the struggle of the wage-earner becomes of that high order which insists upon recognition as a factor in securing to all people something beyond the mere wants of existence. A man who is working simply to secure food, shelter, and raiment, that is, the conditions absolutely essential to keep him an efficient working machine, is not the best product of civilization; but the man who is willing to work industriously to secure these absolute necessaries to make his services efficient, and then, over and beyond them, something of the spiritualizing necessaries of life, is a credit to our civilization; and these spiritualizing influences can be secured only when, after paying for the necessary lubrication of his working muscles, he is able to furnish himself and his loved ones with elements of life which have heretofore been considered luxuries. He must be able to secure something of these higher elements, or he loses, and retrogression is the result. He must be able to educate his family, and to give them of the best things of life to such an extent that they become active participants in the results of invention, which throw around life everywhere more than could be secured under old conditions.

With his conscience quickened by the very atmosphere that surrounds him, the wage-earner understands, more than any other wage-earner anywhere, that the sacredness of property must be insisted upon and preserved, and that all attacks upon existing institutions must be repelled, especially when those attacks are made for the purpose of destruction with a view to the building of a new structure upon the ruins of the old. He is often radical in his political views, but as a class in the community he is ready to aid in the improvement of governmental and social structures rather than to assist in their destruction, even when the view is presented that only on their destruction can a properly developed new structure be erected. He is often led away by specious arguments, and under such conditions allies himself to various so-called progressive movements; but he is always open to conviction, and when he sees that he is simply being led on the old, well-beaten paths of iconoclasm, he turns and allies himself with those who are seeking real and true progress through evolutionary processes.

The American workingman is sometimes a socialist, but he does not believe that socialism, and especially political socialism, has anything in it which will help him to secure the coveted margin over necessaries — anything that will help him to things spiritualizing. He is a socialist, as a rule, in a certain sense, but his socialism is not political; it comes from a spirit within him, and it seeks to aid all who are engaged with him in the struggle to secure better environment. This sort of socialism in American labor has no danger in it. On the other hand, it is critical in its nature, and thus helps the whole body of the people to understand what evils exist and what conditions ought to be secured in their place.

The American laborer, as such, is never an anarchist, for he is a law-and-order man, and believes that through development of the individual character the best social conditions can be reached. Now, as the wage-earners of this country comprehend these high and moral grounds more fully and more clearly, they will become more contented in the true sense — not contented to stand still, but contented with the knowledge that they are progressing.

From what has been said it will be clearly understood that conditions are not always favorable; that there are fluctuations, business depressions, having their discouraging influence, and strikes, unsettling the public mind. The clash between ethical and economical conditions leads to disruptions sometimes in business associations, and arrays, to all appearances, capital on the one side and labor on the other, and gives color to the prophecy sometimes put forth that ultimately this clash will lead to bloody strife. I cannot acquiesce in this view, although I see clearly the clash itself, and largely the causes for it. The causes are mostly ethical, growing out of the relations of men and the lack of appreciation of the duty which is owed to the public. Macaulay said that the evils arising from liberty were only to be cured with more liberty. So the evils which apparently surround us at the present time, and which apparently grow out of the industrial world, are the results of an intelligence which did not exist in the past, and the cure for them is more intelligence. Capital and labor are intelligent enough to get into difficulty: they are not intelligent enough yet to keep out of difficulty. It requires a very high moral character on the part of both employer and employee for each to recognize the rights and the privileges of the other; but with this recognition, quarrels, as such, will largely cease, and contests of mind will take the place of those unhappy contests which are now so frequent. When the employee recognizes that his highest social duty is to render the very best service of which he is capable, and the employer recognizes that his highest social duty is to compensate the best service with the best wage, a vast deal of friction will be avoided. Integrity of business involves both the employing and the employed elements of society. Confidence in each other is the surest cure for many of the difficulties, and while the world is growing altruistic, it will not grow altruistic at the expense of individual development; but after the rendering of the best social service there will come a coördinated force involving both altruism and individualism. Either means destruction in a degree. Coördination means success and reasonable happiness. The ethical force cannot rule at the expense of the economical, nor can the economical force rule at the expense of the ethical. Their coördination is the true line of progress.

As American labor comprehends this more and more clearly, and I believe it is comprehending these principles, and as the employer comprehends them more and more clearly — and I believe that he is so doing — we may hope for the adjustment of difficulties on a plane of moral responsibility not yet reached, except incidentally. The settlement of labor controversies is one thing, their prevention another. If the intelligence of different elements has not reached that degree whereby they can be prevented, then there should be some recognition of that settlement and adjustment which recognize the importance of each side in the success of industrial enterprises. American labor is doing much, and can do much more, in bringing about such prevention and such adjustment. May every struggle to that end meet with the cordial appreciation and support of all right-minded citizens! The century closes with omens of this consummation. We must not look for Utopias nor the millennium; but we must look for the evolution of moral forces through industrial forces, for society flourishes or decays as industrial elements prosper or decline.

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CHAPTER III

IMPORTS AND EXPORTS

THE imports and exports of the United States are the expression and measure of its commercial dealings with the nations and peoples of the world. Their development and importance have been commensurate with the economic growth and political power of the country and people. To compare the foreign trade of the United States in 1795 with that in 1895 would be to compare a wheelbarrow with a locomotive or an ocean liner. The local nature, the simplicity of character, and the limited quantity of the trade in the earlier period have become the world-wide, the complex, and enormously extended commerce of to-day. Then the trade was confined as well by the limited markets as by the selfish greed of nations possessed of colonial dependencies, monopolized by themselves in production and in commerce. Then the long and comparatively infrequent voyages made commerce a matter of speculation, of widely fluctuating prices, of capital at risk, and consequently of doubtful returns. Now the world is one great market to buy and to sell in. Prices are equalized and made stable by banking facilities, by rapid communication by mail or telegraph, by frequent voyages, and by the free and cosmopolitan movements of labor and capital. The millions ventured in foreign trade in the last century have become the hundreds of millions embarked in foreign trade to-day; and over and above the great transfer of commodities from country to country there is a large and ever-increasing transaction in securities, national, State, and corporate. Mere statistics can convey only one idea of this growth and development. They may point out the mass or quantity, which is the least interesting and vital phase of the question; but the nature or character of that mass has also materially changed. It is on this change of nature that I wish to say something.

When the peace of 1783 was declared the United States comprised a strip of territory on the Atlantic Ocean extending from Maine to Florida, and bounded on the west by the Mississippi River. In 1790 the total area of settlement was 239,935 square miles, having a population of 3,929,214 souls. In this comparatively limited area important commercial products were raised. The tobacco of Virginia and Maryland supplied the world; the rice and indigo of the Carolinas stood high in European markets; and the fish and lumber products of New England, with the breadstuffs of the Middle States, gave a large and profitable commerce with the West Indian Islands, then colonial possessions of Europe. In New York the fur trade centered, and even as early as this time the Northwest Territory pointed to an agricultural possibility which fifty years later was to begin an economic revolution in Europe, the results of which are still incomplete. The extension of national territory west of the Mississippi, and southward so as to include Florida and Texas, has contributed to develop commerce on almost the same lines which were marked out in the first years of the Republic.

It was agriculture in 1795 which contributed most largely to the export trade; it is agriculture in 1895 which still feeds the largest part of the exports. The rise of cotton culture, and its rapid extension through the South, were the leading features of our export development for fifty years. The rapid settlement of the West, and an enormous extension of agricultural production in cereals and provisions, were the leading features of the subsequent forty years. Beginning with 1816, the establishment of manufactures, fostered and assured by the peculiar inventiveness of Americans, laid the foundation of industries which at the end of eighty years are fitted in many lines not only to compete with, but almost to supply, the world. In 1895 the estimated population of the country was 70,000,000 and the area of the country in land surface was 2,970,000 square miles. The value of domestic exports per capita of population in the last decade of the eighteenth

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century was somewhat less than $6; the per capita exports in 1895 were over $11. The productive capacity of the country has thus been sufficient to feed, clothe, and support in increasing comfort a population which has increased in numbers seventeenfold; and at the same time afforded a surplus which has given an export trade double in relative importance and increased fifty or sixty fold in absolute value, as the $800,000,000 of 1895 represent an enormous trade, conducted on a basis of low prices, compared with the trade of 1795, conducted under the régime of high prices.

The lasting and substantial qualities of American export trade are proved by its survival of accidents and adverse conditions which threatened at times to overwhelm it. The Napoleonic wars practically closed the ports of the civilized world to American products and American shipping, and the disaster was aggravated by the domestic Embargo. Wildcat banking schemes have periodically swept over the country, entailing wide-spread ruin and economic disturbance, shaking the commercial system of the country to its very foundation. State and corporation repudiation and defalcation have at times thrown a cloud over American interests, and have retarded development, while even destroying something of what had already been accomplished. To these exceptional and preventable conditions should be added others which the economist has recognized as periodic and inevitable—recurrent waves of financial distress and commercial depression, which have seemed to follow a definite law, and yet can never be foreseen, or their effects provided against and neutralized.

The geographical distribution of exports would necessitate a sketch of the changes in political divisions throughout the world during the century. The breaking up of the old colonial system and the rise of independent States and powers, the formation of alliances essentially modifying the sovereignty of political divisions, have introduced so many new conditions that the geographical nomenclature of 1795 will not apply in 1895. The great Spanish and Portuguese colonies in the New World have with few exceptions become emancipated from the mother countries, and as independent powers have sought and developed commercial connections prohibited under the mercantile system of the last century. Central and South America have framed and maintained commercial systems of their own, instead of feeding and supporting a commerce profitable only to the mother state. The Floridas in 1795 were counted among the possessions of Spain. Hayti was a French colony. Germany had no existence as a united power, and the Hanse towns represented commercial Germany. The trade with Canada was of little importance. Australia was a geographical name. Texas was part of a foreign country, as was all westward of the Mississippi; and the exchange of merchandise with Africa and Asia, while important even at that day, was limited in its development by local hostilities and by trading monopolies.

The embryonic condition of exports is shown by the distribution of 1795. Of a total of nearly $48,000,000 outgoing, $31,000,000 were sent to European countries, $14,000,000 to the West Indian possessions of those countries, and $3,000,000 to all the rest of the world. The intimate connection between political and commercial conditions is shown by the fact that the exports to France and the French West Indies were $12,653,635; to the Hanse ports, $9,655,524; while to Great Britain and her possessions in the West Indies and North America the exports were $9,218,540. France ranked first in importance, Germany second, and Great Britain third. The treaty of Jay and the necessities of the British West Indies made necessary some alterations in the regulations imposed by Parliament on colonial trade, and these changes were reflected in the current of the leading exports of the United States. France lost her dominant position and was superseded by Great Britain. This relative position has never been changed.

A study of the yearly fluctuations in the export trade, and a general statement of the leading causes, would be of exceeding interest. Each article would present the material for a study of commercial conditions as influenced by competition, production, or political factors. This, however, would be out of the question in an article of this length. The highest development of exports has occurred within the last thirty years, when the rapid settlement of the West, and the improved methods of transportation have enabled its products to reach a market at such rates as allow aggressive competition with similar products of other exporting countries. Without modern appliances the large export trade in fresh meats, butter, fruits, and even oleomargarine, could not exist.

Another side of this story is of high economic value, showing how a productive interest may wane and die through the rise of more favorable conditions elsewhere for producing or marketing, or by the discovery of other products which will better attain the end to which they are the means. In the same manner an interest may out of a very small beginning become sufficiently important to control the market of the world. A century ago indigo was a large product of the Carolinas; it ceased to be an article of export, in quantity, at the beginning of the century. The United States was a large exporter of rice in 1795; in 1895 it was an even larger importer. Forty years ago whaling was a profitable pursuit, and whale and fish oils constituted an item of export. That industry has almost disappeared as a commercial factor; but the $2,000,000 or $3,000,000 worth of whale-oil has been more than compensated by the $45,000,000 of exports of petroleum, an article which came into use about thirty years ago.

The ills of other nations have at times redounded to the benefit of the United States. European wars created an opening for the prepared meat products of the West; the vine diseases in the wine countries of Europe gave an opportunity for an export of American wine—an export which must grow. Coal was not sent abroad in any quantity till 1850, but it now represents a trade of more than $10,000,000. Cotton was imported from the West Indian Islands in 1795; it has long been the principal item of export. Copper, when it touched $2,000,000 in the trade returns of 1858, was believed to have reached a very high point; but that product of the American mine now controls the world's markets, and an export of $13,000,000 is not believed to have touched an even reasonable limit.

In 1895, seventy per cent. of the total value of domestic exports was composed of agricultural products. The products of the fisheries and of the forest and mining, partaking of the qualities of agricultural products in being subject to the law of diminishing returns, raised the proportion to seventy-seven per cent., leaving about twenty-three per cent. contributed by American manufactures. The articles of food and the crude materials of manufactures are exported to countries which have developed industrial rather than agricultural systems, and which need the food to support their laboring populations, and the raw materials to feed their industries. So long as the United Kingdom held almost the monopoly in the great manufacturing industries where machinery has superseded hand labor, our export trade was chiefly with that country. Within twenty-five years the rise of large manufacturing interests on the Continent, and the extension of merchant marines of continental countries, have been reflected in the direction of American exports. What would formerly have gone to Great Britain and thence been distributed throughout continental Europe is now sent to the continental countries direct.

To sum up, the United States export trade contributes the cotton used in cotton manufactures wherever the industry is developed; by its breadstuffs and provisions it contributes a necessary element to the support of the industrial peoples of other lands, supplying a cheap and wholesome food; its mineral oils are to be found everywhere, giving a cheap and safe light to peoples who have lived heretofore in semi-darkness; its tobacco has always been appreciated, as have its naval stores; its agricultural implements and tram-cars, its clocks and watches, and its rubber goods are evidences of a superior inventive ability. The lines of the export trade of the United States are so broad and well defined that nothing within the reach of human possibilities can destroy their main features.

The imports do not require the special study that exports seem to demand. The latter are a fair gauge of the productive capacity of the country, for it is only the surplus product which can be exported—that which is beyond domestic consumption. Imports measure the purchasing ability of the people and constitute a rough measure of the industrial advancement and of the degree of taste and well-being attained. The development of the import trade has been a process of selection, rejecting one class or article and taking others, as the domestic supply is sufficient or wanting. In the last century all manufactures of a grade above the crudest were brought in from abroad. There were few "industries" outside of the household industries, and consequently little or no demand for raw material of manufacture. A little cotton was imported; some lead from England; and hemp, cordage, and cables from Russia gave material for ship building; but these few articles comprise all the imports which can be directly identified with "industry." In 1795 a little unwrought steel came from the United Netherlands; somewhat later Swedish bar-iron took its place; but manufactured iron and steel have come from the United Kingdom.

Compared with such a situation, the imports of 1895 offer a striking contrast. That there are a large number of commodities of almost necessary consumption which cannot be grown or prepared in the United States needs no proof. Tea, coffee, sugar, spices, and such tropical products can be obtained in the required quantities by exchange more easily and cheaply than by growing them. Articles of food will, therefore, always constitute a large item of imports, and in 1895 constituted one third of the total. Imports of the crude materials of manufactures—wool, cotton, flax, and hemp, coal and iron,

VALUE OF EXPORTS AND IMPORTS OF MERCHANDISE

FROM 1791 TO 1895.

Year Ending	Exports.			Imports.			Excess of Exports.	Excess of Imports.
	Domestic.	Foreign.	Total.	Free.	Dutiable.	Total.		
Sept. 30.	$	$	$	$	$	$	$	$
1791....	18,500,000	512,041	19,012,041	....	....	29,200,000	....	10,187,959
1792....	19,000,000	1,753,098	20,753,098	....	....	31,500,000	....	10,746,902
1793....	24,000,000	2,109,572	26,109,572	....	....	31,100,000	....	4,990,428
1794....	26,517,492	6,526,233	33,043,725	....	....	34,600,000	....	1,556,275
1795....	39,500,400	8,489,472	47,989,872	....	....	69,756,268	....	21,766,396
1796....	32,274,625	26,300,000	58,574,625	....	....	81,436,164	....	22,861,539
1797....	24,294,710	27,000,000	51,294,710	....	....	75,379,406	....	24,084,696
1798....	28,327,411	33,000,000	61,327,411	....	....	68,551,700	....	7,224,289
1799....	33,142,522	45,523,000	78,665,522	....	....	79,069,148	....	403,626
1800....	31,840,903	39,130,877	70,971,780	....	....	91,252,768	....	20,280,988
1801 ..	46,377,792	46,642,721	93,020,513	....	....	111,363,511	....	18,342,998
1802....	36,182,173	35,774,971	71,957,144	....	....	76,333,333	....	4,376,189
1803....	42,205,961	13,594,072	55,800,033	....	....	64,666,666	....	8,866,633
1804 ...	41,467,477	36,231,597	77,699,074	....	....	85,000,000	....	7,300,926
1805 ...	42,387,002	53,179,019	95,566,021	....	....	120,600,000	....	25,033,979
1806....	41,253,727	60,283,236	101,536,963	....	....	129,410,000	....	27,873,037
1807....	48,699,592	59,643,558	108,343,150	....	....	138,500,000	....	30,156,850
1808....	[1]9,433,546	12,997,414	22,430,960	....	....	56,990,000	....	34,559,040
1809....	31,405,702	20,797,531	52,203,233	....	....	59,400,000	....	7,196,767
1810....	42,366,675	24,391,295	66,757,970	....	....	85,400,000	....	18,642,030
1811....	45,294,042	16,022,790	61,316,832	....	....	53,400,000	7,916,832	....
1812....	30,032,109	8,495,127	38,527,236	....	....	77,030,000	....	38,502,764
1813 ...	25,008,152	2,847,865	27,856,017	....	....	22,005,000	5,851,017	....
1814....	6,782,272	145,169	6,927,441	....	....	12,965,000	....	6,037,559
1815....	45,974,403	6,583,350	52,557,753	....	....	113,041,274	....	60,483,521
1816....	64,781,896	17,138,156	81,920,052	....	....	147,103,000	....	65,182,948
1817....	68,313,500	19,358,069	87,671,569	....	....	99,250,000	....	11,578,431
1818....	73,854,437	19,426,696	93,281,133	....	....	121,750,000	....	28,468,867
1819....	50,976,838	19,165,683	70,142,521	....	....	87,125,000	....	16,982,479
1820 ...	51,683,640	18,008,029	69,691,669	....	....	74,450,000	....	4,758,331
1821....	43,671,894	10,924,429	54,596,323	2,017,423	52,503,411	54,520,834	75,489	....
1822....	49,874,079	11,476,022	61,350,101	3,928,862	75,942,833	79,871,695	....	18,521,594
1823 ...	47,155,408	21,170,635	68,326,043	3,950,392	68,530,979	72,481,371	....	4,155,328
1824....	50,649,500	18,322,605	68,972,105	4,183,938	67,985,234	72,169,172	....	3,197,067
1825....	66,944,745	23,793,588	90,738,333	4,796,745	85,392,565	90,189,310	549,023	....
1826....	52,449,855	20,440,934	72,890,789	5,686,803	72,406,708	78,093,511	....	5,202,722
1827....	57,878,117	16,431,830	74,309,947	3,703,974	67,628,964	71,332,938	2,977,009	....
1828 ...	49,976,632	14,044,578	64,021,210	4,889,435	76,130,648	81,020,083	....	16,998,873
1829....	55,087,307	12,347,344	67,434,651	4,401,889	62,687,026	67,088,915	345,736	....
1830....	58,524,878	13,145,857	71,670,735	4,590,281	58,130,675	62,720,956	8,949,779	....
1831....	59,218,583	13,077,069	72,295,652	6,150,680	89,734,499	95,885,179	....	23,589,527
1832....	61,726,529	19,794,074	81,520,603	8,341,949	86,779,813	95,121,762	....	13,601,159
1833....	69,950,856	17,577,876	87,528,732	25,377,582	75,670,361	101,047,943	....	13,519,211
1834....	80,623,662	21,636,553	102,260,215	50,481,548	58,128,152	108,609,700	....	6,349,485
1835....	100,459,481	14,756,321	115,215,802	64,809,046	71,955,249	136,764,295	....	21,548,493
1836....	106,570,942	17,767,762	124,338,704	78,655,600	97,923,554	176,579,154	....	52,240,450
1837....	94,280,895	17,162,232	111,443,127	58,733,617	71,739,186	130,472,803	....	19,029,676
1838....	95,560,880	9,417,690	104,978,570	43,112,889	52,857,399	95,970,288	9,008,282	....
1839....	101,625,533	10,626,140	112,251,673	70,806,616	85,690,340	156,496,956	....	44,245,283
1840....	111,660,561	12,008,371	123,668,932	48,313,391	49,945,315	98,258,706	25,410,226	....
1841....	103,636,236	8,181,235	111,817,471	61,031,098	61,926,446	122,957,544	....	11,140,073
1842....	91,799,242	8,078,753	99,877,995	26,540,470	69,534,601	96,075,071	3,802,924	....

Year Ending	Exports.			Imports.			Excess of Exports.	Excess of Imports.
	Domestic.	Foreign.	Total.	Free.	Dutiable.	Total.		
June 30.	$	$	$	$	$	$	$	$
1843[1]...	77,686,354	5,139,335	82,825,689	13,254,249	29,179,215	42,433,464	40,392,225	....
1844....	99,531,774	6,214,058	105,745,832	18,936,452	83,668,154	102,604,606	3,141,226	....
1845....	98,455,330	7,584,781	106,040,111	18,077,598	95,106,724	113,184,322	....	7,144,211
1846....	101,718,042	7,865,206	109,583,248	20,990,007	96,924,058	117,914,065	....	8,330,817
1847....	150,574,844	6,166,754	156,741,598	17,651,347	104,773,002	122,424,349	34,317,249	....
1848....	130,203,709	7,986,806	138,190,515	16,356,319	132,282,325	148,638,644	....	10,448,129
1849....	131,710,081	8,641,091	140,351,172	15,726,425	125,479,774	141,206,199	....	855,027
1850....	134,900,233	9,475,493	144,375,726	18,081,590	155,427,936	173,509,526	....	29,133,800
1851....	178,620,138	10,295,121	188,915,259	19,653,084	191,118,345	210,771,429	....	21,856,170
1852....	154,931,147	12,053,084	166,984,231	24,187,890	183,252,508	207,440,398	....	40,456,167
1853....	189,869,162	13,620,120	203,489,282	27,182,152	236,595,113	263,777,265	....	60,287,983
1854 ...	215,328,300	21,715,464	237,043,764	25,760,447	272,043,347	297,803,794	....	60,760,030
1855....	192,751,135	26,158,368	218,909,503	36,430,524	221,378,184	257,808,708	....	38,899,205
1856....	266,438,051	14,781,372	281,219,423	52,748,074	257,684,236	310,432,310	....	29,212,887
1857....	278,906,713	14,917,047	293,823,760	54,267,507	294,160,835	348,428,342	....	54,604,582
1858....	251,351,033	20,660,241	272,011,274	61,044,779	202,293,875	263,338,654	8,672,620	....
1859....	278,392,080	14,509,971	292,902,051	72,286,327	259,047,014	331,333,341	....	38,431,290
1860....	316,242,423	17,333,634	333,576,057	73,741,479	279,874,640	353,616,119	....	20,040,062
1861....	204,899,616	14,654,217	219,553,833	71,130,351	218,180,191	289,310,542	....	69,756,709
1862....	179,644,024	11,026,477	190,670,501	52,721,653	136,635,024	189,356,677	1,313,824	....
1863....	186,003,912	17,960,535	203,964,447	35,241,924	208,093,891	243,335,815	....	39,371,368
1864....	143,504,027	15,333,961	158,837,988	41,126,332	275,320,951	316,447,283	....	157,609,295
1865....	136,940,248	29,089,055	166,029,303	44,519,516	194,226,064	238,745,580	....	72,716,277
1866....	337,518,102	11,341,420	348,859,522	59,028,526	375,783,540	434,812,066	....	85,952,544
1867....	279,786,809	14,719,332	294,506,141	23,133,495	372,627,601	395,761,096	....	101,254,955
1868....	269,389,900	12,562,999	281,952,899	15,190,781	342,245,659	357,436,440	....	75,483,541
1869....	275,166,697	10,951,000	286,117,697	21,646,692	395,859,687	417,506,379	....	131,388,682
1870....	376,616,473	16,155,295	392,771,768	20,140,786	415,817,622	435,958,408	....	43,186,640
1871....	428,398,908	14,421,270	442,820,178	36,587,737	483,635,947	520,223,684	....	77,403,506
1872....	428,487,131	15,690,455	444,177,586	47,267,213	579,327,864	626,595,077	....	182,417,491
1873....	505,033,439	17,446,483	522,479,922	144,815,884	497,320,326	642,136,210	....	119,656,288
1874....	569,433,421	16,849,619	586,283,040	151,481,762	415,924,580	567,406,342	18,876,698	....
1875....	499,284,100	14,158,611	513,442,711	146,279,927	386,725,509	533,005,436	....	19,562,725
1876....	525,582,247	14,802,424	540,384,671	140,361,913	320,379,277	460,741,190	79,643,481	....
1877....	589,670,224	12,804,996	602,475,220	140,788,452	310,534,674	451,323,126	151,152,094	....
1878....	680,709,268	14,156,498	694,865,766	141,278,265	295,773,267	437,051,532	257,814,234	....
1879....	698,340,790	12,098,651	710,439,441	142,681,505	303,096,270	445,777,775	264,661,666	....
1880....	823,946,353	11,692,305	835,638,658	208,301,863	459,652,883	667,954,746	167,683,912	....
1881....	883,925,947	18,451,399	902,377,346	202,491,547	440,173,081	642,664,628	259,712,718	....
1882....	733,239,732	17,302,525	750,542,257	210,579,007	514,060,567	724,639,574	25,902,683	....
1883....	804,223,632	19,615,770	823,839,402	207,504,718	515,676,196	723,180,914	100,658,488	....
1884 ...	724,964,852	15,548,757	740,513,609	209,884,184	457,813,509	667,697,693	72,815,916	....
1885....	726,682,946	15,506,809	742,189,755	193,213,624	384,313,705	577,527,329	164,662,426	....
1886....	665,964,529	13,560,301	679,524,830	212,159,296	423,276,840	635,436,136	44,088,694	....
1887....	703,022,923	13,160,288	716,183,211	234,221,131	458,098,637	692,319,768	23,863,443	....
1888....	683,862,104	12,092,403	695,954,507	244,071,615	479,885,499	723,957,114	....	28,002,607
1889....	730,282,609	12,118,766	742,401,375	256,487,078	488,644,574	745,131,652	....	2,730,277
1890....	845,293,828	12,534,856	857,828,684	265,668,629	523,641,780	789,310,409	68,518,275	....
1891....	872,270,283	12,210,527	884,480,810	366,241,352	478,674,844	844,916,196	39,564,614	....
1892....	1,015,732,011	14,546,137	1,030,278,148	457,999,658	369,402,804	827,402,462	202,875,686	....
1893....	831,030,785	16,634,409	847,665,194	444,544,211	421,856,711	866,400,922	....	18,737,728
1894....	869,204,937	22,935,635	892,140,572	379,795,536	275,199,086	654,994,622	237,145,950	....
1895....	793,392,599	14,145,566	807,538,165	363,232,227	368,737,738	731,969,965	75,568,200	....

[1] Nine months.

and silk—constitute a measure of industrial growth and conditions. By the establishment of domestic industries, and by the refining of demand through the accumulation of wealth and the education of taste, better products are demanded of both foreign and domestic manufacture. In 1895 the imports of materials in a crude condition for use in domestic industries comprised more than one fourth of the total imports. What remained were articles manufactured which could not be obtained in this country to meet the tastes of the consumer or to gratify the whims of fashion. The crude materials are, as a rule, obtained from agricultural countries of recent settlement, or from older countries sparsely populated, with a semi-civilized people. Australia is the great source of wool-supply; Cuba of sugar, Brazil of coffee, Asia of silk, Egypt of raw cotton, and South American countries of hides, skins, and india-rubber. Manufacured articles are of European origin.

A word may be added on the geographical distribution of imports and exports in 1895. The United Kingdom received forty-eight per cent. of the exports and contributed twenty-two per cent. of the imports. No other country approaches this percentage in American trade. The natural advantages of the harbor of New York long since pointed it out as a great commercial center; while the enterprise and liberality of State and citizens in making internal improvements have enabled it to maintain a dominant position in the face of intense and apparently almost destructive competition. Canals and railways and banking institutions having foreign connections have made the city what it is. Two thirds of the entire imports are received through New York, and more than one half of the exports are sent out through that port. The main geographical features of the foreign commerce of the United States are shown by the accompanying figures:

IMPORTS AND EXPORTS IN 1895 BY GEOGRAPHICAL DIVISIONS.

	Imports.	Per Cent.	Exports.	Per Cent.	Per Cent. of Imports and Exports.
Europe	$383,645,813	52.4	$627,927,692	77.7	65.72
North America	133,915,682	18.3	108,575,594	13.4	15.74
South America	112,167,120	15.3	33,525,935	4.2	9.46
Asia	77,626,364	10.6	17,325,057	2.2	6.17
Oceanica	17,450,926	2.4	13,109,231	1.6	1.98
Africa	5,709,169	.8	6,377,842	.8	.79
All other countries	1,454,891	.2	696,814	.1	.14
Total	$731,969,965		$807,538,165		100.00
Atlantic ports	$613,737,342	83.8	$590,392,743	73.1	78.21
Gulf ports	18,865,503	2.6	130,275,045	16.1	9.69
Pacific ports	40,568,501	5.5	36,879,310	4.6	5.03
Northern border and lake ports	51,016,783	7.0	49,991,067	6.2	6.56
Interior ports	7,781,836	1.1	....	...	.51
Total	$731,969,965		$807,538,165		100.00

Foreign commerce must grow with the increase of population and wealth. From time to time fears have been expressed that the United States is not holding its own in foreign markets; that its products are being undersold by similar products of other nations. Russian and Indian wheat, Indian and Egyptian cotton, Russian petroleum, and, last, the grain products of the Argentine Republic, have excited apprehensions the full extent of which have never been realized. That competition from the outside must produce some effect need not be questioned; but that this effect could ever end fatally to the productive interests of the United States is beyond belief. If the agricultural products of our country no longer meet with favor in foreign markets, there will always be room for our manufactures, the export of which has shown in recent years a marked increase. In 1875 the value of exported manufactures was $92,678,814, constituting 16.57 per cent. of the total exports. In 1895 the value of manufactures was $183,595,743, constituting more than twenty-three per cent. of the total. It is in this direction that the greatest development of American exports must lie; and the field is so vast that it will more than compensate for any reduction in demand for food products or for materials in a raw condition.

Worthington C. Ford

CHAPTER IV

INTERSTATE COMMERCE

THE colonies, under the lead of Massachusetts, early attempted to provide roads; yet for more than two hundred years nothing existed in this country that by any stretch of the imagination could be called a postal service. The only carriers of commerce for nearly two hundred years after the first settlers sought these shores were the simple sailing vessels, that crossed the ocean only at the greatest hazard. Courageous attempts to navigate the ocean waters and the almost unknown rivers and lakes were numerous before 1800; and canals, even, were attempted. It can hardly be said, however, that anything deserving the name of interstate commerce existed in this country at the beginning of the present century, since at that time the total effects of the government were transported from Philadelphia to Washington in a frail sloop, and President John Adams and his wife lost their way, as tradition has it, in the woods beyond Baltimore, as they proceeded in their carriage toward the new capital. The Alleghanies constituted an almost impassable barrier between the East and the West, and such necessary products as the colonists could not obtain in their immediate neighborhoods were mostly brought from over seas.

There was another difficulty in the way of trade. The high price of labor rendered it impossible to manufacture linen, cotton, or woolen cloth, except at a cost twenty to fifty per cent. greater than the same stuffs could be turned out for in England. The trade of New Hampshire was principally in lumber and fish, which were exported. In Massachusetts a little wool and flax were worked into a coarse cloth, and a few hats were made, but it was cheaper to import them. In the province of New York the export of furs, whalebone, oil, pitch, tar, and provisions included everything. So it was in New Jersey. Virginia produced nothing for intercolonial trade. Tobacco was a permanent staple, but it became chiefly an export. The early colonists were inevitably sailors. Therefore a considerable coasting trade grew up, but there were no means of internal transportation except by wagons and the rude craft plying the natural waterways. In spite of this the Constitution, which went into operation March 4, 1789, embraced the right to regulate domestic commerce, —a right not conferred by the previous Articles of Confederation,—and from that year one may find exhibits of the tonnage employed in the coastwise trade. In 1789 this tonnage was 78,607; in 1812 it was 477,971.

The Americans of those early times had only a vague knowledge of the country west of the mountains; yet the hardy settlers along the coast soon beat out for themselves paths to this unknown region. The act to provide for the Cumberland road was passed in 1806, and the first stage-coach driven from Cumberland to Wheeling in 1818. The length of the line first opened was 130 miles, and its cost $1,700,000. In those years, too, were tried the first experiments with steam-craft. Livingston and Fulton built the *Clermont* in 1807, and Fulton claimed under his patent a monopoly of transportation on the Hudson and other rivers. His claim was carried to the courts and defeated, so that after 1815 the rivers of the country were free to steam-vessels. In 1812 steamboats made their appearance on the Western rivers. The first craft, the *New Orleans*, built at Pittsburg by Fulton at a cost of $40,000, a stern-wheeler of between 300 and 400 tons, put out for New Orleans. Others followed, but none proved able to ascend the river, until 1815, when the *Enterprise*, a stern-wheeler of 70 tons, made the trip from New Orleans to Cincinnati in twenty-eight days. It was later than this, again, that steamships came gradually to ply up and down the coast.

The first charter for canal building was granted to the James River Company by the legislature of Virginia in 1785. Another of these projects was the Dismal Swamp Canal, begun in 1787, under a joint charter from Virginia and North Carolina, and opened in 1794. The owners of its stock included George Washington and Patrick Henry, and it was originally designed to facilitate the movement of lumber out of the Dismal Swamp. The Chesapeake and Ohio Canal, the Delaware and Chesapeake Canal, and the Union Canal, of Pennsylvania, intended to connect the Delaware and Susquehanna rivers, were only forerunners of the Erie Canal, 363 miles long, completed in 1825. A canal from Lake Champlain to the Hudson River was completed in 1823. On the opening of the Erie Canal the cost of freight fell, according to its class, all the way in amount from $15 to $25 per ton, and the time of transit from twenty to eight days. Wheat was worth $33 per ton in western New York, and it did not pay to send it to market, down the Susquehanna to Baltimore. The canal changed all that. Indeed, it has been said that the Erie Canal added $100,000,000 in value to the farms of New York State. It made New York City the commercial metropolis. Freight which had gone overland from Ohio to Pittsburg and Philadelphia, at a cost of $120 per ton, now went to New York by way of the lakes, the great canal, and the Hudson. The opening of the Erie Canal excited also a fever of enterprise in canal building in Ohio, Pennsylvania, Massachusetts, Maryland, and Virginia.

The first voyagers on the Great Lakes, La Salle and Hennepin, set sail in 1678 in a schooner of ten tons, which they had launched near the present city of Kingston, Ontario. From the mouth of the Niagara River they continued their journey by land, and in the following May launched the *Griffin*, the first sailing vessel to navigate the upper lakes. In September they reached their destination at Green Bay. From 1700 until 1756 the construction and navigation of sailing vessels on the lakes was largely confined to Lake Ontario. Then the English began to build and sail vessels upon Lake Erie and Lake Ontario, and the commerce of Lake Ontario increased so fast, that in 1800 it exceeded that of all the other lakes together. The first American vessel to sail Lake Erie was launched at Erie in 1798. The first steam-vessel that navigated the Lakes was built at Sackett's Harbor in 1817, and measured 240 tons. The next year the first steamboat above Niagara Falls was launched at Black Rock, and made voyages between that place and Detroit. The schooner *Illinois*, 100 tons, was the first vessel to arrive at Chicago from the lower lakes. "This event," writes one, "occurred July 12, 1834, when all the male inhabitants of the village, amounting to nearly 100, assisted in dragging the craft across the bar."

Gibson and Linn, according to Ringwalt, in 1776, descended the Ohio and the Mississippi from Pittsburg to New Orleans, and brought back a cargo of 136 kegs of gunpowder for the use of the continental army. When they reached the falls of the Ohio River they were obliged to unload their boats and carry the cargo around the falls; but the success of their trip gave an impetus to the flatboat trade which has continued in one form or another up to the present time. The first regular packet line between Pittsburg and Cincinnati was established in 1794, and consisted of four keel-boats of twenty tons each. They were much like the modern canal-boats, and could be either propelled by sails, pushed by poles, or towed by horses. Freight charges were high, the following rates for steamboats on the Mississippi having been established by the legislature of Louisiana in 1812: From New Orleans to Louisville, four and one half cents per pound for heavy goods, and six cents for light, averaging five cents per pound, or per ton $112; from New Orleans to Natchez, three quarters of a cent per pound, or $1.50 per barrel; and the same rate for all intermediate landings from New Orleans to Louisville. Passage, $125 for the full trip, and $30 to Natchez. Half-rates were allowed for tonnage going down the river.

Hon. Levi Woodbury, who made a trip down the Mississippi in 1833, says: "At every village we find from ten to twenty flat-bottom boats, which, besides corn on the ear, pork, bacon, flour, whisky, cattle and fowls, have a great assortment of notions from Cincinnati and elsewhere. Among these are corn brooms, cabinet furniture, cider, apples, plows, cordage, etc. They remain in one place until all is sold out, if the demand be brisk; if not, they move farther down. After all is sold out they dispose of their boat, and return with their crews by the steamers to their homes."

By 1856, however, the steam-tonnage of the Mississippi and its tributaries equaled the steam-tonnage of the whole of Great Britain. Until 1850 the boats measured from 200 to 400 tons; but the builders enlarged their vessels from year to year, until, in 1878, they attained the size of the transatlantic liners. The steam-tonnage of the inland and coast lines of the United States increased from 24,879 tons in 1823 to 1,172,372 tons in 1876, as follows:

INLAND AND COASTWISE FLEETS, 1876.

	Number of Vessels.	Tonnage.
Atlantic and Gulf coasts	2,081	665,879
Pacific coast	270	78,439
Northern lakes	921	201,742
Western rivers	1,048	226,312
Total	4,320	1,172,372

In 1891 there were on the Great Lakes 3700 steam- and sail-vessels, with a net registered tonnage of 1,250,000 tons. In that year they carried 63,250,000 tons of freight, while in 1890 the ton-mileage carried by this fleet was 18,849,348 ton-miles, or 24.7 per cent. of the ton mileage of all the railroads of the United States. The tonnage of the lake marine more than doubled during the five years from 1887 to 1892. On the 16,000 miles of the navigable waters of the Mississippi River and its tributaries there were afloat, in 1890, 7445 crafts of all kinds, with a registered tonnage of 3,400,000 tons. During the year this fleet carried 30,000,000 tons of freight and 11,000,000 passengers. The Hudson River had, in the same year, a traffic of 5,000,000 passengers and 15,000,000 tons of freight, exclusive of 3,500,000 tons that passed through the canals of New York by way of the Hudson River to tide-water. The total for these four divisions of waterways alone was 111,750,000 tons. The Mississippi Valley rivers furnish transportation facilities for twenty-four States, embracing an area of 1,240,000 square miles.

The average freight rate on wheat from Chicago to New York in 1890 was 5.85 cents per bushel by lake and canal, and 14.31 cents per bushel by rail, the water cost being $1.94 per ton, and the rail cost $4.77 per ton. The Erie Canal is only a little over 300 miles long, yet Mr. Albert Fink says that it regulates the freight rates of all the railroads east of the Mississippi River, not only on those whose tracks run parallel with the canal, but upon those which run in the opposite direction.

The development of the railway system of the United States has been without a parallel. Time and distance have been overcome, and the products of the farmers, the lumbermen, the miners, and the artisans now reach in successful competition the markets of the world. The railway had its inception less than seventy years ago in the little four-mile tramway constructed in the town of Quincy, Mass., and operated by horses. The first really important railway was the Baltimore and Ohio, fourteen miles of which were opened in 1830. In the same year the South Carolina Railway was begun; in 1833 it was completed for 136 miles, and was then the longest railway in the world. It was also the first railway to carry the United States mails. In 1834 the opening of the Philadelphia and Columbia Railroad, as part of the system of internal improvements of Pennsylvania, gave that State a continuous line of railways and canals from Philadelphia to Pittsburg. In 1835 the Washington branch of the Baltimore and Ohio road was opened. The completion of the Boston and Albany road in 1841, and a connecting-link composing the line from Albany to Buffalo in 1842, marked the opening of the first great railway line. The real beginning of interstate commerce in this country may be said to date from this time.

The total railway mileage of the United States has now reached 178,000 miles, or nearly one half the railway mileage of the world. The total mileage of all tracks reaches 235,000 miles, representing a capital of nearly $11,000,000,000—an amount equal to one sixth of the entire wealth of the country, and five times greater than the entire circulating currency of the United States. The annual earning capacity of this capital is $1,200,000,000—an amount more than three times the entire annual revenues of the government; and it operates lines having an annual traffic of over 600,000,000 passengers and 745,000,000 tons of freight. An idea of the magnitude of this single branch, concerned with the transportation of freight, may be conveyed when it is stated that 745,000,000 tons means that a train of cars long enough to reach more than six times around the earth would be required to transport it all at a single load. The average distance over which this freight was hauled by the railroads was about 125 miles. Set a single team to the task, and it would take it something like 1,020,547 years to move the same amount twenty-five miles.

The total number of tons of freight carried by the steamers and sailing vessels of the rivers, lakes, and coastwise transportation routes of the United States in 1890 was 182,448,402; the tonnage moved by the railways in the same year was more than three times greater. Suppose that there had been no increase since 1890 in the water traffic, and add to this amount the freight traffic of the railways during the year 1893, namely, 745,119,482 tons; this would make the total average tonnage of the railways and waterways of the United States 927,967,884. It is difficult to believe that the railways of the country moved in 1893 more than eleven tons of freight for every man, woman, and child within the boundaries of the United States.

As late as 1850 there seems to have been little conception of the influence which the railways were to wield in the development of the interstate traffic of this great country, and of the country itself. It was thought that they could not successfully compete with waterways and canals, except where a speedy carriage was essential. The solution of the problem of cheap transportation from Pittsburg, for example, was not reached until the railroads threatened to take away all traffic from the traders; so that Pittsburg coal can now be delivered in New Orleans for about $2.60 per ton, although New Orleans is 2000 miles away by river. Cow Island, on the upper Missouri, is 4300 miles from Pittsburg; yet coal is carried to market there, a distance as great as from New York to the Baltic Sea. Not less than 20,000 miles of inland navigable waters are accessible to these Pennsylvania coal traders. The aggregate number of vessels engaged in this business is more than 4000, and of the 13,000,000 tons of coal that were mined in 1893 in the counties near Pittsburg about 4,500,000 tons were carried to market by water. Yet let me illustrate further the growth of domestic trade in a part of our country which was only lately as remote and undeveloped as the westernmost provinces of Brazil. This growth, due to the transition from the pony express to the transcontinental steam-car, quickened the activities of California and of the whole Pacific slope like the inspiration of a new life. The assessed value of all property within California rose from $260,563,886 in 1869 to $584,578,036 in 1879. In 1889 shipments were made over the lines of the Southern Pacific system of 1,140,596,010 pounds from San Francisco, and of 1,571,347,605 to San Francisco. The probable duration of an overland journey from the Missouri River to California before the continental railways were constructed was about 110 days. It took Lewis and Clarke two years and a half to travel from the Mississippi to the mouth of the Columbia and back.

It is claimed that the practically unobstructed competition which has prevailed among railways has been a main cause of many consolidations of railway interests. On the other hand, in defense of consolidation and combination, it is asserted that these result in better and swifter service and lower rates. Whatever the cause or causes, rates generally are much lower than they were ten years ago. On June 30, 1894, 44 railways, each with an operated mileage of over 1000 miles, out of a total of 1039 operating corporations, controlled and operated 56.30 per cent. of the total railway mileage in the United States. Extend the classification to include all roads operating over 400 miles of line, and it appears that 90 corporations operate 72.90 per cent. of our total railway mileage. In 1837 the superintendent of motive power of the Columbia and Philadelphia Railroad reported that the following charges were imposed on the railroads named:

FREIGHT RATES ON RAILROADS IN 1837.

Railroad.	Per Ton per Mile. Cents.
Baltimore and Ohio	4½
Baltimore and Washington	4
Winchester and Potomac	7
Portsmouth and Roanoke	8
Boston and Providence	10
Boston and Lowell	7
Mohawk and Hudson	8
Petersburg	10

These rates seem preposterous when compared with the .878 of one cent per ton per mile, which was the average charge on all the railroads of the United States during the year 1893.

The growth of lake commerce in this country is something marvelous. The increase of freight shipments through the St. Mary's Canal, both east and west bound, was from 1,410,347 tons in 1881 to 8,888,759 tons in 1891, or an advance of over 530 per cent. There was an increase in the valuation of this tonnage from $28,965,612.92 to $128,178,208.51, or an increase of over 340 per cent. During the season of 225 days in 1891 in which this canal was open there passed through it 7339 steamers and 2405 sail-vessels—a total of 10,191 vessels, or an average of over 45 per day during the entire season. The total registered tonnage for the season was 8,400,680. The freight which passed through the canal was carried an average distance of about 800 miles, at a cost per mile per ton of 1.35 mills. The size of the vessels passing through the canal continues to increase. The average registered tonnage per vessel in 1867 was 626.3 tons, while in 1891 it was 962.1 tons. This freight-tonnage during the season of 1889 amounted to 19,717,860 tons. The tonnage passing through the same canal during the season of 1890, including the foreign and coastwise traffic, amounted to 21,888,472 tons, while the tonnage of all vessels of the Atlantic coast engaged in foreign trade during 1890 was but little more—22,497,817 tons. All the vessel-tonnage engaged in the foreign trade, entering and clearing at London, England, during the same year was 13,480,767 tons, and at Liverpool the same year it was 10,941,800 tons; so that the vessel-tonnage passing through the Detroit River in 1890 was more than 8,000,000 more than that of London, about double that of Liverpool, and nearly equal to that of the two combined.

Edward A. Moseley.

Another comparison: The tonnage passing through the Suez Canal in 1890 was 6,890,094 tons—less than one third of that passing through the Detroit River. It should be recalled, too, that the Detroit River was open for navigation during the season of 1890 only 228 days, while the Suez Canal was open during the entire year. Take one more comparison: The total tonnage, entrances and clearances, of the foreign and coastwise trade of Chicago and Buffalo for the season of 1890, as compared with that of the four great British ports, was as follows:

	Tons.
Chicago	10,288,868
Buffalo	9,560,590
London	20,962,534
Liverpool	16,621,421
Glasgow	5,977,860
Hull	5,061,882

Carrying the comparison still further, the volume of this inland trade is again shown in the figures giving the foreign trade of the following great commercial ports:

	Tons.
New York	12,646,555
Hamburg	10,417,096
Antwerp	8,203,999
Marseilles	7,392,556
Havre	4,418,876
Bremen	3,481,769
Boston	2,676,387
Philadelphia	2,585,866
San Francisco	1,986,483

It will be seen that the commerce of the two inland cities, Chicago and Buffalo, consisting almost wholly of a coastwise trade within the confines of the Great Lakes, compares most favorably with the tonnage movement of the great maritime cities of the world.

In 1859 the average freight rate by lake on a bushel of corn from Chicago to Buffalo was 15¾ cents; in 1871 the rate was 7½ cents per bushel. In 1857 the average rate by lake and canal on a bushel of wheat from Chicago to New York was 25.29 cents; in 1870 the rate for the same service was 17.1 cents per bushel; in 1880 it was 12.27 cents per bushel; and in 1890, 5.85 cents per bushel. In 1870 the average rate of freight by rail on a bushel of wheat from Chicago to New York was 33.3 cents; in 1880 the rate was 19.9 cents; and in 1890, 14.31 cents. In 1867 the average rate for carrying iron ore from Escanaba to Lake Erie was $4.25 per ton; in 1870 the average rate was $2.50 per ton; in 1891 the average rate was 82 cents per ton; and at one time in that year it was as low as 55 cents per ton.

The benefit of these great reductions in lake transportation rates appears very forcibly in the movements of the huge cargoes of coal that are sent from ports on Lake Erie to the harbors of the upper lakes. In 1887 the average rate per ton for lake transportation of coal from Buffalo to Chicago was $1.05; in 1891 the average rate was fifty cents per ton; and from November 10, 1891, to the close of navigation, coal was carried from Buffalo to Duluth, a distance of 1000 miles, for ten cents per ton. Using the common unit (cost per ton per mile) for comparison, and taking the official report of the movement of freight through the St. Mary's Falls Canal, the ton-mileage rate has decreased as follows: 1887, 2.3 mills; 1888, 1.5 mills; 1889, 1.5 mills; 1890, 1.3 mills. The average revenue per ton of freight per mile on all the railroads of the United States was given at 9.4 mills in 1890, or more than seven times as much as the cost of freight carriage through the St. Mary's Falls Canal.

The regulation of interstate commerce before the Declaration of Independence was by Parliament. Under the Articles of Confederation trade was controlled, where it was controlled at all, by the legislatures of thirteen distinct sovereignties. It soon became evident that the several States would not unite in any general or fixed rule to govern commerce. Discriminations naturally followed, which resulted in confusion and discord among the different parts of the confederacy. Accordingly one of the reforms demanded under the old confederacy, and introduced in the Constitutional Convention, was that "Congress shall have power . . . to regulate commerce . . . among the several States." The dissatisfaction among the States in respect to the interchange of trade, and the urgent demand for a uniform and general principle controlling their commerce, were clearly shown in the debates of the Constitutional Convention. The following contemporaneous opinions are of interest:

"The want of authority in Congress, under the confederation, to regulate commerce had produced in foreign nations, particularly Great Britain, a monopolizing policy injurious to the trade of the United States. . . . The same want of a general power over commerce led to an exercise of the power, separately, by the States, which not only proved abortive, but engendered rival, conflicting, and angry regulations." (Madison Papers, vol. v., p. 119.)

"The oppression of the uncommercial States was guarded against by the power to regulate trade between the States." (Mr. Sherman, Deb. on Fed. Cons., Mad. Pap., vol. v., p. 434, 1787.)

"Mr. Carroll and Mr. L. Martin expressed their apprehensions, and the probable apprehensions of their constituents, that, under the power of regulating trade, the general legislature might favor the ports of particulai States, by requiring vessels destined to or from other States to enter thereat." (*Ibid.*, p. 455.)

To cover this defect, Art. I., Sec. 9, Cl. 6, of the Constitution was enacted, to wit: "No preference shall be given by any regulation of commerce or revenue to the ports of one State over those of another, nor shall vessels bound to or from one State be obliged to enter, clear, or pay duties in another."

General Washington, in a letter to a friend on the weakness of the confederation, and pleading for a stronger government, wrote: "We have abundant reason to be convinced that the spirit of trade which pervades these States is not to be repressed. It behooves us, then, to establish just principles, and this cannot, any more than other matters of national concern, be done by thirteen heads differently constructed and organized. The necessity, therefore, of a controlling power is obvious, and why it should be withheld is beyond my comprehension."

Alexander Hamilton, in the "Federalist," Letter VII., wrote: "The competition of commerce would be another fruitful source of contention. The States less favorably circumstanced would be desirous of escaping from the disadvantages of local situation, and of sharing in the advantages of their more fortunate neighbors. Each State or separate confederacy would pursue a system of commercial probity peculiar to itself. This would occasion distinctions, preferences, and exclusions which would beget discontent. The habits of intercourse on the basis of equal privileges, to which we have been accustomed from the earliest settlement of the country, would give a keener edge to those causes of discontent than they would naturally have, independent of the circumstances." Also, in Letter XXII.: "The interfering and unneighborly regulations of some States, contrary to the true spirit of the Union, have, in different instances, given just cause of umbrage and complaint to others; and it is to be feared that examples of this nature, if not restrained by a national control, would be multiplied and extended till they became not less serious sources of animosity and discord than injurious impediments to the intercourse between the different parts of the confederacy."

In the debates of the Constitutional Convention the clause regulating commerce, etc., was agreed to *nem. con.*, not even a yea-and-nay vote being taken. When the grant of this power to regulate commerce among the States was made by the Constitution, the traffic which might be controlled under it was quite insignificant. On the land there was nothing that could approach the dignity of interstate commerce, and its regulation, as also of that which was exclusively State traffic, was for the most part left to the rules of the common law. The exceptional regulations, if any seemed to be called for, were made by the State laws. For the regulation of commerce on the ocean and other navigable waters, Congress very promptly passed the necessary laws; but its jurisdiction within the limits of the States was not very clearly understood, and it was not until the celebrated case of Gibbons *vs.* Ogden, decided in 1824, that it was authoritatively and finally determined that the waters of a State, when they constituted a highway for foreign and interstate commerce, are, so far as concerns such commerce, as much within the reach of Federal legislation as are the high seas, and consequently that exclusive right for their navigation cannot be granted by States whose limits embrace them. But while providing from time to time for the regulation of commerce by water, Congress still abstained from undertaking the regulation of commerce by land. The reasons were the same. The land commerce was insignificant, and the rules of the common law were in general found adequate for the settlement of any questions. When Congress provided for the construction of the Cumberland road, it was thought undesirable to regulate its use by national law, or to take national supervision of the commerce upon it; and it was left to the supervision and care of the States through or into which the road was built. With the application of steam as a motive power for propelling vessels, conditions were immediately changed. But even then the circumstances were favorable to a prolongation of State control. The first improved highways were turnpikes, the next in grade canals; but the highways by water, as well as the highways by land, were provided for by the States. It was not unnatural that they should be left in charge of the regulation of trade upon them, especially as no complaint was made that their regulations were unjust, or that they discriminated unfairly as against the citizens or the business of other States. When, in 1830, steam-power began to be applied to the propulsion of vehicles upon land, the same conditions continued to prevail. The power of the Federal government in the regulation of commerce between the States was put forth negatively rather than affirmatively; that is to say, it was put forth in restraint of excessive State power, instead of by way of affirmative national regulation.

[1] See First Annual Report of the Interstate Commerce Commission.

The subject of the management of railways in respect to interstate commerce had been more or less discussed in Congress, when in March, 1885, a resolution was adopted by the United States Senate empowering a select committee, known subsequently as the Cullom Committee, to investigate it. On January 18, 1886, this committee submitted a report based upon testimony contained in more than 1450 printed pages. On page 40 the committee says: "Unjust discrimination is the chief cause of complaint against the management of railroads in the conduct of business, and gives rise to much of the pressure upon Congress for regulating legislation."

In summing up the testimony, on pages 180–182 the committee says: "The complaints against the railroad systems of the United States expressed to the committee are based upon the following charges: (1) That local rates are unreasonably high, compared with through rates. (2) That both local and through rates are unreasonably high at non-competing points, either from absence of competition or in consequence of pooling agreements that restrict its operation. (3) That rates are established without apparent regard to the actual cost of the service performed, and are based largely upon what the traffic will bear. (4) That unjustifiable discriminations are constantly made between individuals in the rates charged for like service under similar circumstances. (5) That improper discriminations are made between articles of freight and branches of business of a like character, and between different quantities of the same class of freight. (6) That unreasonable discriminations are made between localities similarly situated. (7) That the effect of the prevailing policy of railroad management is, by an elaborate system of secret special rates, rebates, drawbacks, and concessions, to foster monopoly, to enrich favored shippers, and to prevent free competition in many lines of trade in which the item of transportation is an important factor. (8) That such favoritism and secrecy introduce an element of uncertainty into legitimate business that greatly retards the development of our industries and commerce. (9) That the secret cutting of rates, and the sudden fluctuations that constantly take place, are demoralizing to all business except that of a purely speculative character, and frequently occasion great injustice and heavy losses. (10) That in the absence of national and uniform legislation the railroads are able, by various devices, to avoid their responsibility as carriers, especially on shipments over more than one road, or from one State to another, and that shippers find great difficulty in recovering damages for the loss of property or for injury thereto. (11) That railroads refuse to be bound by their own contracts, and arbitrarily collect large sums in the shape of overcharges, in addition to the rates agreed upon at the time of shipment. (12) That railroads often refuse to recognize or be responsible for the acts of dishonest agents acting under their authority. (13) That the common law fails to afford a remedy for such grievances, and that in case of dispute the shipper is compelled to submit to the decision of the railroad manager or pool commissioner, or run the risk of incurring further losses by greater discriminations. (14) That the differences in the classifications in use in various parts of the country, and sometimes for shipment over the same road in different directions, are a fruitful source of misunderstandings, and are often made a means of extortion. (15) That a privileged class is created by the granting of passes, and that the cost of the passenger service is largely increased by the extent of this abuse. (16) That the capitalization and bonded indebtedness of the roads largely exceed the actual cost of their construction or their present value, and that unreasonable rates are charged in the efforts to pay dividends on watered stock and interest on bonds improperly issued. (17) That railroad corporations have improperly engaged in lines of business entirely distinct from that of transportation, and that undue advantages have been afforded to business enterprises in which railroad officials are interested. (18) That the management of the railroad business is extravagant and wasteful, and that a needless tax is imposed upon the shipping and traveling public by the unnecessary expenditure of large sums in the maintenance of a costly force of agents engaged in a reckless strife for competitive business."

The report of Senator Cullom's Committee formed the basis of the law commonly known as the Interstate Commerce Act, which became effective April 3, 1887. The Supreme Court in the case of the Union Pacific Railway Company against Goodridge, October term, 1892, in speaking of a similar act of the State of Colorado, said: "This act was intended to apply to interstate traffic the same wholesome rules and regulations which Congress two years thereafter applied to commerce between the States, and to cut up by the roots the entire system of rebates and discriminations in favor of particular localities, special enterprises, or favored corporations, and to put all shippers on an absolute equality."

The statute recognizes the fact that it is no proper business for a common carrier to foster particular enterprises or to build up new industries; but, deriving its franchise from the legislature, and depending upon the will of the people for its very existence, it is bound to deal fairly with the public, to extend reasonable facilities for the transportation of persons and property, and to put all its patrons upon an absolute equality. The laws making the giving of transportation privileges a criminal offense are at present difficult of enforcement. Public opinion has not yet been roused to the energetic condemnation which is necessary to make these special favors as completely unknown as they are at the post-office window, where the value of every stamp must be paid.

At the head of all the vast machinery employed in moving interstate commerce are men of integrity, and of ability rarely developed in other walks of life, broad-gauged men, to whom the public is indebted for the efficiency with which they carry on their stupendous enterprises. Under the railway presidents are the traffic managers, the passenger and freight agents. The feeling of these men that they must serve solely the corporations which employ them has grown to be a second nature with them. Their duty to the government and to the public, therefore, is sometimes obscured, and it is hard for them to realize that many practices which they have come to regard as ordinary business methods are wrong. So also the shipper and the merchant find it hard to realize that the push and barter and dicker that have made them successful must be abandoned when they ship their merchandise; that it is no longer to be bargained for, and cannot be carried except at a rate open to every competitor.

On February 4, 1887, the Act of Congress creating the Interstate Commerce Commission, and investing it with authority to regulate certain matters with respect to commerce which were detrimental to the public interest, and with authority to require annual reports from all carriers engaged in carrying interstate commerce, was passed. This act, being in the nature of experimental legislation, has not accomplished all that its framers hoped or intended, but that great good has been accomplished cannot be denied. Various defects in its practical application have from time to time been brought to the attention of Congress, and amendments to remedy some of them have been adopted. The statistics compiled from the reports required under the provisions of this act have marked a new era in railway statistics in this country. Being compiled from sworn reports made up on a uniform plan and for a uniform period, in compliance with a requirement of law, and published as official documents of the government, they are accepted as authority, and eagerly sought after by the public and by railway officers.

I may observe in closing that within the past two or three years the courts have taken advanced ground in asserting the power of the Federal government over interstate commerce. It was held by the Supreme Court in the case of Debs that "the government of the United States is one having jurisdiction over every foot of soil within its territory, and acting directly upon each citizen; that while it is a government of enumerated powers, it has within the limits of those powers all the attributes of sovereignty; that to it is committed power over interstate commerce and the transmission of the mail; that the powers thus conferred upon the national government are not dormant, but have been assumed and put into practical exercise by the legal action of Congress; that in the exercise of those powers it is competent for the nation to remove all obstructions upon highways, natural or artificial, to the passage of interstate commerce or the carrying of the mail; that while it may be competent for the government (through the executive branch, and in the use of the entire executive power of the nation) to forcibly remove all such obstructions, it is equally within its competency to appeal to the civil courts for an inquiry and determination as to the existence and character of any alleged obstructions, and if such are found to exist, or threaten to occur, to invoke the powers of those courts to remove or restrain such obstructions." In this case the extent and nature of the power of the Federal government over interstate commerce, and the methods by which that power can be applied, were discussed. It was decided that the United States Circuit Court, sitting as a court of equity, has power to enjoin, at the instance of the Attorney-General of the United States, acts of obstruction to interstate commerce, notwithstanding that the acts enjoined, or some of them, might amount to offenses against the criminal law of the United States.

While it is clearly the fact that, under our form of government, the national authority has no excuse for interfering with the relations existing between employer and employee in ordinary business transactions, it is maintained by many that as the government has control of the agencies engaged in interstate commerce, those who are employed by such agencies are also engaged in the public service, and for that reason an obligation exists on the part of Congress to enact such legislation as will tend to settle differences which may arise between railroads and their employees without causing inconvenience to the public.

Edw. A. Moseley

CHAPTER V

THE POSTAL SERVICE IN COMMERCE

IT is something more than a mere figure of speech to call the post-office the right hand of commerce. The rapid transmission of news, domestic and public, has been of enormous benefit to individuals and the general community, but to the merchant it has been paramountly one of the most important factors in successfully carrying on his commercial enterprises. We can scarcely conceive how a business of any consequence could ever have been prosecuted without the aid of this most important and, I am happy to say, best appreciated branch of the government service. To tell the story of the post-office in commerce, therefore, would be to recite the history of the service itself, from the time in England, in 1533, when the few posts that were established were for the exclusive use of the sovereign, down to the present day, when the letter of the poorest and most despised person in the British dominions or in the United States is treated as sacredly and handled with as much care as though it were written by the Queen of England or the President of our country. Even with the generous space allotted to me I can only hope to allude briefly to the most important episodes in the service, whose history is a part of the annals of commercial progress throughout the world.

At the beginning of the seventeenth century there were only four established posts in the British dominions—one to Ireland, one to Scotland, one to Plymouth, and one to Dover, the last-named being the most important and most used, because it passed through the county of Kent, the highroad to the Continent. There were no commercial relations between one town and another, but the foreign trade was considerable. Many foreigners, on account of being persecuted in their native countries, had been driven to London. It was the era of the Flemish merchant, who introduced the manufacture of woolen cloth, and so successfully that the exports from England to the Netherlands in the time of Philip II. amounted to 5,000,000 crowns annually. These Flemish merchants were exceptionally intelligent, and nearly all the peasants they employed were able to read and write. A nice little quarrel arose between the crown and the foreign merchants in London. The latter claimed the right to send their letters by their own agents; the crown insisted that all communications should be sent through the regular channel. This feud had existed for many years. A proclamation issued in 1591 gave the state a monopoly of carrying letters through the county of Kent, a law which was applied to all the postal routes eighteen years later. In 1603 another proclamation gave to those who furnished horses for the post carriers the exclusive right of letting horses to travelers; but the foreign merchants, against whom these proclamations were directed, still persisted in sending their letters by their own special messengers, procuring horses from other quarters. Another proclamation, in which magistrates were urged to see that horses were procured at the post-houses alone, had no effect. Under Lord Stanhope, the master of the posts (what we should call the postmaster-general) at that time, there was a foreigner of the name of De Quester, who was superintendent of the foreign post, and who had discharged his duties so faithfully, sending the government despatches with such promptness, that the king, in 1619, made him "Postmaster of England for Foreign Parts out of the King's Dominions." Doubtless this appointment was partly intended to induce the foreign merchants to give up their special messengers; but it not only failed to produce that effect, but gave dire offense to Lord Stanhope, who had letters patent to his office which declared that he had charge of the internal parts of the kingdom and those "beyond the seas within the king's dominions." In this way, through the practice of the foreign merchants in employing special messengers, a serious quarrel was brought about between Lord

Stanhope, De Quester, and the king, which was referred to the Privy Council for settlement. The Council finally agreed that the foreign merchants (who, by the way, were called "merchant adventurers") were "to have a post of their owne choice" to the city of Hamburg and town of Delft, "where the staples of cloth are now fetched, or to have such other place or places whither the same shall happen to be removed." This action superseded De Quester's appointment, though some few restrictions were imposed upon the merchants. Stanhope gained a lawsuit he had instituted to defend his rights, and Billingsley, a broker who had been carrying the foreign merchants' letters, was sent to prison, but afterward, on petition to the king, released.

From the earliest days of the English post-office the merchants had been favored; their bills of exchange, invoices, and bills of lading, when written on a single sheet of paper, were exempt from postage. The postmaster-general contended that the exemption applied only to foreign letters; the merchants claimed that inland letters were included; otherwise, they shrewdly observed, "letters might go cheaper to Constantinople than to Bristol." The result of the controversy was that the merchants procured an act to be passed declaring their interpretation of the law to be correct.

When Sir Rowland Hill, the father of penny postage, was making his brave fight for postal reform, he was glad to have the aid of a committee of London merchants to collect evidence in favor of his plans. The chairman of this committee was Mr. Bates, of the house of Baring Brothers; and other members equally prominent were obtained without difficulty. When the act in favor of penny postage had passed the House of Commons the measure had to come before the House of Lords. The ultraconservative element were in the habit of saying in those days, "Thank God, there 's a House of Lords!" One of the members of the Mercantile Committee, with an enterprise that would be commendable in a nineteenth-century journalist, sought to "interview" the Duke of Marlborough, who was a member of the Upper House, thinking, very properly, that if some expression from him in favor of the measure could be obtained before it came up for consideration in the House of Lords, it would be of immense advantage to the postal reformers. But "interviewing" was not in vogue in that day, and the noble lords were unapproachable, especially to persons who had "views" about reforming any branch of the English government. The merchant, representing the committee, wrote to the duke that they would like to see him and present their reasons for demanding reform in postal matters, and a reduction of the rate to a penny. The duke's reply, through his secretary, was that "he is not in the habit of discussing public affairs in private, and he declines to receive the visits of deputations or individuals for the purpose of such discussions." Rowland Hill then wrote a letter to his Grace, giving his reasons for the establishment of a uniform penny postage. The duke never answered the letter, but when the debate came up in the House of Lords he supported the measure. The merchant of to-day will smile, as I suppose the merchants of that day were amused, at the objection of one noble lord to Rowland Hill's scheme. He argued that, under the low rate of postage, the amount of correspondence would be so greatly increased that "the whole area on which the post-office stands would not be large enough to receive the clerks and the letters." The mind of many an English official or statesman becomes peculiarly dense when he comes face to face with some reformatory measure that is going to make things easier and more convenient for his government or the English people. Rowland Hill mildly observed that his lordship should have no hesitation in deciding "whether, in this great and commercial country, the size of the post-office is to be regulated by the amount of correspondence, or the amount of correspondence by the size of the post-office."

In the early history of the post-office in America it is singular that our colonies were considered second in importance to one of the West Indian Islands. By an order of the English government in 1688, after prescribing the rates of postage to be charged between the mother country and Jamaica, the order reads: "And his Majesty is also pleased to order that letter-offices be settled in such other of his Majesty's plantations in America as shall be found convenient for the service and the ease and benefit of his subjects." Four years later, in 1692, Thomas Neale obtained a grant from the crown authorizing him to "set up posts in North America." Neale never left England, but appointed Andrew Hamilton his representative in this country. By 1698 a weekly post, running over 700 miles of road, had been established between New York and Boston, and from New York to New Castle in Pennsylvania. The postage on a letter between New York and Boston was a shilling. £20 a year was paid "to Mr. Sharpus, that keeps the letter-office at New York," who earned £170 in addition for carrying the mail half-way to Boston, and the mail from New York to Philadelphia. A salary of £10 was "allowed to him that keeps the letter-office at Philadelphia," and an allowance of £100 to the deputy postmaster of Virginia and Maryland.

The receipts from the service increased each year. In 1693 the receipts of the New York office were £61; in 1695, £82; in 1696, £93; in 1697, £122. The "Boston, Road Island, Connecticut, and Piscataway posts" produced from £148 the first two years to £298 in the fourth. The post to Philadelphia kept improving, but the Virginia and Maryland routes never yielded anything; in fact, were run at a loss of £600, the correspondence not exceeding 100 letters a year. The whole system did not pay expenses, and in 1697 Neale was £2360 out of pocket. The great question was then, as it has been even in later years, "How can the postal service be made self-supporting?" Hamilton proposed that the rates should be raised, that the post carriers should go "ferry free," and that ship-captains (after a regular postal rate had been settled between England and America) on both sides of the Atlantic should be required to take the mail they had, at once, to the post-office of the port at which they first touched. Under the new rate, the charge, where the distance was not more than eighty miles from New York, was sixpence; to and from Boston, twelvepence; to and from Boston and Annapolis, Md., thirty-six pence; "to and from New York and James Towne, 380 miles, and many broad and dangerous bays and rivers to be ferryed over," thirty pence. The English government, according to its own home officials, had not supported the postal service in the colonies as it should have done, the extent of its interest showing itself in an annual appropriation of £50, in consideration of which the government letters were to be carried free. Its own postmasters-general, about this period, admitted that the posts in private hands could not prosper for want of due encouragement, and they recommended that the service should be carried on by the government. Neale's offer to sell his patent for £5000, or £1000 a year for life, or for the unexpired term of the grant (about sixteen years), was not accepted by the government. He died in debt, his interest in the posts having been transferred to Hamilton, who died in 1703, when his widow took charge of the business for three or four years, and in 1707 the posts became vested in the crown. In 1722 the posts began to be self-supporting. In August of that year the postmaster-general wrote: "We have now put the post-office in North America and the West Indies upon such a foot that for the future, if it produce no profit to the revenue, it will no longer be a charge to it; but we have good reason to hope there will be some return rather from thence."

In these early days, when there was a monthly service between Boston and New York, the post-office in the metropolis was a locked box that stood in the office of the secretary of the colony. It took four weeks, in those times, to accumulate a post-rider's mail, even with the "small portable goods" that were allowed to be carried in that way. Later on, in 1775, after the time of Benjamin Franklin, the first postal reformer, who established the penny post, made newspapers pay, quickened the pace of the riders, advertised letters, etc., the New York post-office was located in a printing-house in Water Street. Ebenezer Hazard, a bookseller, was the postmaster, and William Goddard, an enterprising journalist and printer of New York (born in New London, Conn.), had charge of the route to Philadelphia, Mr. Hazard managing the route to Boston. This latter route will be remembered for notable exploits in the way of post riding, including the ride of Paul Revere, who in 1773 rode from Boston to New York, and thence to Philadelphia, with the news of the "Boston tea-party"; that of Ebenezer Hurd, who was in the service forty-eight years, traveling over as much space as twelve and one half times around the world, or as far as the moon and half-way back; and the most famous ride of Paul Revere in 1775, when he proclaimed the intended movement of the British army to Lexington and aroused the people to arms.

The development of the ocean postal service presents interesting phases. In the days of New Amsterdam the whole colony looked upon the arrival of a ship as the most important event of the day. It was of special interest to the merchants, whose correspondence was first delivered to them, after which the letters for the general public were distributed, the crowd always being down at the dock waiting to receive their mail. The masters of ships sailing to and from America in those days unconsciously instituted what the well-known reformer, Mr. J. Henniker Heaton, of England, is striving to bring about in the present day—ocean penny postage; that is to say, correspondents would drop letters in a coffee-bag hung up in one of the coffee-houses that were so common then on both sides of the water, and the masters of the vessels would call for the mail just before sailing, and deliver the letters at the port of destination, charging one penny for a single letter and twopence for a double one.

When Thomas Neale (already mentioned in this article) failed to make the inland post pay in the colonies, he proposed to establish sea rates of postage. Letters would then be in charge of the post-office, and the shipmaster, as its agent, would hand them over to a postal official on arriving in port. Correspondence, it was argued, that was being delivered by private hand, under the new system would have to pass through the posts and pay regular rates, which should be sixpence for a single letter, one shilling for a double letter, and one shilling sixpence for a packet. The English postal authorities of that day were wiser than those of the time of Rowland Hill, for they answered that the way to increase the revenue of the post-office was to "make the intercourse of letters easy to people." Rowland Hill, one hundred and fifty-nine years later, had to struggle long and hard to convince the post-office department of the truth of this proposition, while the postmasters-general in the time of Neale wrote: "The easy and cheap corresponding doth encourage people to write letters," and declared that the postal revenue had been increased when the rate, before this time, had been reduced from sixpence to threepence.

The system of the coffee-house delivery of letters was used by the residents of "Breucklyn, Pavonia, and Hackensack," who left their mail at some well-known tavern previously agreed upon. This custom was followed until after the English took possession of New York. The best-known coffee-houses in New York were the Exchange Coffee-House, located at the foot of Broad Street, and the Merchants', located on the southeast corner of Wall and Water streets.

After the War of 1812 the mails were carried by the packet service, which had been rapidly developed, owing to the increased trade between America and Europe. Frequent trips were made, and the facilities for foreign correspondence were much better than they had been. Then, from 1840 to 1855, came the era of the clipper-ships, which were built with special reference to speed, and whose services were quickly utilized by the American newspapers, the best representatives of our national spirit of enterprise. One of these clipper-ships, in 1846 (the *Toronto*, of the Morgan Line), beat the Cunard steamer from Liverpool, bringing a copy of the London "Times," containing European intelligence, forty-two days later than the last paper received. The New York "Herald" secured this prize, and published an "extra" about it the same afternoon.

In 1845 Congress authorized the postmaster-general to make contracts for the transportation of the foreign mails, which had now become an important feature of the postal service. After the ocean mail service had become fairly started it was improved rapidly. Various suggestions have been made from time to time as to granting subsidies for this service. My own opinion is that the ships should receive proper compensation for carrying the mails, on the same plan that we pay the railroads, or should do the work under contract for specified distances. The amount of foreign mail carried has increased enormously. In 1840, when the *Great Western* brought it over, the British mail amounted to two sacks; at the present time it amounts to five or six truck-loads. Over 100,000 letters are now despatched from New York every sailing-day, and nearly the same number are received. The next great step in perfecting this branch of the service will be universal international penny postage. To bring about this change, Mr. J. Henniker Heaton, M.P. from Canterbury, has been and is working with the same intelligence and persistency that characterized Rowland Hill; and eventually, I hope and believe, he will meet with the same success.

The growth of the railway mail service is another most important feature in the history of the postal service. The railroad was first used as a post-office in England in 1837, between Liverpool and Birmingham. On the completion of the railroad line the following year what was called the "flying mail" train was started from the British metropolis to Birmingham. In 1834 the mails were being conveyed in the United States over seventy-eight miles of railroad, being carried in closed bags. In 1860 Postmaster-General Holt arranged to run a mail-train between New York and Boston, via Hartford and Springfield, with the idea of forwarding East the Southern mail more promptly, instead of allowing it, as the practice had been, to remain over a day in New York. The following year a railroad mail was established between New York and Washington. In 1863 it was suggested that "post-office cars" could be placed on the principal railroad lines, and that clerks could sort the mail for the terminal points and intervening stations while the cars were in transit. A test of this system was made in 1864, under the direction of the postmaster-general, by Colonel George B. Armstrong, at that time assistant postmaster at Chicago. The test was made between Chicago and Clinton, Ia., August 28, 1864. There were then no pigeonhole cases for letters, nor such conveniences for handling the mails as now exist. Under the system then in vogue they were not necessary; for postmasters were required to post-bill all letters, paid and unpaid, wrap them in paper, those for each post-office in the State being done up separately, and write the name of the post-

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office of destination on the package. Those for other States were massed together, wrapped up, and addressed to the nearest distributing post-office.

In 1864 a successful experiment of the same kind was made on the route between New York and Washington, expert clerks from the principal Eastern cities being selected for the work, which, it may be said, has been always exceptionally well done. Even as far back as 1863 a convention of special agents reported of the employees: "The amount of labor they perform and the degree of intelligence exhibited can hardly be estimated outside the department."

In 1865, in quick succession, postal cars were placed on the lines between Chicago and Davenport, Ia., Chicago and Dunleith, Ill.; and the Chicago-Burlington and Galesburg-Quincy lines were established. The first railway postal service was put on the Philadelphia-Pittsburg route, on all the principal railroad lines leading out of Chicago, and on the Hudson River and New York Central railroads, between New York, Albany, and Buffalo. The new system made more rapid progress in the West than in the East, the New York and Washington and the New York and Albany-Buffalo being for a long time the only postal-car routes. But the success of the service in the West led to its extension not only in the Eastern States, but over the whole country, so that by 1872 there were railway post-offices on fifty-seven lines of road.

Another improvement that marks the progress of the postal service was the change in the rate of postage in 1851. Before that year the rate was five cents per half-ounce for a distance not exceeding 300 miles, and ten cents exceeding that distance. In the year mentioned the rate was changed to three cents per half-ounce for a distance not exceeding 3000 miles, and ten cents exceeding that distance. The use of adhesive stamps was authorized in 1847 and made compulsory in 1856. In 1863 the distance limit for carrying a letter was removed. In the same year the free-delivery or carrier system was established in 49 cities. In 1895 the carrier service is in use in 610 cities. There are about 12,000 carriers employed, at an annual cost of about $11,-323,000. There are twice the number of carriers now employed in Chicago than were in the service throughout the entire country in 1864.

In 1854 the registry system was established, which is certainly one of the greatest conveniences the commercial world possesses. It took five years to improve it and bring it into general use. The safety of the system is illustrated by the fact that the losses by fire, accident, and theft amount to but one in every 16,306 pieces. About 15,000,000 pieces of all classes of matter are registered in a year. In 1864 the money-order system was established. Within the first six months 419 offices were made money-order offices; now there are nearly 20,000 such offices.

Business men, more especially publishers, will recall the law of 1875 which enabled them to mail newspapers and periodicals at the rate of two cents per pound. Ten years later this law was amended so as to make the rate one cent per pound. In making this change the government showed that it recognized the newspaper and the periodical as educators. Although this wise provision has been abused to such an extent as to make it largely responsible for the postal deficiency, it is safe to say that the law can be so amended in the future as to stop the abuses complained of, and at the same time preserve the undoubted advantages which, by its operation, are conferred upon the people.

In the extent of its work and the manner in which the service is performed it is safe to say that the postal department in this country cannot be excelled by any other in the world. A late English writer (Mr. Herbert Joyce, of the London post-office) has this to say: "American progress has long been the wonder of the world, and in nothing, perhaps, has it displayed itself more remarkably than in the matter of the posts. The figures which the United States post-office presents to us year after year—figures as compared with which even those of the post-office of Great Britain fall into insignificance—make it difficult to believe that only two hundred years ago an enterprising Englishman [Thomas Neale] was struggling to erect a post between New York and Boston."

The United States spends more money on its postal service than any other nation, the expenditures in 1874 amounting to $84,000,000, while Germany, the next in postal rank, expended less than $64,000,000, and Great Britain less than $37,-000,000. The United States is ahead of the other countries in annual transportation on railroads and other roads, the miles of service in 1894 being 264,-717,595; and in Germany, next in rank, 112,480,-758. Our postal service gives employment to about 180,000 persons; that of Germany to 155,000; and that of Great Britain to 131,000.

Thomas L. James

CHAPTER VI

OUR MERCHANT MARINE

EASTWARD for 3000 miles of the group of fifteen States along the fringe of the sea from Massachusetts to Georgia, which Jay's treaty gave a recognized place among the maritime and commercial powers of the world, stretched the barren Atlantic; for 3000 miles to the west stretched forest, plain, prairie, mountain, and lake, storing a wealth the extent of which no man of that time, even in the most extravagant burst of enthusiastic prophecy, was to conjecture, and the development of which has been the marvel of man's industrial progress. If our merchant marine has lagged far behind our other national industries; if, for the time, it has been outstripped by competitors, while American manufacture and agriculture have pushed themselves into the front rank, it must be borne in mind that illimitable natural resources, roughly to be gauged by the creation into new States of over 2,000,000 square miles of territory, and by an increase of upward of 60,000,000 in population during the century, have stood behind the latter. The American merchant marine, on the other hand, in the unrestricted rivalry of nations,—which, from the nature of the element, must obtain upon the high seas,—for forty years has been hampered by the retarded use of modern materials of construction, and by restrictions forbidding it to enter that rivalry on even terms with competing nations, which have sought out and applied every device to promote their own navigation.

The record of the American merchant marine from 1795 to the present day may be divided into two periods. The first, covering two thirds of the century after the promulgation of Jay's treaty, was a period of growth, culminating in the possession of the largest tonnage which up to that time had ever borne the flag of any nation but one, and in the attainment by the United States of a rank on the ocean second only to that of Great Britain and all her colonies combined, with the promise that before many years our sea power would be unsurpassed. At the end of the second period the total tonnage of our great rival surpasses ours three to one, and on the ocean nine to one. We hold by uncertain tenure third rank as a mercantile power on the sea; and of the hundreds of steamships under every flag crossing the Atlantic and the Pacific from our shores to the Old World, only fifteen fly the Stars and Stripes. The dividing-line in time between these strongly contrasting periods was vaguely within the decade from 1855 to 1865. The forces which during this interval turned our maritime progress into retrogression, in the order of their ultimate importance, were the substitution of iron for wood as the chief material of marine construction, the diversion of the nation's energies from the sea to internal development, and the losses inflicted upon our mercantile marine by the Civil War. Even these causes would not have sufficed to produce such destructive results had not the inadequacy of our laws, compared with the laws of rival nations, intensified their operations. Wherein lies that inadequacy and how it may be remedied are questions which unfortunately are matters of partizan dispute. They cannot, accordingly, be discussed within the limitations necessarily placed upon this volume.

On December 31, 1789, the merchant fleet of the United States amounted to 201,562 tons, of which 123,893 tons were registered for the foreign trade, 68,607 tons enrolled for the coasting trade, and the remainder engaged in the fisheries. In May, 1789, James Madison, in the House of Representatives, stated that the tonnage entered in Massachusetts, New York, Pennsylvania, Maryland, Virginia, South Carolina, and Georgia amounted to 437,641 tons (including repeated voyages), of which only 160,907 tons were foreign. "This circumstance," said Mr. Madison, "annexed to our capacity of increasing the quantity of our tonnage, gives us a favorable presage of our future independence." By 1795 the tonnage of our merchant fleet had increased to 747,965 tons, and in 1820, in spite of the oppressive influence of the Embargo acts, to 1,280,167 tons, 583,657 tons of which were in foreign trade, compared with a tonnage for the entire British empire of 2,648,593 tons. Three years later the American tonnage (counting repeated voyages) entering the United States from foreign ports amounted to 810,761 tons, compared with 119,487 foreign, of which 89,553 tons were British.

At the outset the efforts of the United States to engage in the carrying trade were met by discriminating duties imposed by our older rivals on American vessels. Sharp retaliation, begun by the first Congress and consistently followed up, forced nation after nation to withdraw from this mode of warfare upon our commercial life, and led to a series of treaties of friendship, navigation, and commerce, which are the basis of our trade relations with the world. By these treaties, associated with illustrious presidents, and negotiated, as secretaries of state and ministers, by Albert Gallatin, John Quincy Adams, Henry Clay, Martin Van Buren, Daniel Webster, James Buchanan, Hamilton Fish, Thomas F. Bayard, and others, the United States obtained for their vessels in the ports of nearly every civilized nation equal treatment with that accorded to the vessels of the nation itself, and in return granted to foreign vessels in our ports the same treatment which we accord to American vessels. The negotiation of these treaties is doubtless the most splendid achievement of American diplomacy; it is surely one of the greatest boons ever conferred upon the mercantile marine of the world. The destructive effects of discriminating and retaliatory taxation of shipping upon all who resort to it had been forced home upon our early statesmen by the experience of the colonies and of the Confederation; and in freeing for all time American shipping, and with it the shipping of the world, from such warfare, they gave to navigation and to the international trade by which it lives an impetus equal in its way to that given by the substitution of steam for sail.

Enlisting a people predisposed to the sea, within easy reach of boundless forests permitting the building of vessels more economically than was possible in England, which was already compelled to import much of its ship-timber, and freed by diplomacy from foreign restrictions, the American merchant marine in 1860 had reached the impressive total of 5,353,868 tons, of which 2,379,396 tons were registered for foreign trade. The total tonnage of the United Kingdom was but 4,586,742 tons, and of the entire British empire, 5,710,968 tons, while the combined tonnage of France, the component parts of the present German empire, and Norway was less than the tonnage we were employing in foreign trade alone. The tonnage (including repeated voyages) of American vessels entering the United States from foreign ports during that year was 5,921,285, and of foreign vessels, 2,353,911 tons. The tonnage of American vessels entering and clearing at the ports of Great Britain and Ireland was 2,981,697 tons, against 3,227,591 tons German and French combined.

In 1850 the new tonnage built by the United States amounted to 272,218 tons, while that built by Great Britain amounted to only 133,695 tons. In 1860 our new tonnage was 214,798, and that of our foremost rival, 301,535 tons. Our relative positions had changed during the decade before the war. In 1855, the year of our greatest construction, the United States built 2027 vessels, of an aggregate tonnage of 583,450, of which 381 were full-rigged ships. By a steady and rapid decline, without equal in our marine history, the product of our yards in four years fell to 875 vessels, of 156,602 tons, in 1859, of which but 89 were full-rigged ships, rising in 1860, but only to 214,798 tons. The decline is not to be attributed to the substitution of steam for sail, for, as the home of Robert Fulton, this country in the early years of steam-navigation easily took and held the first rank. In 1860 our steam fleet aggregated 867,937 tons, of which 97,296 tons were registered, against a total steam tonnage of only 500,144 for the entire British empire. But the change from wood—the material of marine construction in which our new country abounded—to iron, in the cheap production of which Great Britain excelled, completely altered the conditions of shipbuilding, and thus changed the conditions of our own and competing merchant marines. The reasons for this change of material, as well as the changes in models which it necessitated, may be more appropriately considered under American Ship Building. Only the fact and its relation to our merchant marine are within the scope of this article. The fact became important because our laws restricted the American merchant marine to home-built ships. We stood by the principle that the privileges of the flag and of national register should be bestowed only on home-built ships. Great Britain and other nations had already abandoned that principle, or soon after gave it up. Her foreign and colonial relations, too, had impressed upon England the importance of established lines of steam-communication by sea, and forced upon her the policy of liberal assistance in the establishment and maintenance of such lines. Without insular or remote dependencies, and freed from foreign complications, the United States lacked the motive which made popular in Great Britain the policy of steamship subsidies; and we took it up and abandoned it intermittently, thus establishing an uncertainty in legislation which in business affairs is often industrially more harmful even than a wrong policy consistently pursued. The policies of admitting foreign-built vessels to the national register,—or "free ships," as it is popularly designated,—and of subsidies to shipping, may not be considered, under the restrictions placed on this article; but without transgressing proper bounds, it may be said that the two are not conflicting nor alternative policies, but independent methods of dealing with different subjects. The former aims to encourage navigation under the national flag; the latter to promote domestic ship building. All other nations have adopted one or both of these policies. Our own country has adopted and consistently followed neither. Our merchant marine, in consequence, has naturally yielded place on the seas to rival nations which hastened to adopt, and have steadily supported, legislation adjusted to the changed conditions of construction wrought by the substitution of steel for wood as the chief material of ship building.

Eastward for 3000 miles from our shores stretched the Atlantic, barren, but familiar in its dangers and rewards, and as naturally the home of the ambitious American as of the ambitious English boy, as naturally the place for the investment of American as of British capital. For more than half a century it had been the scene of many of our enterprises. The discovery of gold in California in 1849; the beginning of our railroad system, which doubled in the decade from 1855 to 1865; the discovery of petroleum, carrying confusion to our whaling-fleets,—to name but a few of many causes,—at this time turned westward from the sea our enterprise and capital. The certainty of reward for labor and capital, and the amount to be hoped for, were greater there than the Atlantic or China trade could offer; and from a maritime power, pressing close upon Great Britain, the United States became a railroad power of the first magnitude. Other articles of this centennial volume, testifying to our wonderful inland growth, bear silent witness to one cause of the decline of which this article is required to speak.

From 1861 to 1865, the period of the Civil War, the American tonnage registered for the foreign trade fell from 2,540,020 tons to 1,504,575 tons; and within the four years immediately following the blockade of Southern ports by the Union fleets and the fitting out of Confederate privateers to destroy Northern merchantmen, 874,652 tons of American shipping were transferred to foreign flags. In September and October, 1862, the *Alabama* burned eighteen American merchantmen; and the damage then done to American vessels and cargoes by privateers fitted out in British ports was later compromised by the payment of $15,000,000 to us by Great Britain. In 1865 the tonnage (including repeated voyages) of American vessels entering the United States from foreign ports had decreased to 2,943,661 tons, while the foreign tonnage had increased to 3,216,967 tons. The war thus tremendously accelerated a decline of American shipping which from other causes was already inevitable.

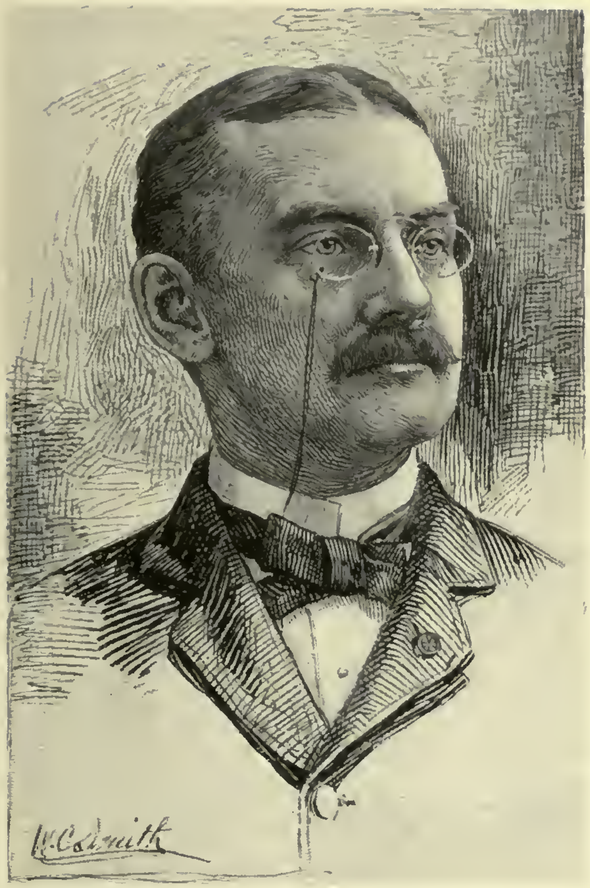
The carrying power of the world's sea-going merchant marine in 1875 was 28,407,946 tons; in 1895 it is 49,526,847 tons. The relative rank of the five principal sea powers at the beginning and end of this period follows:

MARITIME POWERS, 1875 TO 1895.

	1895.	1875.
British	27,885,806	13,347,583
German	4,065,282	1,604,773
American	3,261,982	4,196,463
Norwegian	2,343,173	1,495,958
French	2,121,550	1,558,290
All others	9,849,054	6,204,879
Total	49,526,847	28,407,946

During the last twenty years the United States and Germany have changed their relative ranks, and this year only seven per cent. of the world's sea-going tonnage is under the American flag, as compared with fifteen per cent. twenty years ago. The United States and Italy alone of the ten principal maritime nations show a decline in over-sea carrying power since 1875.

During the fiscal year 1894 the tonnage of American vessels (counting repeated voyages) entering the United States from foreign ports was 4,654,679 tons, while the foreign tonnage was 15,334,984 tons. The American tonnage entering from Europe was 341,876 tons; the foreign, 9,326,235 tons. Transatlantic voyages from the United States to Europe and Africa numbered 187 under the American flag, compared with 5626 under foreign flags; of transpacific voyages to Asia, Australia, and Oceanica, 311 were under the American and 351 under foreign



Eugene T. Chamberlain.

flags. Our shipping in foreign trade is now almost wholly engaged in voyages on the Lakes and northern borders to the British possessions, and to Central America, the Caribbean coast of South America, and the West Indies. The statistics given, and conclusions to be drawn from them, should be modified by one consideration, which, though not a matter of official record, is a well-understood business fact. Within the last fifteen years American capital has purchased abroad a considerable number of steamships, and American enterprise is operating them in transatlantic trade. Though barred by the law from the use of the flag, these vessels are the evidence of an awakened maritime spirit, promising the attainment of higher maritime rank by the nation. This awakened spirit has already secured the admission of the *Paris* and *New York* and the construction of the *St. Louis* and *St. Paul*, giving to the country a line of four steamships unsurpassed in the world. The United States, in consequence, for the first time in many years, have entered into competition for the express, passenger, and mail traffic of the north Atlantic. In one instance we have thus adopted the policy—free ships and liberal compensation to home-built ships for public services—by which our rivals on the sea have made themselves formidable. If that instance is sporadic, its full results are already in sight. But if it is the beginning of a new policy, approved by the experience of nations, we are entering our second mercantile century with the promise of a restored merchant marine.

More than fifty years must pass before the history of the first century of our merchant marine on the Pacific coast can be written. Beginning in 1849 at San Francisco with 722 tons sail, our Pacific fleet doubled its tonnage during the war period, and now numbers 1520 vessels, of 456,359 tons. San Francisco stands alone among our chief seaports as entering and clearing in foreign trade a larger tonnage of American than of foreign vessels; and with the opening of new Asiatic markets and the need of steadily increasing tonnage our geographical position destines us to be the sea power of the Pacific. The century's record of American shipping on the Atlantic coast has been a story of national pride, tempered with national regret and mortification; the record of our shipping on the Pacific is one of brief achievement and good promise. Splendid performance and bright augury, not only for the particular section itself, but for our national future as a maritime power, fill every year of the record of our merchant fleets on the Great Lakes. Two years after Jay's treaty the first small merchant vessel was built on the lakes west of Niagara, and when the first half-century was ended the tonnage of our lake ports was only 89,000 tons. On June 30, 1895, our lake fleets comprised 3342 vessels, of 1,241,459 tons, half in numbers and two thirds in tonnage being steam-vessels. This fleet in carrying power may be estimated at 2,666,261 tons. These figures mean that we have created on our inland seas a mercantile naval power excelled only by the strength of Great Britain or Germany on the high seas, greater than France or Norway, or than any other two maritime powers combined. Natural bonds, easily broken, fetter from free employment on the ocean our reserve powers as a ship-building and ship-owning nation, now confined to the Great Lakes. So eager to pass these barriers have these powers been that the lake interests have built steamships for the Pacific trade, cut them in two in order to pass the locks and canals which separated them from the Atlantic, and then put them together for the voyage round the Horn. Of our 669 steamships of over 1000 tons, 359 are shut within the lakes. Our production of iron and steel draws close upon, and in several years has surpassed, that of Great Britain. Freed by a ship-canal to the Atlantic, our lake ship-building interests—having close at their doors the center of production of sixty per cent. of our iron output—can compete on the high seas, and who could then doubt that interests which in confinement have outstripped the nations of the world, except two, will help to restore to the United States again the rank it held as close second to the entire British empire only thirty-five years ago? Join the union of the Great Lakes to the Atlantic with a removal of the narrow Central American barrier which separates the Atlantic and Pacific, and, as steel in time becomes cheaper here than anywhere in the world, may we not look even to surpass in the first half of our second century the rank we attained in the first half of our first century, and take to ourselves the rule of the wave?

Eastward of the forty-four States of the Union for 3000 miles, westward for 5000, stretch the oceans as we begin our second century of commercial independence, a nation richer in performance and promise than any other the world knows. Geography, natural resources, and our benign policy of neutrality point to an ultimate destiny for this country as the world's great ocean carrier of the future.

Eugene Tyler Chamberlain

CHAPTER VII

OUR COMMERCIAL WEALTH AND VOLUME OF BUSINESS

NOT since the history of the world began has there been such a marvelous advancement of all factors creating wealth and developing trade and commerce as during the past century; nor in any other section has the result been so phenomenal as that attained in the United States. In 1795 this country had acquired but a fraction of its present geographical limits; to the West it reached only to the Mississippi River, and not until 1803, by the purchase of Louisiana, did its territory extend north and west to the Pacific and south to the Gulf of Mexico. In addition to the thirteen original States, Vermont and Kentucky had been admitted to the Union; but the populated area of the country was only 366,000 square miles, against 3,580,000 square miles to-day; and the total population was approximately 4,500,000, scattered along the Atlantic coast, the center being about the city of Baltimore; while to-day the population is about 70,000,000, or more than fifteen times as great, the center of population having moved almost directly west nearly 500 miles.

It is hardly necessary to explain that the commerce of the country in 1795 gave little promise of what it has since become. The only efficient means of transportation were, of course, by water, travel by land being a tedious process, in wagons or on horseback, over rough and unsatisfactory roads. It is self-evident that domestic trade at that time was of a primitive character, and any attempt to fully characterize it must fail except in so far as indicated by a comparison of imports and exports.

Leading domestic industries one hundred years ago included the manufacture of household and other (chiefly wool and hemp) textile products and rag carpets, pig and bar iron in a small way, wheelwrighting and smithing, lumber, carpentry, furniture, wagons, harness, hats, shoes, ships, and meat products, the whole probably not aggregating very many million dollars in value annually. A review of the total value of the annual products of these or like domestic industries in the census year 1890 presents a picture of unparalleled expansion, the value of the products in the nineteen lines indicated amounting five years ago to the enormous total of more than $4,107,000,000, in addition to which our metallic and mineral products in 1890 were valued at fully $587,000,000. It would be impracticable to indicate fully the thousand and one kindred industries to which some of those identified with the earlier history of our country have given rise. And no reader of these pages need be reminded of the enormous stimulus to the production of wealth resulting from the railroad, which is only about sixty years old, from the discovery of petroleum or mineral oil, the manufacture of illuminating gas, and the production and development of electrical motors and appliances.

The total value of foreign shipments from the United States in 1795 was about $47,989,000, which, while small when viewed from the standpoint of to-day, meant a great deal at the time, in that it represented an increase of 150 per cent. over the total four years previous. The exports were mainly to France and her possessions, the free cities of Hamburg and Bremen, Great Britain and her dependencies, Spain and her possessions, the United Netherlands, the Danish West Indies, Italy, China, and the East Indies. Traffic with Russia was of some importance, but with the other countries of northern Europe it was inconsiderable.

A fair estimate of the character of our export trade at that time may be gained from a report of the Secretary of the Treasury in 1793, covering the year 1792, which enumerates, among the leading articles of foreign shipment, breadstuffs, tobacco, rice, wood, salted fish, pot and pearl ash, salted meats, indigo, horses, mules, whale-oil, flaxseed, tar, pitch, and turpentine, breadstuffs constituting more than one third of the whole. South Carolina and

Georgia were prominent as producers and shippers of indigo, but that was before cotton had become a noteworthy product. It had been grown and exported as early as 1791, but only in small quantities; the cotton-gin, invented by Eli Whitney, did not appear until two years later. In his celebrated report on Manufactures, Secretary Hamilton, though expressing the hope of a future of usefulness for the cotton industry, yet said that, "not being, like hemp, an universal production of the country, it afforded less assurance of an adequate internal supply;" and he devoted some space to the advocacy of the repeal of the duty on imported cotton, as well as of granting a bounty on cotton produced in the United States, when wrought at a home manufactory. In a comparatively few years, however, all this had changed, and American cotton had become a factor of the first importance in the commerce of the world.

At the period under consideration the import exceeded the export trade in value. Imports for the year 1795 were valued at $69,756,258. Of this total, $30,972,215 came from Great Britain and her possessions, England furnishing $21,108,350. Next in importance was France and her possessions, of which contributions the French West Indies supplied the greater share. Following these came in order Spain and her possessions, the United Netherlands and their possessions, the Danish West Indies, Portugal and her possessions, Hamburg and Bremen, Russia, China, and the East Indies. The importations from Great Britain comprised manufactures of wool, cotton, linen, silk, metal, glass, and paper, together with salt, steel, lead, nails, cheese, beer, and porter; those from the East Indies included cotton, sugar, and pepper; from the West Indies, spirits, sugar, and coffee; and from other countries, coffee, sugar, molasses, brandy, gin, wines, and tea.

Although the total value of exports from the United States one hundred years ago was $47,989,472, by 1844 (fifty years later) it had grown to $105,745,832—more than doubled. It was during this period, of course, that highways were constructed between some of the larger trading centers, that the Erie Canal was built, and that the country reached a high degree of prosperity as a commercial nation. It was obliged to wait for the development of its agricultural resources and its shipping interests on the New England, south Atlantic, and Gulf coasts. The total value of importations in 1795 was $67,756,258, and fifty years later (in 1844) it had grown to $102,604,606, an increase of more than fifty per cent.

While to no nation has been given a preëminent manufacturing genius, yet we have probably developed peculiar skill not only in improving upon inventions which came to us in the rough, but also in the more general utilization of them upon a much grander scale. At the outbreak of our late Civil War the total value of exports had increased to $333,576,057, about seven times the value sent abroad in 1795. The aggregate value of importations in 1860 was $353,616,119, being five times the corresponding total in 1795.

In 1877, at the beginning of the revival after the period of depression following the panic of 1873 (which was the outcome of inflation, overtrading, and speculation succeeding the war), exportations for the year were valued at $602,475,220, or about twice the like total in 1860, and nearly twelve times the value of shipments abroad in 1795. Importations in 1877 were valued at $451,323,126, an increase of forty per cent. over the total in 1860, and nearly seven times the aggregate value in 1795. From 1877 a rapid expansion in the volume of our domestic and foreign trade took place, not only in exportations of cereal and other domestic products, but owing to the extension of our railroad system and the diversification and development of our manufacturing industries. Over-speculation in financial circles brought on the panic of 1884, which was followed by a reaction in business, and after that came a wide expansion of trade in 1890, 1891, and 1892, followed by the panic of two years ago.

In the fiscal year 1894, one hundred years after, the total value of exports amounted to $1,019,572,873, forty per cent. more than in 1877, three times the value of shipments abroad in 1860, and more than twenty-one times the total value of our exports in 1795. The aggregate value of importations into the United States in 1894 was $740,730,822, an increase of sixty per cent. as compared with 1877, more than double the corresponding total in 1860, and eleven times the total value of importations in 1795.

An indication of the grand total value of the interior and exterior commerce of the United States must be an approximation only, owing to the dearth of statistics. One hundred years ago the total value of imports and exports amounted to only $117,745,730, but in 1894 like totals aggregated $1,760,203,695, or fifteen times as much. While there are not the necessary data to indicate closely the total volume of our domestic trade at the close of the last century, there is, of course, much, although incomplete, information bearing upon the interior traffic of the United States to-day.

Any general estimate of the wealth of the country at the close of the last century is, of course, deficient when contrasted with census reports on that subject during the past forty years. The total, $620,000,000, is the appraisement of the value of houses and lands one hundred years ago, and must, of course, overlook much personal property of value, particularly in that it does not take account of the value of slaves. But even if one should presume that, with all allowances for this and other omitted items, the grand total was as much as $900,000,000, the contrast with the total wealth of the country in 1850, after half a century of growth, was startling indeed, showing an increase of nearly eightfold.

By 1860 we had more than doubled the material resources of 1850. The ratio of gain from 1795 to 1860 (when the total was $16,157,000,000), was still more remarkable, showing more than sixteen times the total at the close of the last century. From 1860 onward the increase of national wealth was so rapid that comparisons with the beginning of the century become fairly amazing. The increase by 1870 was nearly twenty-seven to one, in 1880 nearly forty-nine to one, and in 1890, less than a century having elapsed, the total wealth of the country was nearly seventy-five times that in 1795, the census placing it at $65,037,000,000.

When it comes to the development of our transportation interests by land and water, the record of expansion of our railroad traffic within sixty years is seen to surpass that of the remainder of the civilized world, with 178,000 miles of main line of railways, $5,075,000,000 of capital stock, $5,665,000,000 of funded indebtedness, $1,080,000,000 of gross annual earnings, and net traffic earnings of $322,000,000 per annum, the railways having transported about 675,000,000 tons of freight alone in 1894. Our marine transportation interests, notwithstanding the check since the Civil War, present a total of 25,540 craft registered at United States interior cities and ports, sailing from the Pacific, Gulf, and Atlantic coasts, on the Mississippi, Ohio, and Monongahela rivers, and on the Great Lakes, valued at $215,000,000. Freight transportation on the Mississippi, Ohio, and Monongahela rivers in 1894 did not vary much from 22,000,000 tons, or a little more than half that estimated to have been carried on the Great Lakes, where the total was about 40,000,000 tons. On the Erie and tributary canals the total tonnage last year probably amounted to about one tenth that on the Great Lakes, or 4,000,000 tons, which would leave probably not to exceed 125,000,000 tons of freight carried seaward per annum in vessels registered at the United States ports. This indicates that the total freight tonnage transported by water on the Mississippi, Ohio, and Monongahela rivers, on the Great Lakes and the Erie Canal, and seaward on vessels registered at United States ports, is less than one third the weight of freight transported by the railways of the country each year.

Another evidence of the rapidity of the growth of the wealth of the country is conveyed in the fact that, whereas the government receipts in 1795 amounted to only $9,419,802, last year they aggregated $313,310,166, more than thirty-four times as much; and while the expenditures of the government in 1795 amounted to $10,435,070, last year they were more than thirty-five times as much—$356,135,215. On the other side, there was a public debt of $80,747,587 one hundred years ago (a dozen or more years after the close of the Revolutionary War), while on December 1, 1895, the net national debt was not quite fourteen times as large, amounting to only $1,125,883,997. The significance of this exhibit lies in the fact that notwithstanding the enormous expense involved in four years of Civil War—three decades ago; notwithstanding the consequent check to commercial and industrial enterprise in those and in succeeding years of rehabilitation, yet so great were our powers of recuperation, and so remarkable was the ability of the nation to liquidate its enormous war debt, that we find ourselves to-day with a national debt of only $16 per capita, as contrasted with one of $18 per capita one hundred years ago—a dozen years after the close of the War of the Revolution. These facts in reference to the relative national indebtedness, at once interesting as well as instructive, gather significance when viewed in conjunction with best obtainable data respecting the wealth of the country one hundred years ago and to-day. The strength of our position may be expressed in the statement that whereas our national debt amounted to $18 per capita at the close of the last century, and our national wealth approximately to $200 per capita—to-day the national debt is only $16 per capita, and the wealth per individual somewhat more than $1000. The postal service, of modest proportions in 1795, had already begun to show remarkable growth, for from the time the Constitution went into effect the number of post-offices had grown from 75 to 453. At this time there are more than 70,000 post-offices in the country, and the revenue and expenses have increased in almost as great a ratio.

Charles F. Clark.

Recognizing the many and diverse elements involved in any discussion of the volume of domestic trade, it remains to be pointed out that the total amount of gross earnings of railroads in the United States in 1894 amounted to $1,080,305,000, or $61,000,000 more than the total volume of our exports of produce, coin, and bullion for that year, and more than twice the volume of gross railway earnings in 1877, seventeen years ago.

The foregoing outline of some of the more important elements involved in any consideration of the development of the commerce and the wealth of the United States during the past century must forever stand out conspicuously, as indicating a rapidity and withal a conservatism of growth on the part of a new empire the like of which the world has never seen.

Perhaps as fair an indication, within limitations, of our total volume of wholesale business, foreign and domestic, is that given by totals of transactions at clearing-house banks—about 1000 in number—at nearly eighty of the more important cities. During 1894 the grand total of bank clearings aggregated nearly $45,000,000,000, although the corresponding total two years before amounted to nearly $62,000,000,000, the largest annual aggregate reported since clearing-house totals have been collected. These transactions represent, for the most part, wholesale dealings at nearly all the larger towns and cities throughout the country, and, to a smaller extent, retail transactions in that portion of the business of the country which are settled with checks.

It would not be so bold a stroke as it might appear to estimate the probable approximate grand total of business transacted annually, not only through the banks, but across counters, both wholesale and retail. The average total of bank clearings annually during the past five years has been about $55,000,000,000, or thirty-two times the total value of our exports and imports, including coin and bullion, in the fiscal year 1894. This indicates in some degree the enormous preponderance in the value of our total commercial and industrial transactions, as compared with that portion carried on with foreign countries. It would be difficult to conceive of the total value of all our domestic and foreign commerce (judged by bank-clearing totals and other available data) as averaging less than $70,000,000,000 annually, and probably a larger sum would be required to gauge it.

Perhaps as striking an indication of the enormous expansion of wealth and business in the United States within one hundred years as any other is found in the statement that whereas the approximate total banking capital of the country in 1795 was about $12,000,000, the total capital of national and other banks two years ago, as reported by the comptroller of the currency, amounted to $1,067,000,000, in addition to which there were reported belonging to the banks $686,000,000 of surpluses and profits. From this it would appear that whereas the total available banking capital of the country one hundred years ago was only about $2.65 per capita, the proportion per capita two years ago was only about six times as much. Yet the banking capital of the country two years ago was about eighty-nine times the amount in 1795. It may strike many as remarkable that, whereas the population has increased fifteen-fold, the volume of business probably thirty-three times, and the wealth of the country more than seventy-five times within the last one hundred years the total banking capital is, in round numbers, only about six times as much per capita to-day as at the close of the last century. The lesson taught by this is most timely in this day of excessive and frequently unnecessary fears that the volume of the currency of the country will not be maintained at the maximum. The development of the clearing-house principle in business, the systematic organization and wide-spread distribution of credits of merchants and manufacturers, together with the enormously increased use of checks, drafts, and bills of exchange,—representatives of credit,—are practically responsible for the ability of the banks to do the enormous business of the country on only six times the banking capital per capita they possessed one hundred years ago.

With the tenfold increase in populated area of the country our population is fifteen times as large as it was at the close of the last century, while the increasing complexity of governmental administration has increased total receipts from customs and internal revenue thirty-four times and expenses thirty-five times what they were in 1795. It may be no more than a coincidence, but it is certainly noteworthy that an increase of 1500 per cent. in population has brought with it almost the same increase in the total annual volume of exports and imports. The fact that total gross railway earnings have doubled in seventeen years is far less significant than that they are in excess of the total volume of our exports of merchandise, produce, coin, and bullion. But of even greater interest is the fact that the annual volume of bank clearings at about eighty cities throughout the United States indicates a grand total of domestic and foreign trade probably forty times greater than the total value of exports and of imports. There remains only to be recalled the increase of our interior commerce to thirty-eight times the volume of our business with foreign countries, over and above which is the picture of the total wealth of the country—nearly seventy-five times what it was at the beginning of the century.

In thus concluding a hurried and necessarily brief review of some of the more salient features of the development of the wealth, trade, and manufacturing industries of the United States, the suggestion is almost involuntary that there still remains, in spite of much that has been accomplished in recording our material advancement, an opportunity for perfecting and supplying systems by which records may be kept of various spheres of activity. It is a matter of regret that more definite information is not obtainable respecting what should go to make up an accurate estimate of the total volume of the trade of the country. It is highly probable that estimates and calculations presented herewith get as close to the fact as practicable, yet much might be done were statistics affecting trading, transportation, and banking compiled and prepared with the system and comprehensiveness which mark reports of the Census Department on manufacturing industries of the country.

Charles F. Clark

CHAPTER VIII

THE CORPORATION IN COMMERCE

THE word "corporation" is comprehensive. Every nation, every State, every city, town, and village, is a corporation. Every parish and every similar church society is a corporation, and so are most of our colleges and institutions of learning. The history of such corporations during the last hundred years, interwoven as it is with our national development, would fill volumes; but in this article the writer must confine himself to some remarks upon the corporation with which we are familiar in business—the ordinary joint-stock corporation, operated for the profit of the shareholders. The part played by such corporations in the history of the last century of American commerce is a conspicuous one, and a concise historical sketch of this important form of business organization, giving a brief glimpse at its remarkable growth, together with some reflections as to its influence upon the business community and the country at large, should be of interest.

In 1795 business corporations in America were small in number and insignificant as to wealth. There were, to be sure, several banks, a number of insurance companies, a few turnpike companies, some stage-coach companies, and some manufacturing corporations. The bulk of the business of the country was conducted, however, by individual traders or by partnership concerns. With the growth of trade and the increase in commercial activity of all sorts the organization of corporations was speedily resorted to as offering many advantages over the old-fashioned partnership. Among those advantages is the opportunity afforded to all to embark such part of their property as they may choose in enterprises, whatever they may be, without incurring the liability of general partners; in other words, a man can invest such sum as he is willing to lose in the business, with the certainty that he cannot be compelled to pay anything beyond that amount toward the debts of the concern. Then, again, a shareholder in a corporation has his affairs managed for him by salaried officers, without care or responsibility on his part.

At first, in order to organize a corporation, legislative action was required in every case. This in earlier times answered very well; but this power was abused, and by and by it was found necessary to limit the power of the various State legislatures in this respect. Corporations are, in the eye of the law, persons,—artificial persons,—and it was found that a person of this description, having no body to be imprisoned nor soul to be eternally punished, was hard to control; so the legislatures from time to time passed general laws regulating the formation and management of corporations, endeavoring in this way to restrict them as to power, and to force them to confine themselves each to its own particular business. Efforts have been made from time to time by the State legislatures to enact a systematic code regulating all corporations, with more or less success; so now we have in many States a general law for banking corporations, another for insurance companies, another for trust companies, another for railroads, and there are still others. Recently, also, following the example of the English Parliament, many of the States have enacted laws under which corporations may be organized to carry on any legitimate business, no matter what, not already provided for by general statutes.

There can be no question that corporate organization has been of great advantage to the country—to the poor as well as to the rich. By greater economy in production, rendered possible by concentration of capital, the poor have profited in the reduced price of most of the necessaries and comforts of life. The reduction in the prices of these articles is a most interesting subject for study and reflection, and if space permitted it would be easy to give numerous illustrations. Indeed, it would be hard to find any considerable number of articles, commonly called comforts or necessaries, the price of which has not been reduced by the direct influence of corporate management. The comfort and convenience of all dwellers in this country have been greatly promoted by corporate control of business. Take, for instance, our facilities for traveling. Again, the regularity and cheapness of communication by mail, telegraph, and telephone have only been made possible by the coöperation of hundreds of corporations all working together in intelligent harmony. Again, what could we now do without banks, and without insurance companies? We owe it to the corporations that we can protect our property against loss by fire, and our families from want in the case of the death of their breadwinner; and to the savings-banks that we can safely keep our surplus earnings, and receive them back again, safe and intact, with reasonable interest. And so we may sum it all up in one word and say that the conditions of modern life would be impossible were it not for the corporations. Whether sleeping or waking, engaged in business or pleasure, eating, drinking, dressing, or traveling, or whatever we may be about, we must thank them to a great extent for the means and opportunity of doing so.

The reduction in the price of articles of general consumption, to which reference has been made, is due, in the writer's opinion, to two causes which in their operation would at first glance seem calculated to produce contrary results, but which, in fact, both tend to the same end. These two causes are competition and consolidation. It is easy to see how competition between two or more concerns engaged in the production of an article would tend to lower its price until a point should be reached when but a narrow margin of profit would remain. The consolidation, on the other hand, of all the competing concerns engaged in the same business would seem to tend to an advance in the price of the commodity produced. This would doubtless be the case at first. But experience has shown that there is more money in selling a large quantity at a small profit than in selling a small quantity at a large profit, and the application of this principle results, as has been said above, in the ultimate reduction of the price. A most notable instance of this truth is to be found in the enormous reduction of the price of kerosene-oil since the consolidation into one company of the various corporations engaged in its production.

How great have been the advantages to our commerce and our country's development from corporate organization no one can say. Have these advantages been to some extent counterbalanced by certain evils? The concentration of wealth in the hands of corporations has had the effect of driving the individual producer out of business. In the early days of our country's existence many industries were carried on in the towns and villages by skilled workmen who were their own masters, and who were in business for themselves. Tailors, shoemakers, weavers, blacksmiths, tinsmiths, saddlers, and many other manufacturers on a small scale carried on their business for their own account, and were a useful, self-reliant, and manly element in our population. These industries are now to a great extent monopolized by large corporations, and the men who were formerly independent in their business are now represented by salaried workmen. The gradual extinction of this class of men of moderate means who carried on their business for their own account seems to be a distinct loss to the community.

In the earlier days of the history of this country our foreign commerce was entirely, or almost entirely, in the hands of individual traders and private partnerships. The vessels by means of which the trade was carried on were owned by individuals, the ownership of a vessel being divided sometimes among a number of persons, the captain in many cases being a part owner. The cargo of the vessel, on its arrival at its port of destination, was disposed of by the captain or by a supercargo for the benefit of the owners, and the proceeds invested at his discretion in the return cargo. This method of doing business afforded a good field for the exercise of individual skill, and the profits made by those engaged in it were far in excess of anything that can be realized by traders of the present day. The submarine cables going to all parts of the world, owned by corporations, have entirely revolutionized our foreign trade. Our individual ship owners have nearly all retired from the business, and the carrying trade of the country is done by steam-vessels owned by corporations, and, sad to say, nearly all of them are owned by foreign capitalists and manned by foreign sailors. No doubt the greatest good of the greatest number is promoted by the operation of great industries in corporate hands. The cost of living is reduced; but the disappearance from the ocean of American ships commanded by American skippers and manned by American sailors is a distinct misfortune. Whether this disappearance can fairly be traced, altogether or in part, to the influence of corporate organizations is a question which can never be answered. It is perhaps partly due to this cause and partly to other causes, just as the concen-

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tration of business above referred to in the hands of large corporations and wealthy people is partly due to corporate organizations and partly to the improvements in methods and machinery introduced by the inventive genius of modern times.

Another evil growing out of the great development of corporate control of business is a lowering of the standard of business honor and business morality. The administration of the affairs of corporations of our country by their directors has in many instances been unfair to the stockholders, and to a corresponding extent advantageous to the directors. It cannot be denied that many large fortunes have been made by men who availed themselves of the knowledge acquired by them as directors of the affairs of corporations to buy and sell the shares for their own profit. Many a director in a corporation would consider it preposterous to be told that he had no right to trade in the stock of his corporation, and yet the director is to all intents and purposes a trustee for the stockholders, and ought not, any more than any other trustee, to trade in the trust estate. More than this, it has not been at all uncommon for directors to engage in transactions with their own company, the result of which has been greatly to their own advantage. How many railroad companies have been wrecked by being saddled with worthless lines with which they have been consolidated? Many other instances might be cited where directors, under form of law, have bled the corporations for which they were acting. The directorate, for instance, of some great corporate interest, rightfully active within a certain field, leases in the form of privileges certain of its functions to outside corporations, in the success of which its members are concerned. Valuable concessions, involving thousands of annual revenue, are granted for the most nominal considerations, and the tributary companies wax rich and pay large dividends, while the great corporation whose revenues are thus diverted from its stockholders pays none at all, and its only beneficiaries are found among the directors, who have thus misused their power for their own ends.

Vast sums of money, American and foreign capital, have been invested in enterprises in this country under corporate control. A great deal of this money has been lost to the investor forever. Some of it has gone because the project in its inception was ill considered, and the blame must rest upon the poor judgment of the investor; but too many schemes have been floated by corporations conceived in fraud, through which confiding investors have been fleeced. A common form of swindle is an issue of bonds secured upon nothing but a franchise that has cost the corporation nothing. A fraction of the proceeds may be used in construction; the balance may be, and often has been, distributed among the promoters. An allusion to this form of corporate dishonesty is all that space admits of; were it not so, it would be instructive to refer here at some length to the common device of dishonest directors who contract with so-called construction companies in which they are themselves the shareholders, thereby reaping a dishonest profit.

The power of corporate organization has been invoked to work great hardship and wrong in many cases to the towns and cities throughout the country. Franchises of enormous value—especially the right to use the streets for elevated and surface roads—have been obtained for a most inadequate consideration. This abuse of power by corporations has been demoralizing in its tendency and mischievous in its results. It is impossible to compare our great cities with those of Europe without feeling that ours have been vulgarized, degraded, and rendered hideous by the appropriation of their principal streets by private corporations for private greed. It is idle to say that public convenience requires that hideous structures like the elevated railroad should exist, or that cable-cars should be run on the surface of our principal thoroughfares. It is not so. It is not so in any other civilized country on earth, and would not be tolerated in any other civilized country. Perhaps we are not so highly civilized as we think we are.

The corporation is a tremendous power with us, both for good and evil. It is probable that as time goes on its powers will increase rather than diminish. By its means cheaper living, more comfort, and greater luxury will be brought within the reach of us all. Let us hope that a higher plane of business honor may be reached in the management of our corporations.

William Jay

CHAPTER IX

COMMERCIAL ORGANIZATIONS

IN the early part of the present century the commercial organizations then existing which had any material influence upon the home and foreign commerce of the nations of the earth were exceedingly limited in number. Indeed it is doubtful if at that period there were more than fourteen, viz., three in Great Britain, seven in France, and four in the United States. All of these, save two notable exceptions,—the Board of Trade of England and the Council General of Commerce of Paris,—were largely synonymous in their vocations and operations.

In France Chambers of Commerce had been instituted at a very early date—notably at Marseilles, at the close of the fourteenth or the beginning of the fifteenth century; at Dunkirk, in 1700; at Paris, in the same year; at Lyons, in 1702; at Rouen and Toulouse, in 1703; at Montpellier, in 1704; and at Bordeaux, in 1705. While England had her Board of Trade as early as 1660, it was not until 1786 that the present department was established in Council, being a permanent committee of the Privy Council for the consideration of all matters relating to trade and the colonies, with functions partly ministerial and partly judicial. Of Chambers of Commerce, Great Britain then had but two: that of Glasgow, instituted in 1783, and of Edinburgh, founded in 1785, and incorporated by royal charter in 1786.

In the United States the oldest existing Chamber of Commerce is that of New York, organized in 1768, and incorporated by royal charter in 1770. Shortly afterward a second was established at New Haven, Conn.; another at Charleston, S. C., about 1775; and that in Philadelphia in 1802. It is true that New York about this time had also a Board of Brokers, organized about 1792 or 1793, and had erected the Tontine Coffee-House, where merchants and others met and discussed mercantile and semi-commercial questions.

The Chamber of Commerce of New York is in some respects not only the forerunner but the type of many like institutions which have been organized in our leading cities, representing, both locally and otherwise, our multiplying and diversified industrial interests. In some instances, however, it essentially differs from other kindred institutions, since, while caring for local welfare, it is also broadly national in its sympathies and work. In this connection it may be interesting to trace back this time-honored organization to the names of the old and respected merchants who founded it. They were: John Cruger, Elias Desbrosses, James Jauncey, Jacob Walton, Robert Murray, Hugh Wallace, George Folliot, William Walton, Samuel Verplanck, Theophylact Bache, Thomas White, Miles Sherbrook, Walter Franklin, Robert Ross Waddell, Acheson Thompson, Lawrence Kortwright, Thomas Randal, William McAdam, Isaac Low, Anthony Van Dam, John Alsop, Philip Livingston, Henry White, and James McEvers. It also may not be out of place to reproduce the original terms used in its formal organization, reciting its usefulness as follows: "WHEREAS, Mercantile societies have been found very useful in trading cities for promoting and encouraging commerce, supporting industry, adjusting disputes relative to trade and navigation, and procuring such laws and regulations as may be found necessary for the benefit of trades in general. . . ."

Of the history and character of the persons who are here recorded as the original founders of this Chamber the memories of the present generation will not be wholly oblivious. The first public place of meeting of the original Chamber was at the house, now standing, on the corner of Pearl and Broad streets. This building had been originally erected as a town residence, and had undergone many alterations in size and form. During the period of Washington's first residence in this city it was chiefly remarkable as being a public tavern, where in later days Washington was entertained and took his farewell of the officers of the army on his departure for his home in Virginia at the close of the Revolutionary War. The subsequent meetings of the Chamber were held, first, in 1769, in the "great room of the building commonly called the 'Exchange,' at the lower end of the street called Broad"; afterward, in 1779, at the Merchants' Coffee-House, on the southeast corner of Wall and Water streets; in 1817 at the Tontine Coffee-House, on the northwest corner of Wall and Water streets; in 1827 in the original Merchants' Exchange (in a room specially set apart for the purpose), until that building was destroyed by fire in 1835; then for a time in the directors' room of the Merchants' Bank on Wall Street; then in premises on the corner of William and Cedar streets, where the Chamber remained for many years prior to its final removal to its present commodious quarters on Nassau Street.

At the close of the Revolution the legislature of New York passed an act (on the 13th of April, 1784) "to remove doubts concerning the corporation of the Chamber of Commerce, and to confirm the rights and privileges thereof." Under this act the title was changed from the "Chamber of Commerce" to the "Chamber of Commerce of the State of New York." From the earlier days down to the present period the membership has been principally confined to citizens engaged in finance and commerce, although at different times our records show that public officers of the highest rank, including presidents, governors, Senators, Congressmen, foreign ministers, and members of the State legislature, have been either honorary or regular members of the Chamber of Commerce. In the earlier steps taken, almost a century ago, to form a code of commercial laws and regulations, the most prominent merchants of that era determined and bound themselves reciprocally to prevent "the scandalous practice of smuggling." Within two years after the evacuation of the city of New York by the British a strong effort was made in the new State legislature to adopt a plan for issuing paper money, to be made by law a legal tender in the transaction of business. A memorial was adopted by the Chamber, setting forth in the most forcible terms the evils and immorality of such an issue, and through its influence the proposed measure was defeated. It may be safely alleged that to the good sense and active management of the Chamber may be attributed the policy which the general government adopted at this period of peril, whereby the credit of the nation was maintained. At an early period in the active movements of the Chamber, in January, 1786, a resolution was considered asking the assistance of the legislature of New York for the creation of a fund to connect the city of New York by artificial navigation with the lakes. This action clearly connects the sentiments of the Chamber of that early day with the great purpose of Governor Clinton for the construction of the Erie Canal. A few years later we find the Chamber entertaining the project for the construction of a ship-canal around Niagara Falls, and a railroad from Lake Erie to the Hudson River.

The question of tribunals of commerce was also considered at several periods of its history; but the legislature was not friendly to this new departure in commercial jurisprudence until 1874, when an act was passed establishing a court of arbitration, to be presided over by a judge appointed by the governor; and this court continues to this day. Another highly important subject had from time to time occupied the attention of the Chamber, that of the pilot laws of New York and New Jersey, resulting in the present excellent system. At the annual meeting in 1848 the Chamber took formal measures to assist in organizing a savings bank for the benefit of "merchants' clerks and others"; and a charter was granted by the legislature as the result of this thoughtful action, and since then this institution has grown to be one of the most successful of similar organizations in the country. In 1849 the Chamber was interested in Whitney's project for the construction of a Pacific railroad across the continent, and a report favoring its construction was unanimously adopted and forwarded to Congress. It was also instrumental in getting the United States government to remove the sunken rocks from the channel of the East River and to widen the passage through Hell Gate. In 1852 the Chamber took active measures in regard to the reciprocity agreement with the North American provinces for the free interchange of the natural productions of the respective countries, embracing also a full and joint participation in the fisheries and the free navigation of the river St. Lawrence. It also repeatedly declared its sentiments on the subject of privateering, and has at all times maintained its inviolable determination to adhere rigidly to the principles avowed by the government of the United States.

The treaty negotiated with Japan by Commodore Perry, in behalf of the United States, opened up a new pathway to commerce with an almost unknown nation, and the Chamber took a prominent part in giving signal testimony of its appreciation of that officer's conduct in a graceful gift of a silver service of plate. At a special meeting of the Chamber, held the 21st of August, 1858, the successful result of the united efforts of the English and American nations to lay the first Atlantic telegraph-cable to connect the continent of the Old World with the New was announced, and the sum of $10,000 was appropriated and applied to the presentation of gold medals to the prominent officers engaged in carrying out the enterprise. At the meeting of the Chamber, September 6, 1860, the following resolution was adopted: "*Resolved*, That in the judgment of this Chamber an urgent necessity exists for the establishment, at an early day, of mail facilities between the cities of San Francisco in California and Shanghai in China, with connections at such intermediate ports as the interests of commerce may indicate." It seems hardly necessary to add that the above is the germ from which has sprung the magnificent line of American steamships which traverses the Pacific Ocean to-day.

A remarkable epoch in the affairs of this country, and one especially affecting all its business interests, occurred shortly after this period. The Southern States of the Union had united in revolt against the government, and the President had issued his proclamation calling for military aid. The Chamber responded to this appeal by holding a large and enthusiastic meeting on April 19, 1861, at which an ample sum of money was raised to forward at once for the defense of the national capital two regiments of the State National Guard, and also to organize several additional regiments of volunteers, who left shortly afterward for the seat of war. At this meeting attention was called to the fact that a part of the advertised loan of the government remained untaken. A special committee was appointed, and the balance, amounting to $8,000,000, was at once subscribed, and the Treasury Department notified that the same could be drawn for at once. The great mass-meeting at Union Square—now a matter of history—and the Union Defense Committee were the outcome of the action of the Chamber. The valuable aid rendered to the government by this committee, composed, as it was, mainly of merchants and bankers of New York, was frequently acknowledged by the highest military authorities, and sixty-six regiments were equipped and fitted for service and forwarded in the early stages of the war, as standing evidences of its loyalty and efficiency.

At a special meeting of the Chamber held on May 15, 1872, "to give expression to the views of the Chamber on the Treaty of Washington (resulting in the Geneva award arbitration), and to urge the ratification by the Senate of an additional article thereto, as proposed by Minister Schenck," the following preamble and resolutions were adopted:

"WHEREAS, The Treaty of Washington, referring the differences between this country and Great Britain to arbitration, has justly been regarded as a measure of great importance to the interests of civilization and peace, and the honor of proposing it belongs to this country; and

"WHEREAS, Differences of opinion have arisen between the governments of the two countries respecting the proper construction of the treaty in regard to the claims for indirect damages, and a supplemental article for settlement of those differences has been proposed by the government of Great Britain, and by the President laid before the Senate for its advice, which article appears to this Chamber to be sound in principle, binding the two governments to the adoption of a beneficent rule for the future, and especially beneficial to the United States and its commerce; and

"WHEREAS, The failure of the treaty would be a great public calamity; therefore

"*Resolved*, That this Chamber, without meaning thereby to imply that our government has at all erred in its construction of the treaty, and believing that the supplemental article is more than an equivalent for the claims of our government as originally presented, and feeling the importance of removing all obstacles in the way of the execution of the treaty, earnestly recommends the adoption of the supplemental article, and prays the Senate to ratify it."

As the Senate was "hanging fire" in regard to the ratification of this treaty, and war between the two countries was apparently imminent, the action of the Chamber in this matter was not only timely and praiseworthy, but also wise, patriotic, and influential, as the sequel showed.

Thus it will be seen that to outline the history and operations of the New York Chamber of Commerce is largely to portray the political, commercial, industrial, and financial development of the country; for really no great politico-economic question has arisen in the United States from the War of 1812–15 to the present time in which it has not been vitally and patriotically interested. The foregoing are, however, but few of the services which it has so signally performed. It has been concerned in nearly everything which related to the commercial welfare and prosperity not only of the city and

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State of New York, but also of the country at large, of which it is in a measure the commercial guardian.

The class of people who possessed the most means and experience before and immediately after the Revolution were the merchants and ship owners, and they were the first to perceive the advantages and value of mercantile or commercial organizations, which, as already outlined, they perfected in New York, New Haven, Charleston, and Philadelphia. These commercial bodies were the initial organizations of the kind in America. Their foundations were broad and deep, and each in its way and time performed substantial service for the public good, both local and general. The Chamber of Commerce of Baltimore, instituted in the early decades of the century, but subsequently reorganized as the Board of Trade, still continues its usefulness. The Merchants' Exchanges of New York and Philadelphia, which were founded at an earlier date, have passed away, probably from having been too heavily handicapped at first with expensive buildings and inadequate revenues.

Succeeding the War of 1812–15, and later, other Chambers of Commerce, Exchanges, and Boards of Trade were organized in various cities of the Union, which also have done much toward developing the industries, trade, and traffic of their localities, as well as taking more or less active part in promoting the general commercial welfare of the country. But the commercial associations which are the most numerous, and withal the strongest, are those founded by people who deal in like things in towns or cities which are to some extent centers of particular callings, such as cotton in New Orleans, leather or wool in Boston, iron in Philadelphia, crockery in Trenton, paper in Holyoke, or print cloths in Fall River or Providence. Among the earliest of the general Boards of Trade which still retain their vitality, and form an important element in the town or city in which they are located, is the Chicago Board of Trade, which came into existence on March 13, 1848, but did not begin business until May 2, 1850. From the beginning it has been an important center for grain, animal-food products, and lumber. Similar boards were established in Detroit, Milwaukee, Cincinnati, St. Louis, Toledo, Minneapolis, and other Western cities. That in St. Louis is also an important center for the cotton trade. Smaller organizations exist in towns numbering less than 10,000 inhabitants, and have proved valuable adjuncts by the infusion of greater local pride and energy among their citizens.

Next to the New York Chamber of Commerce is the Associated Board of Trade of Boston. This is probably the best representative body among strictly business associations in this country. Founded on a new idea or plan, it has so demonstrated, during the few years of its existence, its great practicability and usefulness as to become the exemplar of the newer Boards of Trade throughout the country. The Boston Associated Board of Trade is not a promiscuous grouping of business men coming together as individuals, but is made up of delegates from the various regularly organized trade associations of that city, these representatives being duly elected by their own organizations, and attending the Associated Board of Trade meetings, to speak and act not only for themselves, but as voicing the wishes of the associations which send them. Thus, when the members of the Associated Board of Trade make a decision, their action is at once of importance (because of its comprehensiveness) in forming commercial and legislative opinion.

As New York is the commercial metropolis of the United States, her merchants, of necessity, must be equally comprehensive in their dealings not only in home products, but also in those of all other countries with whom they hold commercial relations. To facilitate the operation of this great concentration of business it was found expedient to organize separate Exchanges and Boards of Trade, which as time passed have grown into large proportions. It is impossible in this short article to describe them all, —some seventy in number,—but a few of the more prominent may be mentioned. The New York Produce Exchange, with its 3000 members, specially deals in grain, flour, provisions, lard, tallow, etc. It possesses the finest exchange building in the United States, and its business and influence are proportionally great in the line of its specialties. The Stock Exchange confines its dealings to stocks and bonds and other similar securities of this and other countries, and has given great impetus to the development of transportation in this country. The Cotton Exchange, which deals almost exclusively in that staple, buys and sells more cotton for future delivery than any other Cotton Exchange either at home or abroad. The Petroleum—now the Consolidated—Exchange first dealt in petroleum and mineral oils, but of late years it has turned its attention to stock securities, and is to some extent a competitor of the Stock Exchange. The Coffee Exchange has lately grown into very great prominence, and now surpasses in the volume of its business that of Havre, France, which is believed to be the largest in Europe. The Merchants' Exchange confines its operations to farm products, such as butter, cheese, eggs, poultry, and the like, and now aggregates an enormous business. The Wool Exchange and the Metal Exchange are other important associations, which, with the foregoing, own their buildings; but besides these there are the Maritime Exchange, the Board of Trade and Transportation, the Coal Exchange, the Mechanics' Exchange, and many more with names indicative of their trade specialties, which have organized from time to time as the city developed.

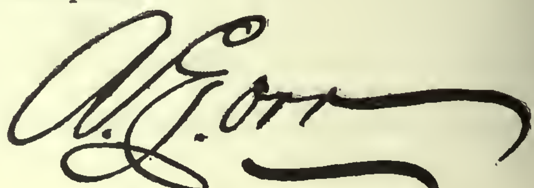
The approximate numbers of the various commercial associations located in the principal cities, not previously enumerated, are as follows: Philadelphia, 20; Boston, 48; Pittsburg, 11; Baltimore, 21; San Francisco, 15; Indianapolis, 8; Louisville, 9; New Orleans, 11; Minneapolis, 12; Kansas City, 9; St. Louis, 26; Omaha, 9; Buffalo, 16; Cincinnati, 17; Cleveland, 9; Milwaukee, 10; and the entire number of such organizations throughout the whole country will probably reach 2000.

The national and trade associations probably aggregate in number over one hundred. Following is a list of prominent national organizations, and their leading officers at the present time:

NATIONAL COMMERCIAL ASSOCIATIONS.

Name.	Location.	President.	Secretary.
American Association of Flint and Lime Glass Manufacturers	Pittsburg, Pa.	George W. Blair, Pittsburg, Pa.	George F. Easton, Pittsburg, Pa.
American Boiler Manufacturers' Association of the United States and Canada	St. Louis, Mo.	H. S. Robinson, Boston, Mass.	E. D. Meier, 421 Olive St., St. Louis, Mo.
American Iron and Steel Association	Philadelphia, Pa.	B. F. Jones, Pittsburg, Pa.	James M. Swank, Gen. Man., Philadelphia, Pa.
Association of Iron and Steel Sheet Manufacturers	Pittsburg, Pa.	J. G. Battelle, Piqua, O.	John Jarrett, Pittsburg, Pa.
Carriage Builders' National Association	Philadelphia, Pa.	Channing M. Britton, New York.	Henry C. McLear, Wilmington, Del.
Heavy Hardware Jobbers' National Union	Chicago, Ill.	S. D. Kimbart, Chicago.	W. C. Brown, 45 La Salle St., Chicago, Ill.
Manufacturers' National Association	Cincinnati, O.	Thomas Dolan, Philadelphia.	E. P. Wilson, Cincinnati, O.
Merchant Tailors' National Exchange of the United States	New York.	Emile Twyeffort, New York.	James S. Burbank, New York.
Millers' National Association of the United States	Milwaukee, Wis.	C. A. Pillsbury, Minneapolis, Minn.	Frank Barry, Milwaukee, Wis.
National Association of Builders	Boston, Mass.	Charles A. Rupp, Buffalo, N. Y.	William H. Sayward, Boston, Mass.
National Association of Furniture Manufacturers	Indianapolis, Ind.	Otto Strechhlan, Indianapolis, Ind.	T. B. Laycock, Indianapolis, Ind.
National Association of Galvanized Sheet-Iron Manufacturers	Pittsburg, Pa.	N. S. Whitaker, Wheeling, W. Va.	John Jarrett, Pittsburg, Pa.
National Association of Stove Manufacturers	Chicago, Ill.	Lazard Kahn, Hamilton, O.	T. J. Hogan, Chicago, Ill.
National Association of Wool Manufacturers	Boston, Mass.	William H. Haile, Springfield, Mass.	S. N. D. North, Boston, Mass.
National Board of Trade	Boston, Mass.	Frederick Fraley, Philadelphia, Pa.	W. R. Tucker, Philadelphia, Pa.
National Board of Trade of Cycle Manufacturers	Hartford, Conn.	A. G. Spalding, New York.	A. Kennedy Child, Hartford, Conn.
National Brick Manufacturers' Association of the United States	Indianapolis, Ind.	F. H. Eggers, Cleveland, O.	Theo. A. Randall, 5 Monument Place, Indianapolis, Ind.
National Cigar Manufacturers' Association	New York, N. Y.	Moses Krohn, Cincinnati, O.	Morris S. Wise, New York.
National Confectioners' Association	St. Louis, Mo.	John S. Gray, Detroit, Mich.	F. D. Seward, 525 North Main St., St. Louis, Mo.
National Dairy Union	Elgin, Ill.	W. D. Hoard, Fort Atkinson, Wis.	D. W. Willson, Elgin, Ill.
National Hardware Association	Philadelphia, Pa.	William W. Supplee, 503 Market St., Philadelphia, Pa.	T. James Fernley, 505 Commerce St., Philadelphia, Pa.
National Iron Roofing Association	Cincinnati, O.	James Beichele, Canton, O.	George M. Verity, care American Roofing Co., Cincinnati, O.
National Live Stock Exchange	Chicago, Ill.	W. H. Thompson, Jr., Chicago, Ill.	Charles W. Baker, Chicago, Ill.
National Paint, Oil, and Varnish Association	Chicago, Ill.	Howard B. French, Philadelphia, Pa.	D. Van Ness Person, Chicago, Ill.
National Retail Grocers' Association	Chicago, Ill.	George A. Sburer, Peoria, Ill.	W. M. Crawford, Chicago, Ill.
National Retail Hardware Dealers' Association	Boston, Mass.	S. S. Bryan, Titusville, Pa.	Hiram G. Janvrin, 9 Dock Square, Boston, Mass.
National Retail Jewelers' Association of the United States	St. Louis, Mo.	Herman Mauch, St. Louis, Mo.	William F. Kemper, St. Louis, Mo.
National Transportation Association	Chicago, Ill.	Frank Barry, Milwaukee, Wis.	George F. Stone, Chicago, Ill.
National Wholesale Druggists' Association	Minneapolis, Minn.	J. C. Eliel, Minneapolis, Minn.	A. B. Merriam, Minneapolis, Minn.
Tinned Plate Manufacturers' Association of the United States	Pittsburg, Pa.	W. T. Graham, Bridgeport, O.	John Jarrett, Pittsburg, Pa.
United States Brewers' Association	New York, N. Y.	Leo Ebert, Ironton, O.	Richard Katzenmayer, New York.
Vapor Stove Manufacturers' Association	Cleveland, O.	Hon. D. Dangler, Dangler Stove Mfg. Co., Cleveland, O.	F. L. Alcott, Standard Lighting Co., Cleveland, Ohio.
Vessel Owners' and Captains' National Association	Boston, Mass.	J. S. Winslow, Portland, Me.	R. R. Freeman, 95 Commercial St., Boston, Mass.

Thus it will be seen that, starting with but four commercial organizations, of the character and scope outlined, at the beginning of the nineteenth century, their number at its close will have increased five hundred fold. What they have accomplished for the people of this country is simply incalculable. The record is found in our extensive manufacturing industries; in the products of the soil, forests, and mines; in our enormous interstate commerce; in our foreign trade; in our circulating medium and monetary institutions; and, finally, in the unprecedented increase in national wealth, prosperity, and development.



CHAPTER X

ONE HUNDRED YEARS OF NEW YORK COMMERCE

INEVITABLE from the first as was the supremacy of New York in the commerce of the Western world, her preëminence to-day has largely been attained along the lines of her own endeavor. Competing in the open fields of enterprise and trade, she fairly won the wealth that has rendered possible the ever-increasing magnitude of her operations. Her later progress is linked to that of the nation by the double and indissoluble bond of cause and effect.

To the geographical location of New York have been attributed, and to a certain extent justly, the great advantages she enjoys over every other city on the Atlantic seaboard. Her harbor is one of the largest and safest in the world. It is never closed by ice, and is always easy of access. Situated at the mouth of that great inland waterway, the Hudson, the island of Manhattan affords a shore front capable of docking the navies of the world, while Long Island Sound, a miniature Mediterranean, stretches far away to the east. Great trunk-lines, tapping the vast resources of every part of the country, bring here the products which are later distributed over the whole habitable globe. This is the condition of affairs to-day; but there was an era, prior to the railroads, when small vessels of far lighter draft demanded spacious harbors, and when, the manufacturing interests of the country being undeveloped, natural products alone sought the markets of the world.

This was the time, a century ago, when New York won her spurs. With a population of about 50,000, she held her claim to commercial and metropolitan honors only by contention. Philadelphia, Baltimore, New Orleans, and even Charleston represented interests as important as those which centered upon Manhattan Island. Cotton was then an infant monarch of little power, but the plantation interests of the South, which were striding daily into prominence, centered at Baltimore and Charleston; the great highway of the Mississippi was already beginning to take the products of the West to New Orleans; while Philadelphia, with her great banking interests, and New England, with her flourishing West Indian trade, were further challenging New York. Of the total commerce of the country, New York had only about one fourth credited to her. Singularly enough, it differed but little in its import features from that of to-day. The causes of this are not hard to discover. The mercantile interests of the city were already developed. Her social life differed only in degree from that of the European capitals, and wealth and luxury were found everywhere. The old aristocratic flavor of the colonial days still remained, and in politics alone was found the dominant democracy of the time. Gentlemen's cellars still nursed in dusty bins the choicest wines of sunny France, of Portugal, and of Madeira, which made the invoice of many an arriving merchantman. Olives, oil, dried fruits, and hundreds of other luxuries came from the Mediterranean ports, while coffee, sugar, spices, indigo, dyestuffs, and other tropical products arrived from the West Indies and from the Orient. Cloth and manufactured articles of all kinds for the use of New York were brought from England and France, and with the other imports were traded for the wheat, flour, corn, beef, fish, provisions, furs, lumber, and tobacco which our own country sent here for a market. Very little money, generally speaking, changed hands. Commerce resembled more an extended application of the barter system of the early trading-post than an international business relation.

To this brief résumé of the situation as it presented itself to the bewigged old gentlemen who gathered daily at the so-called Merchants' Exchange in the Tontine Coffee-House during the early days of the year 1795, only one thing remains to be added. This was the extreme insecurity of our commercial relations, which dashed the otherwise legitimate undertakings of our merchants with a speculative savor found to-day only in the stock market. England in 1783 was unable longer to withhold political liberty, but a dozen years later she still endeavored to hold on to many of the material advantages of colonial days.

The first step toward removing the obstructions which embarrassed our commerce was the Jay treaty. The successful negotiation of this first of our commercial treaties, imperfect though it was, well deserves centennial celebration. It marks our admission as a nation into the world's fraternity of commerce.

Many a famous fortune of to-day, and many a great business house since known all over the civilized world, were founded in the next decade. At this time New York was scarcely half as large as Philadelphia. Its merchants, who to-day would be called importers, and its retail storekeepers, transacted the business of the town. There were no manufacturing interests, and even in 1800 this branch of industry had only reached an annual output of about $250,000, a large part of which was accredited to brewing and distilling. When it is considered that to-day New York's factories turn out annually over $600,000,000 worth of goods, the significance of the change from the condition in which they started will be better appreciated.

The city of New York during this period extended only about to Reade Street or Duane Street, and above Canal Street was still the open country. The docks were in the southeastern part of the island, beginning at Whitehall Street and running around to Peck Slip. Above these, all along the shore, were the shipyards, which were the first to feel the impetus of the good times that were inaugurated in 1795. Those were the days when a few hundred dollars built a stanch little vessel. Her hull was easily mortgaged for so much as would supply her with sails and rigging, and the profits of her first voyage to the West Indies were such that she would tie up to the home dock completely paid for. Through the activity of trade the ship-builder and the merchant prince reached a prominence never before gained by any class in the community. With the exception of the farmers, they were almost the only employers of labor. It was an age which, with all its simplicity, affected a lavishness of living expenditure, and these nabobs spent their money as freely as they made it. Their argosies came back to them laden with all the latest products of European industry and skill. Their warehouses, filled to overflowing, poured into the empty holds of these vessels great cargoes of grain, breadstuffs, fish, and provisions, which were carried to Europe, laid waste by Napoleon and his French legions, and which brought fabulous prices. Return cargoes, sold at enormous profit here, still further added to the lucrative nature of this early trade, and the merchants of New York improved their time to accumulate wealth without interruption until the Embargo of President Jefferson in 1807.

In the mean time, however, many things were happening which were later to produce their effect upon the trade of New York. These causes had already begun to shape themselves in 1800. The population of the city was then 60,489, and it was distinctly commercial and maritime in its nature. The offices of the largest merchants, the three banks, the three insurance companies, and all the business energy of the city had centered about Wall Street, excepting the shops and smaller retail establishments, which lined Pearl Street, making it a main thoroughfare then and for thirty-five years thereafter. The coastwise and inland trade had brought to the docks sloops and quaint old craft in shoals from New Jersey, up the Hudson, and along the Sound, which brought firewood, brick, farm produce, and other articles, and took away general supplies. Further than this, a large fishing-fleet made this port its headquarters, and its season's catch, dried and salted, continued for many years to be an important part of our exports.

Of manufactured articles, except the very coarsest grades, we produced almost none at that time; but under the fostering of the Embargo and the war blockade there came a great manufacturing movement, which continued for a period of three years. In 1800 attempts were made for industrial independence in many branches. The iron-working industry, always prohibited by England to the colonies, was begun in a minor way in New York by such men as Robert McQueen, James P. Allaire, and others. Pianos, soon to become an essential in the drawing-rooms of all cultivated people, were among the earliest of American manufactures. Dodds & Claus, the first firm engaged in this business, were making them as early as 1792 at 66 Queen Street, now a part of Pearl. Besides this most important branch, New York's other industries were two or three hat factories, which employed a few hands at cheap wages, and several breweries, distilleries, and tanneries. The trade in furs, too, was extensive at this time, and John Jacob Astor soon after organized a single company, with a capital, enormous for those days, of $1,000,000, the greater part of which was furnished by him. He further increased his

Horace Porter.

operations a few years later by absorbing two other companies, and establishing a Western depot on the Columbia River. With the exception of this latter enterprise, which soon failed, his business was in New York.

Europe during all this period was torn by the struggles of those national giants, France and England. Each of the combatants had proclaimed a blockade against all European ports except those under its own control, and any merchantman flying the United States flag was liable to confiscation, if caught by a patroling cruiser or privateer of either nation near the blockaded coast. Many ships were lost in this way; but the enormous profits gained when a vessel managed to slip a cargo through were so tempting that New York merchants continued to embark in such ventures. It was at this time that, protest having proved unavailing, President Jefferson believed himself to have found a way to force the belligerent powers to respect the neutrality rights of America. To this end he issued in 1807 his Embargo, prohibiting all American merchantmen from leaving port, and forbidding the shipment of American cargoes in foreign bottoms. It was his belief that Europe's need of the provisions this country supplied would drive her to conciliation. In this idea he proved mistaken, and the Embargo was necessarily repealed in 1809. It had, however, accomplished great mischief to New York's commerce, as well as to that of the country at large. The great fleets of the merchant princes lay rotting at their anchorages. The warehouses were deserted, and grass grew upon the unused docks. Many clerks were discharged, and their poverty, together with that of hundreds of sailors thrown out of employment, made the suffering among the laboring class severely felt.

The most important event of this time, however, and one that far outranks the Embargo in its continuing importance, was the building by Robert Fulton of the *Clermont*, the first steamboat, though it was little more than a toy. He was aided with means by Chancellor Livingston. At a speed of between four and five miles an hour the little vessel made the trip to Albany and return, thus inaugurating the present era of steam-navigation. She was speedily followed by others. Steamboats were running on Long Island Sound in 1818, and the following year John C. Stevens, of Hoboken, built the steamer *Savannah*, of 380 tons, which was the first steam-vessel to cross the Atlantic. Ten years later there were fifty steam-packets running into New York harbor, and in 1840 the first regular transatlantic steamers were started by the Cunard Line.

The repeal of the Embargo in 1809 had scarcely time to bring about any great results before the War of 1812; and an immediate blockade by a British fleet of the port of New York again locked up the city within the narrowest limits, even her coastwise trade being stopped. Much distress resulted in the winter from the lack of firewood ordinarily brought by the Jersey sloops. The blockade, too, had an added severity over the Embargo, in the fact that, being a community dependent upon England for goods, we were suddenly cut off from our supply, and found ourselves without means at home to remedy the deficiency. Then it was that the attention of New York was for the first time turned seriously toward manufacturing. Homespun, although worn in the country at large, would scarcely do for the fashionable people in New York; and all the hundred and one conveniences demanded by dwellers in city and country must be supplied. In response to this demand factories sprang up as if by magic. Especially wonderful was the sudden growth when it is considered that there was not a shop in the country then capable of turning out anything but the simplest machinery. Despite all adverse conditions, industries multiplied and prospered. American wool, which had hitherto been supposed only fit for the coarsest kinds of cloth, was successfully used for the manufacture of finer fabrics. The first woolen-mills, owing their origin to the pressure at this epoch, were started in 1809, and during the war turned out satinet which sold at $4 per yard, and broadcloth which brought from $10 to $12 per yard. In this, as in the majority of other lines, prices were abnormally high, and the manufacturers made much money. Cotton-mills were also started. Many embarked in the new ventures, and nearly every kind of manufacturing was represented. When the war ended prosperity departed as suddenly as it had come. England, in her desire to regain her former market, poured in her goods at prices far below those at which the New York manufacturer could afford to sell his products, and forced him to shut his doors. Tens of thousands of dollars of lost capital, and hundreds of operatives out of work, made up the result of New York's first effort to enter the ranks of the world's producers. It was not altogether a dead loss, though, for a spirit had been roused which continually manifested itself during the next twenty years, and which eventually placed this city high in the list of manufacturing centers.

With the return of peace, Messrs. Adams, Gallatin, and Clay went to England, where on July 3, 1815, a commercial convention was negotiated, copied substantially from Jay's treaty, but with an added proviso for absolute reciprocity in direct trade by the abolition on both sides of all discrimination. This convention was ratified December 22d. Confidence was seriously checked by the financial and industrial depression which followed the war, but New York was among the earliest cities to rally and continue her enterprises. By far the most important of these was the proposed Erie Canal. It contemplated the connection of the Hudson River and the Great Lakes, thereby bringing to New York the wealth of products of the great inland basin thus reached. Ground was broken in the work of digging the great canal by James Richardson, on July 3, 1817, near Rome, N. Y. Eight years were required for the completion of the task. On November 4, 1825, the first fleet of canal-boats came through from Buffalo to New York City, Governor De Witt Clinton, who in the face of almost insurmountable obstacles had carried the work through, being in the first boat. The event was celebrated in New York with the greatest enthusiasm, and marked the commencement of the system of communication since established both by rail and water with the interior of the country.

As Governor Clinton and the few far-sighted men who had supported him in his giant undertaking had foreseen, the new canal began at once to revolutionize the internal trade of America. By it New York was able to reach, cheaply and quickly, districts which had hitherto been accessible only by a long and circuitous route around Florida, through the Gulf, and up the Mississippi River. The Erie Canal afforded to New York what she then most needed—an opportunity to extend her domestic distribution and collection. It was the first move made for the protection of this city against the prosperous factors of New Orleans, to whose doors the great Mississippi was bearing in daily increasing numbers the huge flat-bottomed river-boats laden with the products of the West. Many States, like Ohio, Indiana, and Illinois, were in the habit of sending their products to New Orleans for export, although obtaining their supplies and imports from New York. The canal put all these localities in closer touch with the great seaboard city, and paved the way as nothing else could have done for railroad transportation facilities, when their turn came, a few years later.

Meantime the commerce of New York continued to flourish. Packet lines with regular weekly sailings were established, the first being the Blackball Line, founded in 1816 by Isaac Wright & Son, Francis Thompson, Benjamin Marshall, and Jeremiah Thompson. It was followed by the Red Star Line, organized by Trimble & Company, in 1821; the Havre packets of Depau, in 1822; Grinnell, Minturn & Company's London Line, in 1823; and the China and California packets of Low, Griswold & Aspinwall, still later. The first of these lines, with its regular sailing-days, began the systematizing of transatlantic trade; and the imports to New York during the ten years following 1820 increased nearly $8,000,000, while the export trade made a corresponding gain, the total imports and exports of the country in 1830 amounting to $144,776,428. Two years later the $10,000,000 which New York had put into the great ditch of the Erie Canal was showing its fullest results. With a registered and enrolled tonnage of 286,438,—greater than Liverpool or any city in the world except London,—the harbor of New York was daily thronged with vessels. Either discharging at the docks—which had by this time stretched themselves around to the North River front—or at anchor in the stream, over 500 vessels could be counted any day in the year. From foreign ports nearly 2000 vessels arrived annually, while twice and a half that number, engaged in the coastwise trade, ran in and out in the same time. From the invoices of all these craft could be read the story of a volume of trade of dimensions hitherto unprecedented. The amount New York paid as valuation of her imports in 1832 was $53,214,402, while the total for the rest of the country reached only $47,815,864. By these figures it will be seen that New York's percentage in duties would easily make her the chief contributor to the revenues of the government, as she was and always has been. Of the imports of that time, manufactured articles, fully fifty per cent. of which were dry-goods, made the great bulk. Besides the silks, woolens, cotton goods, and linen, hardware, cutlery, earthenware, and workings of brass and copper, together with the wines and spirits which England and France supplied, there was a large and flourishing trade with Brazil and the West Indies in sugar, molasses, and coffee, and with the Orient in tea, spices, indigo, dyestuffs, and other tropical products.

The exports from New York during this same year reached the amount of $26,000,945, or between one fourth and one third of the total exports of the country. The prominence of New Orleans as a port of the West explains the discrepancy between in and out volume of trade of New York, which discrepancy, in fact, existed more or less markedly up to the time of the railroads. The exports most important at that time were wheat, flour, corn, rice, beef, pork, butter, dried fish, general provisions, furs, tobacco, and lumber, together with some of the coarser grades of manufactured goods. In this list the manufacturing progress of the city since the disastrous setback that followed the War of 1812 is plainly shown. Soap, boots and shoes, furniture, carriages, trunks and leatherwork, hats, cordage, earthen and stone ware, drugs, and rough ironwork were all being turned out, and in quantity sufficient to warrant exportation in many of the lines enumerated. There were also paper-mills, type-foundries, printing-press manufacturers, and large flouring and tanning interests centered here.

The prosperity of this time, commercial and financial, was rudely broken in upon three years later by the great fire which occurred on the night of December 16, 1835, in Merchant Street, and which, after raging three days, was finally extinguished only by blowing up a number of houses with gunpowder, thus leaving a vacant space that the flames could not pass. It had destroyed, however, nearly the whole of the business section. In and around Hanover Square, Pearl and Wall streets, 648 houses and stores were burned, together with contents valued at $18,000,000. The blow was a terrible one, and the insurance companies of the city succumbed at once. Scarcely one survived. Business of every sort had been affected, and in the severe winter weather that prevailed, building had to be delayed and many interests found themselves homeless. To the depression of this great conflagration can be traced many of the active causes of the financial panic which broke over the city and country in 1837, and for a time darkened the whole commercial horizon.

As in the past, however, New York was one of the first to feel better times. The country was growing fast and demanded hundreds of articles for which New York was the distributing point. Ohio, Indiana, and Illinois had undertaken canals connecting the Ohio and Mississippi rivers with the Great Lakes at Cleveland, Toledo, and Chicago; but with all these increased activities elsewhere New York had maintained its position as the great port of entry. Baltimore's attempt to accomplish a connection with the West by the Baltimore and Ohio Railroad in 1828 did not prove immediately valuable when completed, and Philadelphia, with the other seaboard cities, still found the lofty walls of the Alleghanies an insurmountable obstacle. Railroads were in operation, but only in unconnected lengths, and trunk-lines were still in the future. The telegraph, destined in its later applications to revolutionize the commercial methods of the world, was discovered by Professor Morse in New York, and a line—the first—was built between this city and Philadelphia in 1845. A setback caused by another great fire in this same year (1845), which destroyed nearly $8,000,000 of property, was speedily passed over. The railroads were surely, if slowly, increasing and improving. The trade in the China seas and with India was extending, and despite its great risks many houses were growing rich and powerful in its pursuit. Manufacturing had increased to a point where the permanency of its institution could no longer be doubted. The boundless resources of the great Western granaries were pouring in yellow streams to Europe. The Collins Line of steamers, with five magnificent ships subsidized by the United States government, were put upon the Atlantic Ocean; but the loss of the *Pacific* and *Arctic*, followed by the withdrawal of the subsidy, ended the operations of the line in 1858.

The event of this period, so far as New York's commercial greatness is concerned, however, was the opening of the first trunk-line, the Erie, to Dunkirk, in 1851. It demonstrated the usefulness of the railroad, doubted even at that day by many, and was speedily followed by other great systems stretching out in all directions. Long before this first road was finished New York's position as the metropolis of the United States was assured; but its connection with railroads of sufficient length was as important to it as the opening of the Erie Canal had been twenty-five years before. The commercial interests, which had originated, developed, and supported the city's greatness, began still further to expand. The financial troubles of 1857 found New York the least susceptible to their attack. It speedily recovered, and the next year saw the commerce of the country reach a total valuation of over $500,000,000, of which only about two fifths was accredited to New York, despite the fact that nearly two thirds of the imports, amounting to $180,953,843, had passed through her custom-house. The preëminence of New Orleans in the cotton export trade still continued to keep that city on terms of formidable rivalry with New York, while Galveston, also deriving its importance from the same staple, was coming to the front with Baltimore, Savannah, and Charleston.

This year of 1858 was destined to see one of the most marvelous of the century's achievements—the laying of the first transatlantic cable, which was accomplished through the enterprise of several of New

York's public-spirited citizens. Though it operated successfully for only a few days, its practicability was demonstrated, and 1865 and 1866 saw others laid and the present great oceanic system of telegraphs begun.

The brief operation of the cable of 1858 furnished one striking incident of the utmost commercial importance. Over it was announced the collision between the steamers *Europa* and *Arabia*, the reception of this news saving the business world at least $250,000, which would otherwise have been spent in additional insurances on the vessels and their cargoes.

In 1859 the country at large owned a total tonnage of 3,485,266,—greater than that of any or all nations on earth except the United Kingdom,—while New York herself alone had a tonnage greater than any of the other countries, with the exception of Great Britain. This great fleet, carrying the chief part of all America's commerce under her own flag, was also strong in her competition for the carrying trade of the world, the lion's share of which she had already won. In the coastwise trade an enrolled and licensed tonnage of 1,377,424 plied to and from New York harbor.

The period comprised by the next few years is one which lends itself to be told by figures more readily than in any other way. The growing network of the railroads had been slowly diverting the cotton from the smaller seaports in its movement to the markets, and New York was now getting a fair share. Her total imports for the year 1861, preceding the Civil War, amounted to $188,790,086, out of $287,250,542 credited to the country as a whole. Of the exports, of the value of $204,899,606, New York had more than doubled the figures of three years earlier, and claimed $118,267,177. The tonnage of the country had swelled to the vast total of 5,299,175, and merchantmen carrying the Stars and Stripes and hailing from New York could be seen in every port of the civilized world. It was the golden age of American shipping; and although New York is a far greater city to-day than she was then, it is still a matter of regret that she cannot carry on her vast transactions with an American marine, rather than beneath the flags of other countries whose vessels traverse the seas. The golden age was brief, however. It grew up in the years between 1820 and 1860, and it was cut down almost in a year—one year of war. The close of 1862 found the United States' merchant fleet smaller by many thousands of tons than it had been the preceding year, while Great Britain, ever on the watch to secure an advantage, had increased her fleet correspondingly and was rapidly becoming the carrier of the world's freights.

The imports at New York showed still further the effects of the war. A falling off of over $50,000,000 was the record, but even this was far better than that which happened to the remainder of the country, which added up its total import trade to only $189,356,677. The export trade of the country at large was affected least by the troubles of this time and only decreased slightly, while New York's exports actually increased, amounting to $127,651,778, or about $9,000,000 more than during the preceding year. The cause of this was shown later in the year following the war, when between the exports of New York for 1864 and those for 1866 there was a falling off in the latter year of nearly $33,000,000, due mainly to the resumption of the Southern ports.

The effect of the Civil War upon New York's commerce fortunately lasted only a short time. Had it not been for the disturbance it caused to general business it is doubtful whether the war, in its effect commercially, would not have been considered to a high degree beneficial. The figures, when studied, show this to have been so relatively, at least. New York was undoubtedly more prominent and a larger factor in the trade of the country between 1861 and 1864 than she is now, but it was a much smaller trade. Her own particular prosperity increased with the end of the war, and in 1870 her imports and exports had increased to over $100,000,000 greater than they were in 1862, while the total trade of the United States aggregated nearly $900,000,000.

The foregoing figures show that the commerce of New York recovered very quickly from the shock of war. The shipping interests of the city were not so fortunate. Out of a total lost tonnage of 1,104,435 due to the war, New York had suffered about one fifth of the whole. This loss has been recovered but slowly, and even to-day the figures have not returned to the point from which they fell. Instead of two thirds of the commerce of the port being done in American bottoms, as it was prior to 1860, there is scarcely a quarter of it that does not go to foreign carriers. England has nearly 8,000,000 of tonnage more to-day than we, and much of New York's trade is carried on under her flag. Ship-building has accordingly ceased to be a great New York industry, which it was earlier in the century.

Since the war all attempt to particularize in sketching the history of such a gigantic emporium as New York is hopeless. The causes which have already been laid down as operating to bring about her greatness are equally strong to maintain it. The natural center of the enormous wealth of the Eastern seaboard States, she is also in direct contact by her railroads and waterways with the most remote centers of production, and to her as the only real distributer must the imports come. Despite the fact that storage and wharfage charges are higher than in almost any other port, one third of the entire wheat crop of the country is exported from this city. The war and the railway systems together have so militated against the Southern cotton ports that a large share of that trade passes through New York. Petroleum and the valuable products of the wonderful oil regions, dressed beef and pork from the enormous packing-houses of Chicago and other Western cities, live cattle from Texas and the Western plains, and breadstuffs and provisions of all kinds, make up much of the great volume of exports. Of the staples of import, among the most important are sugar, coffee, tea, and tobacco. Of these, one half the sugar and three fourths each of the coffee and tea imported for the whole country pay duty at this port.

To show more clearly the magnitude of the business transactions involved in the commercial statements of to-day, a few figures taken from the best available sources will be useful. The year 1885 gave a total volume of commerce for the United States of $1,304,210,275. New York's returns for the same period showed imports amounting to $380,077,748 and exports $334,718,227, making a total of $714,795,975. In 1893, in the face of the financial and commercial troubles of the year, the country's total foreign trade showed an increase of nearly $350,000,000, making a total of $1,652,354,534. New York's share in the nation's increased trade was about $170,000,000, her total figures for the year being $886,487,641.

To meet the demands of the enormous traffic indicated by these figures, New York has expanded in every way. It now has a population of about 2,000,000, and manufacturing interests with an annual productivity of $600,000,000 and employing 500,000 hands. It is a center for the greatest railways of the country, and a sailing port for half a hundred great ocean steamship lines. It has a water-front of twenty-five miles, thirteen of them being along the North River, and the dock facilities are increasing every day. The recently completed Harlem Canal between the Harlem and Hudson rivers has been put into operation, and with its facilities the great coastwise trade in bricks, ice, and lumber between New England and the Sound ports and the Hudson River towns has been materially increased, and a saving of many miles accomplished for a number of vessels coming in on one side of Manhattan Island and having to discharge on the other side.

The harbor of New York to-day is thronged with vessels the year round. Lofty-masted sailing fleets are docked along South Street; coastwise vessels and freight and passenger transatlantic steamships stretch for miles along West Street, interspersed with slips for market-boats and fishing craft; while countless ferries furnish a connection with neighboring cities. 5,000,000 annual tonnage is computed to be the extent of the city's shipping traffic, and 928,000 of this is in the foreign trade, the coastwise trade with its colliers, and the fleet of New England schooners, making a large percentage of the remainder. A total of about 6000 vessels, steam and sail, arrive here annually from foreign ports, while nearly 16,000 enter in the coastwise trade, of which fully 14,000 are sailing craft. In addition to the European lines there are regular steamships to Brazil, Venezuela, the Central American and Mexican ports, and the West Indian Islands.

The precautions taken to guard the city from contagion from any of the increasing number of merchantmen have resulted in the establishment of an effective quarantine. Originally instituted in 1746 on Staten Island, moved to Bedloe's Island in 1784 by the State legislature, and to Governor's Island in 1794, it returned finally to Staten Island in 1801, where its usefulness has steadily increased. The immigration in this country centers almost entirely in New York, over four fifths of the total tide coming to Ellis Island.

The mercantile interests of the city have likewise increased with the general expansion, until to-day there is scarcely a great interest in the country which has not agents in New York. Foreign houses also have established branches here, and the old merchant of one hundred years ago has become the great importer of to-day, while his jealously guarded designation of "merchant" has fallen upon the modern business man, jobber, wholesale dealer, and manufacturing agent.

Diversified as the commercial lines have become, the growth to separate importance of the various branches with their ramifications has compelled the introduction of new methods. The Chamber of Commerce and the Board of Trade and Transportation constitute bodies as great and productive of good as ever, but around them have grown up many subdivisions of the various interests. A single trade to-day transacts a greater business than the combined interests of the whole city did one hundred years ago, and some facilitation of this enormous business became necessary. This has resulted in the establishment of many exchanges, such as the Produce, Cotton, Coffee, Coal, Metal, Consolidated, Fruit, Real Estate, and others, all of which concentrate the interests they represent at some commercial point. The shipping interests are represented at the Maritime Exchange, and the facilities of the custom-house, public stores, and bonded warehouses are such as have been found to be of the greatest practical benefit. There are 1700 employees in the customs service in New York; and \$150,000,000, collected at the modest cost of about two per cent., is the annual revenue this port contributes to the Federal government.

Summing up the whole situation, New York today as a commercial metropolis outranks any city in the world, with the single exception of London; and it requires no especially boastful spirit to say that her prosperity is founded upon a securer basis than that of even the great English capital. Standing at the national gateway to the great West, the wealth that pours each way must pass through her portals. Combining the enterprise that attempts with the wealth that makes of the attempt a sustained effort, she has only begun her career of greatness. She has won success in the first and hardest stage of her journey, and the way is now clear before her. Her future is secure, for as surely as the nation shall wax greater, richer, and more powerful, so surely shall the metropolis of New York continue her onward progress.

Horace Porter

CHAPTER XI

OUR FOREIGN TRADE FROM A TRADER'S STANDPOINT

DIFFERENT conditions of soil, climate, and population exist throughout the world, so that a large portion of the wants of one section is supplied from the products of another. This interchange is the most important agency for bringing the peoples of the world into harmonious relations. By its means the interests of different regions have become so interwoven that to-day no nation can go to war without seriously prejudicing the interests of neutral countries as well as those of many of its own citizens. With improved methods of production, and the increased facilities for interchange of commodities, the wants of mankind have rapidly grown. The luxuries of one generation have become the necessities of the next, so that to-day the masses are living under more favored conditions than the nobility of medieval times, and international trade has increased fortyfold since the beginning of the eighteenth century.

The most important developments of this "industrial age" are the railroad, the steamship, and the telegraph. They have made possible the transportation of merchandise of great bulk under conditions generally beneficial to both producers and consumers. Foreign trade has become to-day of so much importance that the leading men of all nations are alive to the necessity of mastering the complex conditions governing international commerce, and he takes the highest place in this age of industrial wars who is most prominent in creating conditions favorable to the industrial development of the people he represents.

In looking at these rapidly changing conditions from a trader's standpoint, one fact stands out, that while the volume of foreign trade has increased, the margin of profit has proportionately decreased. The barter of tinsel trinkets, firearms, and spirits for ivory, pearls, and gold-dust showed such an enormous percentage of profit as to illustrate the ignorance which existed under primitive means of communication. As facilities for communication and transportation improved, rates of freight declined, widening the circle of trade. During the first three quarters of this century the margins of profit in foreign commerce were so large that merchants with only moderate capital entered the field successfully, and there grew up in the maritime cities and towns of this country a well-distributed business in foreign trade and in the building and freighting of sailing vessels until we possessed the finest fleet of clipper-ships in the world.

During the past twenty-five years, however, the margins of profit in foreign trade and transportation have been reduced at least seventy-five per cent. New methods have been adopted in order to successfully meet these new conditions. Most of the houses that were leaders in our foreign trade one quarter of a century ago did not adapt themselves to the changed environment of commerce, and were forced out of business. To-day quick communication and improved banking facilities enable the foreign merchant to transact safely a much larger business in proportion to his capital than was possible half a century ago; but these very facilities have created a competition so intense that to-day there is little or no profit in transferring the great staples from producer to consumer, so that the trader is forced into the position of a speculator unless he has special facilities for distribution. While in foreign trade the middleman is more useful than in domestic commerce, the tendency of the times is, by bringing together producer and consumer, to eliminate him. The trader is forced to enlarge the field of his transactions. This he cannot safely do except by the use of expert abilities and scientific organization. All this makes necessary large aggregations of capital; and the tendency to consolidation, which is the striking feature of industrial enterprise, is finding its way into international commerce.

Yet the trader has a great advantage over the farmer and the manufacturer, for his capital is mobile, and not locked up in land or in machinery that in most factories must be thrown away within a decade by reason of new inventions. The Bessemer-steel rail and the triple-expansion engine have practically placed the wheat-fields of India, the Argentine Republic, and the western United States alongside the farms of western Europe. The cheap land and cheap labor of India, the natural advantages of the Argentine, and the great machine-reaped prairies of the West have destroyed the profit of the European tiller of the soil, and practically extinguished the margin for the landed proprietor. The great discontent in Europe to-day is largely due to the unfavorable condition of the agrarian classes; and the demand made by them for something to better their condition has forced to the surface the agitation of false theories for improving trade through silver legislation.

The statistician Mulhall has made it possible to know what the trade of the world has been, and to trace year by year its enormous growth. The following table shows approximately the aggregate value of imports and exports of each country in millions sterling:

FOREIGN TRADE OF DIFFERENT COUNTRIES IN MILLIONS STERLING.

COUNTRIES.	1720.	1750.	1780.	1800.	1820.	1830.	1840.	1850.	1860.	1870.	1880.	1889.
Great Britain	13	21	23	67	74	88	114	169	375	547	698	740
France	7	13	22	31	33	41	66	95	167	227	339	311
Germany	8	15	20	36	40	46	52	70	130	212	294	367
Russia	8	14	17	30	22	28	33	40	48	103	131	118
Austria	2	4	6	8	10	15	22	29	47	83	107	92
Italy	3	5	7	10	15	20	30	38	52	66	91	94
Spain	10	14	18	12	10	7	10	11	25	41	50	59
Portugal	2	3	4	4	3	3	4	5	8	10	14	18
Scandinavia	2	3	5	5	6	8	12	18	27	48	64	72
Holland and Belgium	4	6	8	15	24	30	45	61	86	136	237	310
Switzerland	1	2	3	5	6	8	10	20	30	45	60	60
Turkey, etc.	2	3	4	5	6	7	10	20	29	55	49	72
Europe	62	103	137	228	249	301	408	576	1,024	1,573	2,134	2,313
United States	..	..	3	17	23	22	41	62	136	165	308	320
Spanish America	10	15	20	25	30	35	48	70	94	135	160	166
British colonies	2	3	1	2	3	9	21	44	103	128	203	298
India	9	9	10	10	11	10	20	30	52	85	108	131
Various	5	10	15	20	25	30	35	50	80	105	120	149
The world	88	140	186	302	341	407	573	832	1,489	2,191	3,033	3,377

From this general view of international trade let us turn to the foreign trade of the United States. I am informed that Mr. Worthington C. Ford in his contribution to this history of American Commerce, will give in detail the statistics of our imports and exports. Although the foreign trade of the United States has increased so that we now do as much in one week as we did in one year a century ago, the great force of the nation has been directed toward the development of our internal resources; to interstate commerce rather than to the extension of foreign trade. The largest commerce of the world, conducted under the conditions of absolute free trade, is carried on between the States of the United States. Untrammeled by customs-duties, the people of the United States, covering a territory of 3,000,000 square miles, have created the most efficient systems for exchange of commodities. They have built 185,000 miles of railways—as many miles as exist in all the rest of the world. They have created the most complete systems of navigation by lake, river, and canal, and a banking system by which a uniform and stable currency exists throughout the entire country. They have not only opened up mines and extended agriculture, but they have developed manufacturing; and while the rate of wages has been higher in this than in any other country, the people of the United States, forced by necessity to meet the low-priced labor of other countries, have applied their high intelligence to the invention of labor-saving machines, so that to-day, although the population of the United States is but 70,000,000, the labor-saving machinery which is run daily in this country—its fixed steam power being one third of that of the entire world—has a far greater productive capacity than the population of the Chinese empire.

The restless enterprise of America, having conquered more than half the continent, it is now turning toward other fields of activity. In the effort to

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extend our commerce it is natural first to consider the countries south of us. These countries can buy of us manufactures and food products. Their principal employment is agriculture, and they form one of the most important groups of those nations which are known to economists as "neutral markets." There are many evidences of the strength of the movement toward enlarging our commercial relations with these sister republics: the assembling of the International American Conference, at which all the republics of the Americas were represented, called under an act of our Congress for the purpose of extending inter-American trade; the completion by an American company of telegraphic communication by land and sea to the southernmost cities of South America; the appointment of a commission, with representatives from North, South, and Central America, to report the most desirable route for an intercontinental railway; the establishment of the Bureau of American Republics, for the purpose of publishing their statistics and other information of interest to those engaged in American trade; the simplification and unification of customs regulations; a Monetary Conference to study plans for facilitating inter-American exchange; the unanimous recommendation by all of the American republics to establish an International American Bank under an act of the Congress of the United States, with branches in all the other American republics; the celebration of treaties of reciprocity; the proposed establishment of a permanent court to settle all inter-American disputes by arbitration; the opening to our southern neighbors of this great consuming market by continuing the free admission into the United States of hides, rubber, nitrate of soda, and other products, and the recent removal of the duties on coffee, sugar, and wool, so that to-day over ninety-five per cent. of the products imported from Mexico, the West Indies, South and Central America, amounting to $235,000,000, are admitted by us free of duty. Important as these have been, of still more efficiency is the incessant activity of American merchants and manufacturers who are engaged in pressing their wares upon the attention of these most excellent customers.

The merchant engaged in foreign trade is obliged to study not only the conditions of the markets which are the distributing points of products, but he must also investigate the conditions of production. The American system of manufacturing great quantities of articles all precisely alike is favorable to uniform quality at the lowest cost. This cost is still further decreased when manufacture is highly concentrated. As a result many great industries are availing themselves of the advantages of centralization, and so securing economies. The first important aggregation in capital and intelligence for the purpose of securing cheap production was the Standard Oil Company, and they show what may be accomplished by economical methods in building up a great foreign trade. Without assistance from tariff protection that great combination has reduced the cost of illuminating oil to a point where it has been able to furnish a brilliant but low-priced light even to the countries where the people are the poorest and demand the lowest price, such as China, Japan, and India. The aggregate of these exports has reached the enormous sum of $45,000,000 per annum. The underlying principles which have created this great success are now being applied to many other industries. Through these consolidations the capacity for cheap production is greatly increased, and such concentration of capital and industry will be a great lever in enabling the United States to take possession of foreign markets that heretofore have been dominated by competing nations.

In labor-saving machinery and in intelligence of the labor employed, the United States to-day is in advance of the rest of the world. As an evidence of the progress we are making as a manufacturing nation our exports of manufactures this year will amount to about $200,000,000 as against $40,000,000 in 1860. While our merchant marine has relatively declined, the fleets of other nations are at our service. But in one respect we are far behind the manufacturing nations of Europe. Our banking system was organized originally with a view to enable the government to borrow great sums of money from the people during the Civil War by selling bonds to be used as a basis for circulation. It has since been modified, and is to-day a most excellent instrument of interstate commerce; but it is utterly inadequate to deal with foreign trade. The banking facilities of Great Britain devoted exclusively to the foreign commerce of that country represent an investment of hundreds of millions of pounds sterling, while the foreign merchants of the United States are forced to not only be their own traders, but their own bankers. Yet the advantages of foreign trade are great, and when the attention of the financiers of the country shall be directed to the organization of proper institutions devoted to supplying this deficiency, the effect upon the increase of American exports will be marked.

Such are the conditions of the past and of today from the trader's standpoint; yet he may look toward the future with equanimity. While there is a tendency to eliminate the middleman, nevertheless, if he be one of those fittest that are to survive, he will greatly increase his capital. He will perfect his organization so that he is ably represented in every market where he attempts to do business. He will freely use the cable to put himself in possession of all the price-making facts. He will assist in the formation of banking organizations which will enable him to finance his operations. While the average profit of transactions is steadily decreasing, he may so increase their volume and decrease the expenses of doing business that the net profits shall be as large as or larger than before. Then the rapid advance of America into the field of international trade will almost push him forward into prosperity, for the skill and knowledge acquired through long years of business relations with foreign markets must be availed of by the manufacturers and producers who wish to sell their goods abroad. By reason of superior organization he is able to perfectly protect himself with reference to the standing and credit of his customers, and through his large capital he is enabled to spread his transactions over so many countries as to greatly divide his risks. By associating himself with the many movements toward concentration of capital and consolidation of production he will be able more readily to defeat his European rivals in the markets of the world. He will do all that he can to forward such enterprises as the Nicaragua Canal and the Intercontinental Railroad, which, while in a sense yet dreams, are dreams in course of realization. By means of these agencies certain disadvantages of the United States in the struggle for the world's trade will be more than counterbalanced, and the trader will be brought far nearer than before to the many regions with which he desires to do business.

During the past ten years the foreign trader has been most seriously prejudiced by the violent fluctuations and uncertainty arising out of the unwise attempts to create an artificial value for silver. Through legislation the price of silver was advanced to $1.20 per ounce, but speedily reacted to less than sixty cents. While these conditions, because undermining confidence, caused the panic of 1893, the trading in this country, owing to the government sustaining the stability of its currency, had the advantage of being conducted upon a fixed basis; but the trade of our sister republics and of the other countries on a silver basis was directly subject to the rapid fluctuations in the white metal. Importers were obligated to remit in gold, and then, owing to the depreciation of the currency, had to take fifty cents on the dollar. These conditions doubled the prices of imports, thus curtailing the volume of importations.

No conditions have ever arisen which have so obstructed foreign trade. False hopes of relief were based upon efforts to formulate an international agreement fixing a uniform ratio between gold and silver. Fortunately the silver question, after several campaigns of education, is better understood, and this vexed problem is in course of solution by natural laws. Low prices are reducing the production of silver, while the output of gold is rapidly increasing. No business has been so seriously affected by the uncertainty and extreme fluctuations in the price of silver as international trade, and probably none will benefit so much by stable monetary conditions. Our foreign trade is already beginning to feel the effect of greater financial stability. The power of returning confidence, with the accumulated energy of years of inactivity, multiplied by the modern facilities for production and transportation, will create an era of prosperity in international trade unknown in the history of the world.

Chas R Flint

CHAPTER XII

WALL STREET

THE name "Wall Street" is but a symbol used to signify the American money market. As the dollar-mark placed before long rows of figures throws a golden luster on the column, so the name of the little great thoroughfare that runs from the high gate of old Trinity down to the East River lends its own significance to the surrounding locality. Nassau, Pine, Cedar, Broad, New, William, and Hanover streets are all as truly parts of the expanded Wall Street of to-day as their bankers, brokers, and business are a part of the great American money market. Around the Wall Street of a century ago as a nucleus have gathered the great moneyed interests of the New World, and it is they, rather than any particular street, that are designated to-day by the term "Wall Street." Yet, if the historic old street has broadened somewhat in significance and application during the past century, it has still lost none of its identity. Since the memorable day in 1789 when George Washington, standing on the steps of the old Federal House, took the oath as first President of these United States, the street he then surveyed has been a center for every great national enterprise. It has been the one fixed point around which have revolved the great financial panics that swept the land, and it has also been the source whence have sprung many of the greatest of those undertakings which have rendered our country and the age alike famous.

Something over two centuries ago green rolling fields stretched from Broadway to the East River. Along the ridge of the hill at the head of Broad Street stood the high palisade of stout timber defending the town against any sudden incursion of the red warriors who still prowled the neighboring land. This palisade, which gave its name to Wall Street, has long been gone. It outlived the red men, and was finally torn down, the line it made being laid out and named Wall Street. To-day it and its significance are forgotten, as are those fair-haired, red-cheeked Dutch maidens, who, tripping down the foot-path to the water, bearing the household linen to the wash, gave their name to Maiden Lane; or the jolly old burghers, clad in baggy knee-breeches and smoking long pipes, who, in the days of doughty Peter Stuyvesant, played their game of bowls upon the smooth turf of Bowling Green. It is only in the few names like these still left that we find how historic are many old city ways. Among them all Wall Street stands with the earliest. There, when the old Town House was demolished in 1699, was built, upon the site of the present Sub-Treasury, a new City Hall, the building which was fitted up six years after the close of the Revolution for the meeting-place of Congress, and at which President Washington was inaugurated.

The importance of Wall Street, therefore, may be dated from 1700, when the affairs of the municipality centered there. By the middle of the century it was a "grand street" with handsome private residences, the seat of the colonial legislature, and the central point for all the political and social life of the day. The State legislature, too, met in Wall Street until the capital was removed from New York to Albany, and for fully fifty years the official life of New York converged there. Nevertheless the tide of affairs was slowly rising in the old thoroughfare, and the private residences began to give way before the offices of the great merchants, who were forsaking lower Broadway and the smaller streets downtown. The shopkeepers and small traders, however, did not venture upon this ground. It was only the great merchant princes and moneyed traders who first planted the standards of business in Wall Street. To them naturally came others, and the Bank of New York, of which General Alexander McDougal was the first president, was in existence but a few years when it was removed to Wall Street, where it established itself in 1791 at the corner of William Street, being the first bank in New York City and the first on Wall Street.

Had the wishes of the Bank of New York been respected there might never have been another one in the Street; for its influence was strong in the legislature, and for years it was impossible for any other banking charter to be obtained. The establishment of the second bank in Wall Street, and the State as well, came about in a most curious manner, and the credit of its accomplishment belongs to that shrewd lawyer, Aaron Burr. He introduced in 1799 into the legislature a bill to charter the Manhattan Company, a corporation of large capital which proposed constructing a system of water-works. Yellow fever, then an annual scourge, caused the people to welcome gladly any improved sanitary regulation, and pure water was considered of the utmost importance. Viewing the matter thus, even the watchful politicians who were assembled in the legislative halls saw little to object to in the new company, and it was chartered accordingly. One brief clause had been overlooked, however, and in it lay the pith of the cunning Burr's success. This clause, after reciting that the company's capital should be expended in the construction of a system of water-supply, provided that if any surplus should remain it could be used in any business "not unlawful." Under this head banking most certainly fell, and the Manhattan Company, finding speedily that they had a surplus, used it in founding their bank that same year, the location chosen being at what was then 23 Wall Street.

One thing, however, must be said, which is that the Manhattan Company was equally prompt in providing its water-supply. The water was obtained from an old spring, and the reservoir was located near the corner of Reade and Center streets, where it remains to this day, an odd-looking, old-fashioned cistern enough, but still capable of providing water as it did nearly a century ago, when it was considered almost as great an engineering feat as the present Croton Aqueduct. It is years since water has been used from it. The pipes by which the Manhattan Company carried water through the town were made from solid logs, the centers carefully bored out and the lengths jointed together. Occasionally, even now, some contractor digging in the lower streets of the city brings to light one of these old pipe logs, laid so long ago; and several sections thus exhumed have been bronzed, and are carefully kept in the Manhattan Bank as mementos of the great work in the earlier days.

The choice by these two banks—the only ones in the city—of Wall Street for their location must be regarded as the final election of that street as the home of American finance. The United States Branch Bank was opened there in 1792; the Merchants' was there in 1805, and the Mechanics' Bank in 1810. Meanwhile, too, another potent factor in centering business interests in Wall Street was introduced by the erection in 1794 of the Tontine Coffee-House. Here at noon every day gathered the merchants from their counting-rooms and warehouses to discuss the news of the day, compare notes, chat, and even make trades. At the plain old bar in the center of the great room the best liquors, at a time when good liquor was the rule, were to be had; and sedate old merchants, with a piece of the thirst-provoking salt codfish or a dry cracker in one hand, and a steaming glass of old Jamaica, oily schnapps, or sound old port in the other, gravely exchanged the courtesies of the day. "High 'Change" they called this hour, and, entirely apart from its convivial features, the benefits of this general intermingling of the business men of the city were found to be so important that a merchants' exchange, having the Tontine Coffee-House as its headquarters, was formed. Thus did the Exchange first manifest itself in Wall Street, and quotations now disseminated broadcast by electricity were then obtained by word of mouth, the Tontine Coffee-House being large enough to contain all the great interests of the New York business world of 1795.

In this latter year, with which the century under discussion begins, the banking facilities of New York, exclusive of the branch office of the Bank of the United States, aggregated considerably less than $1,000,000, and business was synonymous with foreign trade. The merchants were the men of affairs, and, except in foreign commerce or domestic traffic, there were few ways to invest idle funds. The buying of land—real-estate investment—had not then become general, and manufactures were almost unknown, at least as a field for the investment of large capital. Gradually the very extension of trade and business requirements began to bring complexities. Capital increased, and the distinctive function of the banker began, which, according to Ricardo, is "using the money of others." Banks increased, insurance companies sprang up, and the management of money as apart from its use in the channels of trade gradually became more and more distinct. Private bankers, always in existence, gave up little by little the mercantile branches of their business, brokers who bought and sold for others on commission could be found as easily in Wall Street

John P. Townsend.

as at the present time, and by 1810 all the various elements found on 'Change to-day could be observed working themselves into distinctness.

One of the earliest of the great merchants and bankers who ruled on Wall Street in 1796 was Nathaniel Prime, better known as "Nat" Prime. Later on he was the head of the famous banking-house of Prime, Ward & King, a firm as great in its day as any whose name rules the Street now. "Nat" Prime was a hard-headed, picturesque old figure, who had, rumor said, been a coachman in Boston in his younger years. A keen fellow, he had saved and loaned at interest until he gathered a small sum. He was doing a small brokerage business in New York, when, it is related, he met at a dinner-party one evening a rich Southern planter. The conversation turned on money-making, and Prime remarked that if he had $5000 he would double it in a year. The planter asked him what security he could give for such a loan. "The word of an honest man," replied Prime; and on that collateral the Southerner advanced him the money. So Nathaniel Prime got his start. Within the year he had paid his benefactor back; but he gave no more than was strictly due; and when, some years later, the same Southerner, being in financial straits, applied to him for a loan on the security he himself had given, he refused him. Gratitude was a debt the law did not recognize nor "Nat" Prime pay, but in his financial dealings he was always the very soul of integrity.

From these beginnings to being head of the greatest banking-house in New York and a king in Wall Street was a career, however, that showed the business qualities of Nathaniel Prime; and in the dawning importance of that famous street his was one of the most prominent figures. One of the first significant events showing the extending influence of Wall Street as a financial center was the famous conference of its four great powers, Nathaniel Prime, John Jacob Astor, John Robins, and John Hone, when the State of Ohio, in 1825, contemplating internal development on a large scale, applied for a heavy loan. Two days and a night did this session last, and then the first great ultimatum of Wall Street magnates went forth to the Ohio ambassadors. Enact into statute certain stipulated concessions and the money will be forthcoming, was the tenor of this decision. Back to Ohio went the delegates. The legislature deliberated, and passed the required bills, and from Wall Street to Ohio went a vast loan. This first syndicate was one that might have been a little more peremptory in stating its terms than those of to-day, but it was equally prompt in living up to its agreements.

The development of the business of Wall Street as a financial power brought in its train a system of operations based upon the exchange of funds, the representation in stocks of intrinsic values, and the acknowledgment in bonds of indebtedness and lien. Around these three simple quantities has grown the multiplex money market of to-day. There were few stocks, or bonds either, in 1795; nevertheless the brokers were already on the Street, and Bleecker's famous old auction-room was the first place where the early bulls and bears resorted. It was a small enough stock-list they had to operate with in those days, and seemingly simple to master. The two or three banks and insurance companies then existing were quoted, and the three or four classes of government secuirties, but these were all. Sudden or extreme fluctuations, except in time of war, were almost unknown, and an operator who conned his list well on Monday was generally posted for the week. Upon such a field as this did the great New York Stock Exchange make its first appearance. Under an old buttonwood-tree standing in front of 60 Wall Street the early brokers of New York met one day in 1792, and set forth the purposes and obligations of the association in the following agreement:

"We, the subscribers, brokers for the purchase and sale of public stock, do hereby solemnly promise and pledge ourselves to each other that we will not buy or sell from this date, for any person whatsoever, any kind of public stocks at a less rate than one quarter of one per cent. commission on the specie value, and that we will give a preference to each other in our negotiations. In testimony whereof we have set our hands, this seventeenth day of May, at New York, 1792. Lemuel Bleecker, Hugh Smith, Armstrong & Barnewell, Samuel Marsh, Bernard Hart, Sutton & Hardy, Benjamin Seixas, John Henry, John A. Hardenbrook, Samuel Beebee, Alexander Zuntz, Andrew D. Barclay, Ephraim Hart, Julian McEvers, G. N. Bleecker, Peter Anspach, Benjamin Winthrop, John Ferrers, Isaac M. Gomez, Augustine H. Lawrence, John Bush, Charles McEvers, Jr., Robinson & Hartshorn, David Reedy."

This agreement was the only one by which the members were bound until 1820, when daily meetings and the regular call of stocks began. The board had its permanent headquarters after 1825 in the Old Merchants' Exchange; but after that was destroyed by fire it established itself in one of the

Jauncey buildings, whence it removed in 1842 to the New Merchants' Exchange, now the Custom-House. There it remained until 1853. Until that time the board had been the closest of corporations, its membership being governed by iron-clad rules. Financial news agencies were unknown in those days, and the board kept its proceedings a profound secret, violation of this secrecy being punished by expulsion. So intense was the curiosity over the proceedings of this body that an Open Board, which had been organized in 1837, took a building adjoining and dug the bricks out of the wall for the purpose of spying out what was going on.

The board removed from the Merchants' Exchange Building in 1853 to a room in the old Corn Exchange Bank Building at Beaver and William streets. In 1857, the year of the great panic, the board changed its headquarters to the Daniel Lord Building, with entrances on William and Beaver streets. Here it was that some of the great speculators of the day flourished. Among these were Daniel Drew, Jacob Little, and Morse, known as the "lightning calculator," who made and lost a fortune of millions in a little over a year. The rule enjoining secrecy still continuing in force, it is a fact of record that $100 a day was freely offered for the privilege of listening at the keyhole during the time of the calls. The board continued to hold its meetings in the Lord Building until 1865, when it removed to its present location. During the war period the Stock Exchange, with a view to assisting the government, prohibited its members from selling government bonds "short," and also forbade them all dealings in gold. The later action led to the formation of the Gold Exchange, which, although resulting in a loss of many millions of dollars to its members, was taken for purely patriotic purposes. A second Open Board of Brokers was organized in 1863, with headquarters in a basement in William Street, called the "Coal-Hole." So rapidly did its business increase that it soon took more spacious accommodations in Broad Street, adjoining the Stock Exchange. The competition continued until 1869, when the old board called a truce. Amicable negotiations led to a consolidation of the Stock Exchange, the Open Board, and the United States Government Board, the result being the strongest public financial association in the country, and one of the most important in the world. William H. Neilsón was the first president.

The business of this exchange has become to-day much greater than that of the combined exchanges of the kind existing in the rest of the country. It is the very heart of Wall Street, and its functions are as vital to the development and prosperity of the country as to the money market. It affords a constant and regular market for the securities of the great corporations, and indexes their value in quotations of actual bids and sales. Without such facilities as it affords, the shares of these corporations, aggregating a total par value well up in the billions, would move so slowly that great enterprises would often lag from sheer lack of capital. Again, transactions would be vague, only known to the public when the interested parties were willing, and the door would be opened to manipulation and fraud almost unlimited were the safeguard it affords to be removed. The Stock Exchange, it is true, cannot control the relation of values to prices, nor can it direct the management of corporations by their officials; but it can and does secure a fair, free, and absolutely open market, where the dealings are matters of record and public knowledge. It can and does further insist that all stocks dealt in on its floor shall have certain qualifications warranting their genuineness, and its "listing" committee examines and investigates the claims of every new security brought before it, before it is allowed on the list of those in which members may deal. In admitting a security to its list the Stock Exchange does not recommend it to the public; it simply places it among the honest possibilities of the market, to stand or fall by its own merit. In the unlisted securities dealt in by special privilege of the exchange the action of the board differs but in degree, and any stock in which transactions are allowed, however slight its intrinsic value may be, is stamped as not bogus.

In the exercise of these functions the Stock Exchange has come to stand as the great regulator of the market for securities, and its transactions, fully reported, serve as the standard by which values are established. In the internal economy of the Stock Exchange every method best adapted to conserve the ends of straightforward and legitimate business investment has been adopted. Among the more important changes of the last thirty-five years have been the following: the rule requiring the registry of stocks, in 1869; the abandonment of the regular call of stocks, in 1875; the rule authorizing the buying in, if not delivered when due, of contracts of active stocks, in 1884; the establishment of the Department of Unlisted Securities, in 1885; and finally the establishment in 1892 of its own Clearing-House, where all active stocks dealt in are daily cleared. The publicity the Stock Exchange thus allows to all transactions, the centralization it affords to the great interests of the country, and the regulations it imposes upon all operations are among the greatest advantages it confers. Its liberal enterprise, coupled with the strictest integrity, aided by the advantages mentioned, has most naturally placed it in the van of organizations of this character in the whole world.

Leaving now the consideration of the component parts of Wall Street, and taking the Street in its true significance as one of the greatest financial centers in the world, its history becomes so vast, so interwoven with the woof of national affairs and prosperity, that it will only be possible to review it in its more important phases. The War of 1812, which, treading on the heels of the Embargo, brought the first set-back to the new Republic, found Wall Street still so identified with the mercantile interests that its prostration with them at the close of the struggle was only natural. The heavy war loans floated by the government, however, had found their largest takers in Wall Street, and that at a time when men needed all their faith and patriotism to believe even in the eventual solvency of the country. This was the first time that the men and institutions of Wall Street came to the nation's assistance. Looking back and recalling the era of prosperity that followed the war and the reëstablishment of the United States Bank,—a prosperity that in twenty years paid off the great war debt and amassed a surplus of nearly $50,000,000,—we can see that their confidence was not misplaced. In this same period, too, during which De Witt Clinton, in the face of the most violent opposition, achieved the construction of the great Erie Canal and placed commercial advantage in the hands of New York, the evolution of Wall Street was rapid. For twenty years its progress was unimpeded, and then came the great fire of December, 1835. Millions of intrinsic value went up in smoke and flame, and millions more followed in lost time and opportunity before conditions could readjust themselves. Every insurance company in Wall Street gave up without recourse before the overwhelming loss, and the banks felt most keenly the ruin of their best customers, the merchants.

Just at this juncture grim old Andrew Jackson demolished at a blow the great national bank. It was the match to the train, although few saw the mine it would explode. Between $40,000,000 and $50,000,000 distributed to the State banks throughout the country gave a momentary prosperity that found vent in the gigantic bubble of land speculation which the Specie Circular so woefully pricked. Banks were asked to redeem their notes, but could not, and then came the panic of 1837. Wall Street felt the crash, but nevertheless her bankers were the first to reopen their doors, and her capitalists the first to regain their confidence. Long and slow was the process of recuperation in the country at large; but through it all, with the banks of the West and South opening one day only to suspend the next, Wall Street continued evenly on its course, and the completion in 1851 of the Erie Railroad to Dunkirk shows how well her capitalists had retained their faith and their courage.

The long drag of ten years, succeeded by an equal period of prosperity struggling against bad banking and ill-regulated finance, culminated in 1857. A branch office of the Ohio Life and Trust Company was located in Wall Street, and from there on the memorable 24th of August, 1857, issued the news of its suspension. Like a house of cards the great financial structure of the country came tumbling down. Over-importations, with no comprehension of the effects of heavy and continued gold shipments, joined to over-speculation and high prices, may be said to have been primarily the cause of the disaster. It was more severely felt in Wall Street than its predecessor of a score of years before, for the reason that it affected wider and more general interests. The railroad, initiated in 1830, accepted by 1835, and being pushed in every direction by 1857, was an interest with which, as to-day, Wall Street was identified. By means of the telegraph, then lately brought into use, the dimensions of the panic were thoroughly known in a week. Failures aggregating $291,750,000 were reported for the year, and Wall Street set itself to work to repair the damage. Of what might have been, had the troubles of 1860 never arisen, no one can say; of what did occur history tells us plainly. The government, harassed and embarrassed, turned to Wall Street, and it did not seek in vain. Never did a threatened power obtain freer or more speedy relief. Obligations were fast maturing which the government found no means to meet. Besides this, vast sums were needed to carry on military operations. Not only the national credit, but the national existence, was threatened.

In this emergency, Salmon P. Chase, Secretary of the Treasury, communicated with John J. Cisco, the subtreasurer of New York, to use his utmost endeavors to raise the money necessary to sustain the nation's credit. Mr. Cisco informed the banks of the condition of the national finances and of his instructions from Washington. He pointed out to the leading operators and financiers that within a few days interest on the accruing obligations of the government would have to be paid or it must necessarily go to protest. This was clearly one of the most critical moments in the history of the nation, and the crisis demanded sound judgment and prompt action. The gravity of the situation was clear to the bankers. The collapse of the government's credit would endanger the perpetuity of our very institutions. The foundation of all security was threatened, and the destruction of all values was imminent.

The outlook throughout the Union at that time was dark, while all Europe looked on either in apprehension or in hope that our political fabric was going to pieces. But Wall Street took prompt and united action to extricate the government from its perilous position. The spirit of patriotism was everywhere, and the great financial institutions of the country responded with a heartiness that showed their faith. The old Bowery Savings-Bank, one of the richest, as it was one of the first, of such establishments in New York, voted in February, 1861, to loan one half of all its funds to the government, and this was accordingly done. It is difficult at the present time, when four per cent. bonds of the United States are selling daily in the market at twenty-one per cent. premium, to estimate the courage that was necessary at that period to resolve on such a course as that followed by this bank. Government securities paying as high as seven and three tenths per cent. interest were at that time at a substantial discount, and it is matter of history that the issue, a year later, of legal-tender notes, or "greenbacks," fundable in six per cent. bonds, was largely influenced by the fact that except by such seemingly arbitrary methods the loan could not have been secured with either certainty or rapidity.

In the history of war-time finance, and the measures adopted under stress of the sternest necessity, none was more lasting in its effects, nor greater in the lengths to which it was ultimately carried, than this authorization of the issue of legal-tender notes —"greenbacks." When, in the autumn of 1861, the bankers of the country had paid to the government the last instalment of $50,000,000 of the $150,000,000 in gold loaned, their condition was one of extreme exhaustion. This money, disbursed by the treasury to the army and navy, returned to the banks but slowly, and the result of the drain that it had produced was seen when, on December 30, 1861, the banks suspended specie payment. Of this $150,000,000 in gold thus lent the government in the time of its direst need during the dark days following the disaster of Bull Run, Wall Street may pride itself on the fact that $105,000,000 came from its associated banks. The suspension of the banks complicated the financial situation seemingly beyond extrication. The maintenance of the army and navy, which was synonymous with maintaining the Union itself, was dependent upon a vast sum being raised within three months. Therefore it was as an expedient dictated solely by necessity and not choice that the first Legal-Tender Act, providing for an issue of treasury or government notes to the value of $150,000,000, redeemable in six per cent. twenty-year gold bonds, was passed, and signed by President Lincoln, February 25, 1862. $50,000,000 of this issue, however, was to be in lieu of the treasury demand notes authorized the previous July. An issue of $500,000,000 in bonds bearing six per cent. interest, and redeemable in five and payable in twenty years, was also authorized by this act for funding purposes. The first legal-tender notes issued under the act bore the date March 10, 1862, and none were of smaller denomination than $5. Their effect in easing the pressure upon the treasury was immediate. Within a month another and smaller issue was declared, and on July 11th a second issue of $150,000,000 in notes of the same kind was authorized, and bills of smaller denomination than $5 were authorized. On March 3, 1863, a bill was passed authorizing the $900,000,000 six per cent. loan; but, at the urgent request of Secretary Chase, a clause was inserted leaving it optional with the Secretary of the Treasury to permit the right of holders to fund greenbacks into six per cent. gold bonds. Under this new power greenbacks were funded into sixes until January 21, 1864, when, the original $500,000,000 issue of bonds having been all taken up, the secretary decided that greenbacks in future could only be funded in the five per cents. The effect of this decision was to instantly and seriously depress the value of the enormous paper currency, and in it may be found the cause of much of the manipulation which, using the premium on gold as a leverage, shook and deranged values in the money market for so many years.

It is thirty years now since the war closed, and during that time there has been so much of notable importance linked with Wall Street that only the more prominent events need be mentioned. The speculation in gold, giving the opportunity to unscrupulous operators to manipulate the stock market for their own ends, culminated in "Black Friday," September 24, 1869, when many in Wall Street began business in the morning as rich men and went home ruined. Many versions of the causes have been given; but one thing remains certain: that had not unnatural financial conditions permitted the famous Gold Room to exist, the disaster would never have occurred. It is always a situation of incalculable danger, when a nation's paper is at a discount in her own markets. The next few years saw no abatement of the troubles by which the financial world was beset, and the rally which followed 1869 was but the comparative calm preceding the storm which burst four years later. The great banking-house of Jay Cooke & Co., staggering almost single-handed under the terrible burden of the Northern Pacific Railroad, precipitated the trouble in 1873. Wall Street knew that a catastrophe was imminent, but how to avert it was a problem.

As a bit of the unwritten history of that time, it is related that a representative of one of the great banking-houses in Wall Street, having formulated a plan to relieve the tension, went to Washington to lay it before the Secretary of the Treasury, William A. Richardson. The latter declined to believe in the gravity of the situation, and the banker gained an audience with President Grant, to whom he related his fears of impending trouble and outlined certain measures for relief. So much was the President impressed by the imminence of peril that he not only gave the banker a letter to the Secretary, requesting that official to give him a careful hearing, but the President at once ordered the withdrawal of his own private funds, a great part of which, as it happened, was on deposit with the firm of Jay Cooke & Company. How fortunate this action of the President's was was shown when the very next day the failure of the great banking-house was announced.

The panic which this failure brought on was sharp, as was the rally which followed and overdid itself about ten years later, when over-extension of railroads and incautious speculation brought a relapse. In May, 1884, the failures of Grant & Ward and the Marine Bank first alarmed the Street. A few days elapsed without further serious trouble, and then the Metropolitan Bank closed its doors and the trouble became general. No less than fifteen firms on the Stock Exchange failed during this time.

It was in the panic of 1873 that the wonderful power of the Clearing-House as exercised in the issue of loan certificates was made manifest. This power had already been appreciated as one of the moving causes which had permitted Wall Street to respond so readily to the government's demands for large loans during the war, but its influence as a factor in easing a tense market and relieving the strain of panicky times was first learned in 1873, when certificates aggregating $26,565,000 were issued. Its second great manifestation was in 1884, and its latest in 1893, which, following, as we have, the course of financial crises since 1795, brings us to the present time. This panic, from the effects of which we are but now slowly recovering, had its origin in many causes. Some solvent institutions were forced to the wall through a general distrust which compelled them to realize on good security at a time when the market would not buy. In looking for the causes of this distrust many things must be considered. Tariff changes long impending provoked a general feeling of uncertainty detrimental to our commercial interests. The Silver Purchase Law caused, in addition, distrust of our currency both at home and abroad, causing the foreigner, for that reason, added to his needs on account of failures in South America, Australia, and Africa, to send back our securities for sale, which caused large shipments of gold out of the country. The Interstate Commerce Law and the State Railroad Commission laws decreased the earnings of railroads. The Reading Railroad receivership, which occurred early in the year, was followed by others; the failure of the Cordage Company in April; the failure of Western farm mortgage companies, caused by the inability of farmers to pay interest and principal of their mortgage loans; the failure of banks, caused by an unusual demand for deposits; the hoarding of currency withdrawn from banks, so that the premium on it went up to five per cent., were all causes tending to the general disaster.

The issuance of Clearing-House certificates to the amount of nearly $50,000,000 followed, which tended to strengthen public confidence, or prevent it from being wholly destroyed. All this happened before the people's attention was directed to the modification of the tariff which the election of the new administration and House of Representatives indicated. At and before the assembling of the new Congress in December public attention was attracted to the tariff, and this added to the distress; and together with continued failures of corporations, individuals, and railroads, the year 1893 closed in the midst of gloom. The last week, when the Atchison and New England railroads went into the receivers' hands, was the bluest week the country experienced in its history, unless the blue week in July may be the exception.

Since then Wall Street and the government, or rather the treasury, have been in more intimate relation than at any other time since the Civil War. The real necessity for this close connection is found, perhaps, in those principles of national finance which leave an unprotected treasury to bear the brunt of attacks which it is powerless to avert. In this position no more logical ally than Wall Street could be found, despite the clamor of the uninformed; and in the work of the recent Bond Syndicate, headed by J. Pierpont Morgan, has been given a demonstration of certain important economic and financial principles never before correctly estimated. In the preliminary steps leading up to the formation of the Bond Syndicate of 1895 was demonstrated the helplessness of the treasury, unaided, to control our national finances. A depleted gold reserve in the first month of 1894 was met by an issue in February of $50,000,000 of bonds bearing five per cent. interest, which sold at a sufficient premium to yield $58,661,000 in gold to replenish the waning treasury reserve.

The tide of exchange, always flowing outward in the spring and summer, speedily lowered again the gold reserve. From $106,527,068 in February, the reserve had fallen to $52,189,500 early in August. The movement of the crops turned the tide at this juncture, but by October the reserve was only $61,361,826, or far below its traditional limit of $100,000,000; so a second bond issue was made in November. $58,538,500 was netted by this sale, and the gold reserve stood at $105,424,569. Then came the most significant and disquieting event in all our financial history. At a season of the year when large exports of gold were scarcely to be expected there came a drain upon the treasury such as had never before been known. Distrust and rising excitement were visible everywhere; less than half the gold withdrawn was for export, the remainder was hoarded. In less than two months the gold reserve fell to $44,705,967, and drastic measures were required. It was evident that while the treasury might continue selling bonds, it could not hold the gold in reserve in the face of the prevailing rates of exchange and the wide-spread distrust. Not only was action required that would inspire immediate confidence, but it must be also such as to sustain that confidence by regulating foreign exchange.

This was the problem before the treasury in February, 1895, and the Bond Syndicate, which came forward to undertake the novel task, had far more to overcome than was generally recognized. For this syndicate to supply the treasury with gold was, comparatively speaking, a simple matter; but for them to so protect this reserve that it should not be drained away as the proceeds of the previous bond sales had been was a different matter. Nevertheless this the syndicate undertook to do, and a contract was entered into whereby the treasury bought from them, by an issue of $62,317,500 in "coin" bonds, 3,500,000 ounces of gold, making the amount paid by the syndicate for the bonds $65,117,500. From February, when the agreement was entered into, until the last week in June, when the final payment into the treasury was made and the connection of the Bond Syndicate with the government terminated, this association kept the gold reserve above suspicion, and their final payment left the treasury with $107,512,362. How well they performed their contract is shown in the fact that during April, May, and June, when heavy gold shipments are always made, they so regulated exchange that instead of losing $45,000,000 of its reserve, as the treasury had done during the same three months of the preceding year, it actually increased it by $7,242,963. The method of the syndicate was to meet the local needs for exchange and to sell American securities abroad in sufficient amounts to offset this exchange. This it accomplished from February until the end of July. By that time the movement of the crops should have been sufficient to influence exchange in our favor, but a delay of some three weeks in their shipment caused a brief fall. Nevertheless the power of the Bond Syndicate had been shown. It had done all it had contracted to do, and revived the public confidence at a time when it sadly drooped. It took great risks, accomplished great good, and showed again how far-reaching is the influence of Wall Street. That the reserve of the treasury cannot remain where it placed it is no fault of the syndicate's. The root of this evil lies far deeper—in the fallacies of national finance; and the problem it presents must some day be met and solved.

Without entering into any exhaustive argument of a subject so vast as this, it may be said that at the very base of the trouble are the greenback or legal-tender and United States treasury notes. While the aggregate of these is only about $500,000,000, their actual volume is unlimited, for the reason that they are redeemed only to be reissued. Like an endless chain, these notes running in and out of the treasury drain in a steady stream the nation's gold, of which by far the greater part goes to foreign countries, while our government, confronted with the task of paying out gold to redeem notes it may not cancel, has to borrow that its reserves and credit may be maintained. The nation is in the position where it has to give gold to all comers, but may not demand it for itself, except in the duties of the custom-houses. It is a fallacy which has already caused great loss to our people, and unless speedy action be taken will cause still more. It demands that the treasury exercise banking functions that it was never meant to have; and until these so-called legal tenders are retired it is hard to see how the finances of this country can be either satisfactory or sound.

If Wall Street was the sole reliance for supplies of gold when it was required for export, it could protect itself from too great a drain by raising the rate of discount, which would check imports and stimulate exports, thus giving the danger-signal to the commercial classes, who are directly responsible for the error of over-trading. The United States Treasury, which does not discount commercial paper, but has obligations outstanding in the form of legal tender or treasury notes redeemable on demand, has no means of protecting its reserve, which must be paid as long as the demand for it continues or until its stock of the metal is exhausted.

The work of the Bond Syndicate closes the chapter of memorable events by which Wall Street has risen to its present importance. A century ago Lombard Street was the center of the world's moneyed interests; Wall Street hardly had an existence. To-day it rivals the former in many respects. The Paris Bourse and the great centers of Berlin and Vienna are as intimately connected with Wall Street as with one another. A flurry in one center reflects itself within the hour in all the others. The Old World is coming to regard American securities as the best and safest outlet for her investors. At the present time Wall Street most certainly is the channel leading to the richest and most profitable fields of enterprise in the world. The railroads, commerce, mines, and industries of our continent serve as her sources of supply, and in their development has been and will be still greater wealth.

If in tracing this sketch of Wall Street I may have seemed to infringe in some degree upon the domain of national finance, it must be remembered that the two are indissolubly linked together, and in the integrity of both lies the great safeguard of our country's prosperity.

John P. Townsend.

CHAPTER XIII

ADVERTISING IN AMERICA

THE development—yes, even the continued existence—of every industry described in this work depends on the dissemination of information concerning it, and the resulting knowledge of what it is and what it is doing. Such dissemination of information is advertising.

It may take myriad forms,—traveling representatives; exhibits at fairs, by window displays, or in the stores of the retailers; distribution of samples; circulation of catalogues, circulars, or other printed and lithographed matter; advertisements in newspapers; signs, stationary and movable; use of "novelties,"—but whatever it is, it is all advertising, and, for want of a better term, may be defined as "an effort to cause others to know," and which it is hoped will also cause them to remember and do.

Emerson says we should read history actively rather than passively; that is, we should treat it as a commentary on our own lives. While much history has in it nothing in common with our surroundings or purposes, and cannot, therefore, yield us anything of direct value, the history of advertising, being a record of the adaptation of business methods to modern business conditions, is peculiarly rich in helpful information, and a careful study of it in the manner Emerson suggests should greatly benefit the modern business man.

The advertising of the pre-printing period had, of course, to be adapted to the conditions of that age; the crier, the carved sign, the crude poster, were then the best means of conveying information to the public. Even after the advent of the printing-press and the newspaper the development of advertising necessarily awaited the general education of the masses. Book and paper were alike valueless to those who could not read. How slowly conditions changed may be gathered from the fact that the Boston "News-Letter," the first paper in the country to maintain publication, had only 300 subscribers in 1744—forty years after its establishment.

A century's history of advertising in the United States is a story of wonderful development; but so marvelous has been its growth during the last fifty years that the record of the other fifty now seems scarcely more than one of mere existence. American advertising has advanced along many lines, concerning each of which much of interest might be written.

Inasmuch as it has been estimated that more than seventy-five per cent. of the amount expended for American advertising is now paid to the newspapers,—in which term are included the magazine, the trade journal, and all other publications of the class known as periodicals,—we will speak first of newspaper advertising.

The wider use which it has attained over all other methods is not to be accounted for on the ground that newspaper advertising is a fashion or a fad. Its wonderful use to-day, and the still more wonderful future which awaits it, have for their enduring foundation the fact that newspaper advertising appeals to human intelligence by the great method through which information will for all time be communicated—the printed page. The plain millions of America are an ever-reading, ever-wanting, ever-buying people, and the business man who realizes all three of these facts can but recognize the reasonableness of newspaper advertising as a means of telling others what he has and what he is doing.

Newspaper advertising could not, of course, exist apart from the newspaper press. So closely are they related, that the growth of the former cannot be adequately set forth without some reference to the latter. This accounts for the appearance here of a few newspaper statistics, which may be found in more complete form in the able article on newspapers elsewhere in this work.

In 1795, at the beginning of the period covered by this work, there were in this country about 200 newspapers. In 1810 there were 366; in 1820, 700 (estimated); in 1830, 1000 (estimated); in 1840, 1403; in 1850, 2526; in 1860, 3343; in 1870, 5871; in 1880, 11,314; in 1890, 17,712; in 1895, 20,217. Dividing the century equally, the growth in each half is about 1000 per cent.

It will be interesting at this point to consider the position which the United States occupies in relation to the rest of the world in the extent of its newspaper press. Comparative statistics of this character have been gathered only three times. The first effort was in 1828, when the number of newspapers and periodicals in the world was 3168, of which 800 (twenty-five per cent.) were published in America; in 1866 the total number was estimated at 12,500, and of these America claimed 5000; the count made in 1882 showed a total of 25,766, of which

The Daily Advertiser.

New-York, Saturday, March 7, 1795. Printed by FRANCIS CHILDS, Printer to the State. No. 71, Pine-street, corner of Water-street.

11,000 were published in the United States; at the present time the whole number is probably in the neighborhood of 40,000, of which more than one half are published in this country.

The first daily in the United States was the "American Daily Advertiser," of Philadelphia, established in 1784, of which the "North American" of that city is the direct lineal descendant. The following year the "Daily Advertiser," New York, was started. We reproduce on preceding page the first page of this paper, date of March 7, 1795. To-day we have upward of 2000 dailies.

The first newspaper advertisement in America appeared in the Boston "News-Letter," established in 1704, a two-page paper, printed on a sheet eight inches by twelve, two columns to the page. It had but one advertisement, which read as follows:

"This NEWS-LETTER is to be continued Weekly, and all persons who have any Houses, Lands, Tenements, Farms, Ships, Vessels, Goods, Wares or Merchandizes, &c., to be Sold or Let; or Servants Runaway, or Goods, Stole or Lost; may have the same inserted at a Reasonable Rate from TWELVE PENCE TO FIVE SHILLINGS AND NOT EXCEED. Who may agree with John Campbell, Postmaster of Boston. All Persons in Town and County may have said NEWS-LETTER every Week, Yearly, upon reasonable terms, agreeing with John Campbell, Postmaster for the same."

The earliest recorded instance of the publication of any number of advertisements was in the "New England Weekly Journal," of Boston, established in 1728, a two-page sheet, seven inches by thirteen. The news in this paper was all foreign, and from three to four months old. The advertisements were of books, coffee importations, runaway slaves, sales of negro girls, and a notice of a school for negroes. Beyond this there was nothing but obituaries and the sailing and arrival of vessels. But notwithstanding these early instances of the use of advertisements, American advertising cannot be said to have begun before 1788, and then only in a very humble way, the advertisements being confined almost entirely to the classes just enumerated. These conditions continued until about 1820, when greater prominence began to be given to news. Hitherto the columns not devoted to advertising had been largely filled with elaborate treatises on party principles and politics, and articles on literary and scientific subjects; but as the news columns became fuller and more interesting, the number of subscribers and readers increased, and the growth of the advertising patronage kept pace with both. The rapid increase of newspaper advertising may, however, be said to date from the establishment of the "Sun," New York, in 1833; the "Herald," New York, in 1835; the "Public Ledger," Philadelphia, in 1836; and the "Tribune," New York, in 1841.

Leading metropolitan papers of to-day carry during the week from fifteen to forty columns of advertisements, while their big Sunday editions frequently have over 100 columns each. In a recent examination of an ordinary week-day issue of ten leading dailies selected from different sections of the country, the space occupied by advertisements ranged from twenty-five per cent. to seventy per cent., the average of the ten being forty per cent.

In the beginning of the century advertising was almost exclusively local; but to-day newspaper advertising divides itself, naturally and perhaps quite equally, into two classes—local and general. Local advertising portrays the activities of the locality. These find expression in the myriad "want" advertisements and other classified announcements, for the gathering of which numerous branch offices are maintained, and the services of local and district telegraph companies employed; and as well in the large daily announcements of the leading retailers, from some of whom single papers are said to receive an annual income approximating $50,000.

General advertising, on the other hand, voices the enterprise of the business man anywhere who believes he has that which is really wanted otherwhere. By such advertising, and with moderate outlay, almost numberless articles, otherwise little known, have been brought into general use throughout the country, and in like manner some of the most remarkable commercial successes of the century have been achieved. General advertising ranges from the advertisement of the dealer, who seeks to make direct sales to the consumer, to that of the manufacturer who annually expends from $500,000 to $750,000 to acquaint people with the name and merits of an article which can be procured only through the retailer. It has grown of late years to such dimensions that many papers find it profitable to employ one or more representatives whose only duty is to present the claims of the publication to advertisers.

Just as the marvelous strides by which American journalism has outstripped the journalism of all the rest of the world could never have been possible except for the marvelous patronage of American advertisers, so there would never have been such wonderful growth in advertising except for the men whose ability and energy have been entirely and untiringly devoted to the promotion of newspaper advertising. From the small beginning of special representation of a few papers, there has grown the advertising agency system of to-day, which well deserves recognition among American industries. There are probably more than fifty concerns in the United States trading as newspaper advertising agents, and to at least thirty of them the leading mercantile agencies accord recognition and commercial rating. The aggregate of capital invested runs into the millions, and one or more representatives of the industry are to be found in every prominent newspaper center.

The first beginning in this line was made in Philadelphia, in 1840, by Volney B. Palmer, who afterward established branches in New York and Boston. The S. R. Niles Agency was an outgrowth of the Boston branch, and, with a record of honorable dealing through all these years, still continues business. Mr. W. W. Sharpe, of New York, commenced as a boy in Mr. Palmer's employ, and to-day does business under the style of W. W. Sharpe & Company. Mr. S. M. Pettingill, of New York, was also employed by Mr. Palmer, and with Mr. Bates carried on the business there established. The Bates & Morse Advertising Agency was their legitimate successor, and this business is now continued by the Lyman D. Morse Agency. The business at Philadelphia was likewise carried on continuously and with constant growth, until in 1878 it was absorbed, by purchase, into the business of N. W. Ayer & Son, who are to-day recognized leaders in this line. Some idea of the magnitude of their business can be gathered from the fact that their outlay for clerical help during 1895 will fall little, if any, below $100,000.

As in the enormous growth of the advertising interest the advertising agency became an important factor as well as a necessary result, so the newspaper guide or directory was a necessity to, as well as an outgrowth of, the exigencies of the agency. At the first the agencies guarded with jealous care their lists of the papers of the country, but the rapid multiplication of papers soon necessitated printed lists; and as the preparation of these lists necessitated the expenditure of large sums of money, the agents finally concluded to give them to the public, and solicit advertisements from the newspaper publishers to help pay their cost.

The first attempt was the "Newspaper Record," containing lists of newspapers and periodicals in the United States, Canada, and Great Britain, by Lay & Brother, Philadelphia, in 1856. The first permanent publication of this character, however, the "American Newspaper Directory," was started in New York, in 1869, by George P. Rowell & Company, newspaper advertising agents, who have continued the publication regularly to this date. In 1880, N. W. Ayer & Son, of Philadelphia, began the publication of the "American Newspaper Annual," which has been regularly issued since. In addition to these two directories, Pettingill & Company, of Boston, publish a very commendable handbook, while Dauchy & Company and J. Walter Thompson, of New York, and Lord & Thomas, of Chicago, all widely known advertising agents, with some others of lesser repute, publish manuals, more or less pretentious, varying in contents and make-up according to the publisher's conception of the needs of the advertiser.

Perhaps no better general idea can be obtained of the great extent of the newspaper press of the United States, and of the vastness of its advertising patronage, than by an examination and study of the most complete of these publications. It is almost impossible for one not familiar with the book to appreciate the amount of labor and expense which its annual revision involves. Hourly changes are going on in all parts of the country: changes of location, changes in editors, changes in size, price, or day of publication; consolidations; removals; suspensions. When it is known that about 4000 publications are started annually, and that, owing to suspensions and consolidations, the net annual increase in seasons of business prosperity ranges from 750 to 1000, even the uninitiated can appreciate in some degree the immensity of the undertaking, and the greatness of the industry that renders the publication of such books not only advisable, but absolutely necessary. The newspaper directory is as essential to the general advertiser as are the reports of the great mercantile agencies to the business man.

An important factor in the spread of advertising has been the coöperative newspaper, known to printers and advertisers as "patent insides" or "patent outsides"—a system which has had all its growth within the last twenty-five years. Under this system half-printed sheets are supplied to the offices from which, after the printing of the other half, the papers are issued. The cost of type-setting is reduced to a minimum, because the reading matter, with slight variations, is the same in all papers issued from any one house. This and the wholesale purchase of paper, together with the income from the advertising, make it possible to supply the half-printed sheets at a price scarcely more than the ordinary cost of white paper. It is readily apparent that this whole system is contingent upon newspaper advertising. Except for the income from the advertising, the system could not exist. Except for the system, hundreds of small places over the country could not sustain the local papers which they now issue. There are at present nearly 8000 such papers published,—more than one third of the entire number of the newspaper press of the country,—and consequently a large amount of money is annually expended for advertising in them.

Magazine advertising is only about twenty-five years old. Although there were successful magazines before that time, they did not admit advertisements. It was with the appearance of the "Century" (then called "Scribner's Monthly"), in 1870, that the new order of things came in. Its first number contained advertisements, which have steadily increased in quantity, until its issue of December, 1894, contained 134 pages of them. In 1882, after thirty-two successful years without them, Messrs. Harper & Brothers yielded to the inevitable and began the insertion of advertisements in their "New Monthly Magazine." Here, too, the increase in quantity was rapid, reaching 144 pages in the number of December, 1894. At the page rate of $250 the advertising income of such an issue would be $36,000. Putting the average amount of advertising the year through at 92 pages per month, the advertising receipts of this one magazine for one year would reach $276,000. It is estimated that the December, 1894, issues of six leading monthly magazines represented an advertising investment of more than $180,000. There are, of course, a great many other excellent publications of this class which cannot here be mentioned, but which are widely recognized as advertising mediums of great value.

It is said that Mr. Gladstone prefers the American to the English edition of such of our magazines as print both, for the reason that the advertisements in the American editions are so interesting, and set forth so clearly the enterprise and progress of our country. Thousands of people have made the same discovery as the great English statesman and student of human affairs. The truth is that the public has to-day a great and growing interest in the information which we call advertising, and the newspapers and periodicals themselves would feel bound to print much of it as news, did they not print it in the form of advertisements.

The trade journal is an interesting illustration of specialization. Starting with the papers which attempt to set forth the condition and movement of trade in general,—of which class the "New York Prices Current" (from an old issue of which we reproduce a page) was one hundred years ago, as it is to-day, a good example,—it has followed the branching out of each particular industry, keeping close step with its progress, until to-day there is scarcely a manufacturing or commercial interest but has its representative journal, and often several of them, whose reading and advertising columns alike are of value chiefly to its own special class of readers.

In early days a certain amount of advertising went with each subscription. For instance, one hundred years ago the payment by a merchant of a certain sum to the "Shipping List" as a subscription, carried with it the privilege of the use of all needed advertising space during the same period. That this privilege was not overworked is perhaps as forceful proof as can be given that the value of such advertising yet lacked recognition.

That space itself then had no fixed value may be seen from the announcements in the "New Jersey Journal," of Elizabethtown, on January 16, 1790, that "advertisements of A MODERATE LENGTH will be inserted three weeks for eight shillings, and two shillings for each insertion afterward."

While newspaper space to-day very often sells at a fixed rate, the fixing of that rate is very arbitrary. The most mentioned factors are quantity of circulation, character of readers, and control of the field. The price of newspaper space has advanced greatly with its wider use. The "Herald," New York, and "Public Ledger," Philadelphia, having always enjoyed liberal advertising patronage, are good illustrations of this. Established in 1835 and 1836 respectively, they both at first charged for advertising fifty cents per square per insertion. The square was for a long time the unit of measurement, and fifty cents was for a long time the rate per square; but the square itself gradually shrank in size with the flying years, until from being nineteen agate lines in 1836 in the "Ledger," in 1863 it equaled only four agate lines. This, of course, was twelve and one half cents per agate line. The minimum price soon climbed to twenty cents in the "Ledger" and forty-five cents in the "Herald," at which it stands to-day, showing an increase in the sixty years of 750 and 1800 per cent. respectively.

While the price of advertising has been advancing, the size of the papers has been increased many times also. These enlargements have in almost

Francis Wayland Ayer.

every case been made necessary by the encroachment of the advertising upon the reading columns. In some instances the paper would become three fourths advertising, then an enlargement would follow which would relieve the condition until the ever-flowing, ever-growing stream of trade again filled its columns. The average daily edition of the "Herald" and the "Ledger" is now perhaps eleven times the size of their first number, with the advertising barometer steadily on the rise. In this respect the two papers named are not exceptional, but rather good examples of prosperous journals the country through.

The development of newspaper advertising has been so rapid that many newspapers themselves have not yet caught up with it; that is to say, while they all freely recommend it to other people for the improvement of their business, but comparatively few employ it for the development of their own. This, of course, refers to advertising in other journals —not to the exploiting of a paper in its own columns. There are, even now, conspicuous exceptions to the rule above stated. A number of the most successful publications have obtained very unusual circulation, in very unusual time, by means of advertising in the columns of their contemporaries. A notable instance is the "Ladies' Home Journal," of Philadelphia, whose 750,000 circulation has been largely obtained and maintained by newspaper advertising.

The New-York *Prices Current.*

Publiſhed every MONDAY by *JAMES ORAM,* No. 33, Liberty-ſtreet, near Mr. *Carry Dunn's.*

3 *Dlls. per ann.*] MONDAY, JANUARY 9. 1797. [No. 55.

CHAMBER of COMMERCE.
Monthly Committee.

THEOPHYLACT BACHE,
ROBERT BOWNE,
CHARLES L. CAMMAN,
WILLIAM CODMAN,
DAVID GRIM.

NEW-YORK PRICE of STOCKS,
MONDAY, *Jan.* 9.

U. S. Bank Stock,	12 p. ct.
New-York, -	28
6 per Cent. -	16/3
3 per Cent. -	9/3
Deferred, -	19/9

COURSE of EXCHANGE.
MONDAY *Jan.* 9.

Bills on London, 60 days ſight, 5 per cent. under par.

On Amſterdam, 60 days ſight, 40 cents per guild. at 60 days credit.

WHOLESALE PRICES, carefully corrected—In Dollars and Cents.

		From D. C.	To D. C.
ASHES, Pot,	Ton.	190	195
Pearl,	—	none.	
Allum, -	Cwt	7 50	8
Almonds, -	lb.	21	22
Anchors, -	—	9	10
Arrack, -	Gal.	none.	
BACON, -	lb.	12	
Barley, (Scotch) -	—	7	8
Beans, white, -	buſh.	1 37	
Beef, Cargo, -	bbl.	9 50	10
Prime, -	—	10 50	11
Meſs, -	—	11 50	12
Brandy, Fre. 1ſt proof	Gal.	1 50	
2d proof,	—	1 56	
3d proof,	—	1 66	1 68
4th proof,	—	1 81	2 87
Spaniſh, 1ſt proof,	—	1 37	1 44
2d proof,	—	1 50	
3d proof,	—	1 59	
4th proof,	—	1 75	
Braziletto, -	Ton.	75	80
Bread, Pilot, -	Cwt	9 50	10
Middling,	—	7	7 50
Ship, -	—	4 75	5
Crackers, -	Keg.	75	81
Bran, (ſtruck meaſ.	buſh.	27	
Brimſtone, Roll, -	Cwt	3	
Butter, for export.	lb.	13	14
CANDLES, dipt,	lb.	15	
mould,	—	17	
Sperm.	—	53	
Caſſia, -	—	50	
Capers, -	Bott	40	47
Caſtor, -	lb.	1 50	1 87
Cinnamon, -	—	2 50	

		From D. C.	To D. C.
Cheeſe, Engliſh, -	—	25	31
American,	—	8	10
Chocolate, -	—	25	
Cloves, -	—	1 25	1 37
Coal, Foreign, -	Chal	10	10 50
Virginia, -	—	9	9 50
Cocoa, Surinam, -	Cwt	11	22
Iſland, -	—	20	
Copper in ſheets, -	lb.	29	
Copperas, -	Cwt	2 25	2 50
Coffee, for export.	lb.	20	28
Cordage, -	Cwt	13 75	15
Currants, -	lb.	6	8
Cotton, Georgia,	—	28	
Bahama,	—	35	
W. Iſland,	—	30	
St. Domingo,	—	32	37
Demarara,	—	35	37
Surinam,	—	36	40
Cayenne,	—	37	42
DUCK, American,	Bolt	12 50	
Ruſſia, -	—	15	18
Ravens, -	—	12	12 50
Engliſh, No. 1,	yard	34	36
Ruſſia Sheetings,	Piece	17	17 50
FLAX-SEED, -	Buſh	2 50	
Flax, -	lb.	11	14
Feathers, -	—	53	62
Fuſtic, -	Ton.	20	25
Fiſh, Cod, dry, -	Quin	5	
do. pickled, -	bbl.	5	5 50
Salmon, -	—	9 50	10
do. ſmoaked,	Piece	40	45
Mackarel -	bbl.	9	
Herrings, -	—	5	5 25

		From D. C.	To D. C.
Flour, Superfine, -	bbl.	11	
Common, -	—	10 50	
Virginia Flour,	—	10	10 75
Middling, -	—	6	8
Cornell, -	Cwt.	2	3
Buckwheat,	—	3 50	
Rye, -	bbl.	7	
Indian meal,	196	5 61	5 75
Furs, Otter, -	Skin.	1	4
Fiſher, -	—	25	1
Miok, -	—	6	37
Martin, -	—	18	60
Red Fox, -	—	25	1 25
Croſs Fox, -	—	50	3
Grey Fox, -	—	19	75
Wild Cat, -	—	19	62
Luciſe Cat, -	—	50	3 50
Muſkrat, -	—	6	34
Raccon, -	—	6	62
Bear, North.	—	75	4 50
Wolf, -	—	25	1
Beaver, North.	lb.	2 25	2 50
do. Northweſt, (beſt)	—	3	
GENEVA, Holland	Caſe	6 25	
Caſk,	Gall.	1 18	1 25
Grain,			
Wheat, North.	Buſh	none.	
South.	—	1 87	
Rye, -	—	1 12	
Barley,	—	none.	
Oats, -	—	50	53
Corn, North. (new)	—	1	
South. (old)	—	1 [illegible]	[illegible]
Gunpowder, Engl.	lb.	62	80
American,	—	45	60

Some attempts have lately been made to introduce color-work into the display of newspaper advertisements. This has generally taken the form of covers for special editions of newspapers and periodicals. Quite recently a large newspaper advertiser has been using color printing on colored paper for inserts in the leading magazines. This is regarded as a significant innovation. The wide use of color printing in the regular issues of daily papers, however, awaits the overcoming of mechanical and financial obstacles.

We have no means of knowing what was the value of the advertising in the newspapers of 1795, but the Tenth United States Census gives the value of advertisements in the American press in 1880 at $39,136,306, and the next census shows that these figures had increased in 1890 to $71,243,361—a gain of eighty-two per cent. in ten years. We are justified in believing that the value to-day is considerably over $100,000,000—a notable result of a century of progress!

Perhaps nothing has done more to develop newspapers, and therefore newspaper advertising, than the railroads, whose remarkable story is told elsewhere in this volume. Perhaps, also, nothing has done more to develop the railroads than the newspaper. Each without the other would seem to be as ineffective as a half-pair of scissors; but worked together they have cut the restraining cords of environment and made possible the greatest national and individual prosperity. With the newspapers to tell of affairs and trade, and the railroads to carry persons and things, in spite of our wide territory, we really touch elbows with one another, and the future greatness of our commercial interests is beyond prediction. But of one thing we may feel certain: "the best is yet to be."

When the business man of an earlier time put an advertisement in the newspapers, what he inserted was often an inventory of his leading articles—a sign, so to speak, showing the nature of the business carried on at the address indicated. The preparation of such an advertisement required no special ability. Then, again, he generally expected what he put in the paper to stay there for a long time. This fact also contributed to make his newspaper advertising of very little trouble to him.

But a change of ideas of what an advertisement should be, and how it should be used, brought into existence what are to-day two prominent features of advertising, viz., the advertisement writer and the paper devoted to advertising. The advertisement writer is an outgrowth of very recent years. The fierceness of competition and the increasing cost of newspaper space have made attractive, interesting, truthful, and convincing advertisements a necessity. The advertisement writer studies to supply this need. That he well supplies it must be evident to any reader of to-day's advertisements. Many an advertisement now represents far more thought than has been used in a corresponding space in any other part of the publication.

The good advertisement writer must of necessity be able to see and to tell very clearly. The really capable ones are in demand, and receive good pay. Some business houses employ one exclusively; others use the services of those who write for any one on order. The leading advertising agencies also have them in their employ. Their work is telling for the better on American advertising.

Papers devoted exclusively to the subject of advertising have appeared in the last ten years. There are to-day perhaps a dozen of these, the largest number of them being connected more or less intimately with some particular advertising agency. In so far as they point out methods of proved success, publish unbiased statements, and call wider attention to the common-sense nature of newspaper advertising, they do the community a service; but to whatever extent they air the foolishness of the "ad. smith," with his "catchy" and "fortune-bringing" advertisement, or circulate ill-informed or ill-intended criticism, they do injury to the greatest business-getting method of modern times. We believe those familiar with them will agree that these journals are as a class growing broader in their treatment of newspaper advertising, better recognizing its seriousness and its dignity. They certainly have great responsibility, as they receive very careful reading and are the exponents of a most useful business idea.

The trade catalogue, always a useful business adjunct, has in recent years been transformed into what is often a work of beauty and interest, reflecting credit on all concerned, and materially increasing trade. The "descriptive circular" which the advertiser of other days was wont to offer his readers has been to a large extent superseded by the business primer, booklet, or brochure, which is now a distinct feature in general advertising. It grew out of recognition of the fact that everything cannot be told in an advertisement. Perceiving that the prime object of a newspaper advertisement is accomplished when the reader has by replying to it singled himself out from the mass of mankind and placed himself within reach of correspondence or representatives, the bright advertiser employs these publications to give details and to further or complete sales. To their preparation the best writing, illustrating, and printing skill is often brought, with the result that their value in advertising has now become widely recognized. It is impossible to estimate closely the amount annually expended in advertising matter of this class, but the figures are certainly enormous.

Reference should here be made to lithographic printing, which now covers an annual expenditure estimated at more than $15,000,000. Most of this output is intended for advertising purposes. Cards, folders, hangers, banners, albums, booklets, and posters are produced by the million. The work as a class is artistic and attractive, while competition and ingenuity have greatly cheapened its cost and widened its use.

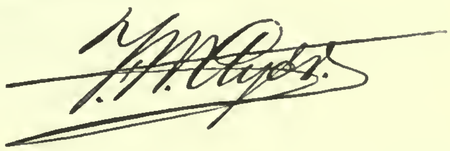
The use of posters for advertising is of course very old. The practice has not only grown greatly, but many of the posters themselves have of recent date possessed great artistic merit. The poster, as its name implies, was originally an announcement intended to be posted or put up in a certain place, and it was therefore for a long time confined to local use. About twenty-five years ago it transpired that the effectiveness of a poster was often increased by its being placed in unusual positions. This led to sign painting, which in turn has become a recognized method of general advertising. To-day the most effective and ingenious use is made of blank walls, barns, etc., for acquainting the public with various articles. The employment of natural scenery as a background for this work has fallen under public disapprobation, and appears to be going into disuse.

Another development of this outdoor work is the erection and painting of large bulletin-boards along the lines of railroads and great travel. These are leased by the year to advertisers. Such a sign-board, thirty feet long and four feet high, costs the advertiser $30 a year. Perhaps $1,250,000 are spent annually in all kinds of out-of-door painting, exclusive of the bill posting above referred to.

Street-car advertising may be said to be a development of the last fifteen years. During the first half of this period it received practically nothing but local patronage. About seven years ago the invention of the now everywhere common curved car-rack, because of the uniformity in the size of cards which it secures, opened the method to the use of general advertisers, who were not slow to avail themselves of it. From that time the growth has been very rapid, until to-day there are perhaps in this country 15,000 street-cars carrying advertisements. At $100 per year per car this would make the annual advertising expenditure $1,500,000.

Enterprise is ever seeking expression. Advertising has always been the expression of enterprise. The few meager, colorless announcements of 1795, written with a dull and heavy pen, fittingly expressed the enterprise of that day. At the close of a century of marvelous progress the enterprise of to-day finds expression in advertising of every conceivable form, in every available place, in the preparation and illustration of which have been combined the best obtainable skill of hand and brain.

Great as has been the evolution of a hundred industries in a hundred years, wonderful as has been the advance in the arts and sciences, the printing-press has always led the way, and is to-day the herald and helper of them all. Its usefulness will still further increase with the discharge of its duty, which will be to tell the story of the better things which the opening century will unfold to the better-seeking millions of America.



CHAPTER XIV

FIRE AND MARINE INSURANCE

AMERICAN fire and marine insurance business had its birth at about the close of the eighteenth century. Both kept in the forefront of American affairs for many years, but marine insurance suffered heavily when the American flag began to disappear from the high seas. For the past quarter of a century it has had a hard struggle to keep itself anywhere near the old standard of prosperity. To do this it has had to draw for the greater part of its returns upon foreign commerce, and been forced to compete with English companies. Fire-insurance has not, as a whole, fared much better.

So distinct are the differences in the business operations of these two lines of insurance that it is necessary to treat of each separately. The theory of fire-insurance is exceedingly simple—it collects from the many and distributes to the few, relying for its profit upon an intelligent calculation of the chances of fire and the collection of more than it distributes. The sources of profit are twofold: first, interest upon invested funds; second, excess premium receipts over losses and expenses.

Reviewing the history of fire underwriting for the past century, it cannot be classed as one of the profitable departments of business activity. A certain number of companies have been successful, but only a very insignificant percentage of the various companies organized in the United States during the past century have sustained life for a score of years. Only one American company which was in existence in 1795 is now in successful operation. It is the Insurance Company of North America, of Philadelphia, organized in 1794, and which now has a cash capital of $3,000,000, with total assets of nearly $10,000,000.

The large conflagrations of the century at New York, Chicago, Boston, Philadelphia, Portland, and Pittsburg each in turn crippled all interested companies and ruined many; but, as experience is a dear but a sure teacher, these fires brought about needed improvements in municipal fire departments, and led to new safeguards in underwriting. At the time of the great New York fire in 1835 there were about forty companies doing business in the city, and all but two found themselves hopelessly in debt when the blaze had burned itself out. The two companies spared were the Bowery Fire and the Jefferson, which had not taken many risks downtown, in which section of the city the fire raged. To save the companies from utter ruin the legislature passed an act on February 20, 1836, allowing them to take what assets they had and pay their losses, without interfering with their charters. This privilege was granted for a limited period. About ten companies availed themselves of this opportunity, and then obtained a new capital and continued in business. Twenty-eight of the remaining thirty companies never recovered from the blow. The company paying the greatest percentage of losses was the Howard, which gave fifty-eight per cent. To-day there are only two companies—the Eagle Fire and the North River—in existence that survived the conflagration of 1835. Ten years later there was another great fire in New York, in which the damage was also large; but neither the public nor the insurance companies suffered as much comparatively, owing to more careful underwriting. The fire of 1845 brought about a schedule of new tariff rates, which lasted until 1850.

The Chicago fire of 1871 was the most disastrous conflagration underwriters have ever known. It has been accurately estimated that $118,000,000 worth of property was destroyed, on which the insurance amounted to $92,000,000. Of this sum companies outside of the State of Illinois had written $58,144,000, and while the exact amount held by Illinois companies could never be ascertained, it was calculated to be $33,878,000. $39,233,000 was paid to the assured by the companies outside of the State. About every insurance company involved in the fire

HENRY H. HALL.

was forced to make assessments on its stockholders in order to live. Credit is due to the Liverpool, London & Globe Insurance Company for their promptness in paying the amount of their losses at Chicago; but to the Home of New York, Ætna of Hartford, as well as to many other American companies, equal credit is due. The strength of many American companies was manifested by this severe trial, and the necessity for foreign capital was fully demonstrated. It is safe to say that over one hundred companies were driven to the wall, while every company in the State of Illinois was wiped out. Shortly after the Chicago fire came the great Boston fire, both preceded by the one in Portland, each adding its proportion to the general wreck of fire-insurance companies.

It may therefore be very readily seen that the business of fire underwriting in the United States for the past century has been done at a loss, and the most successful companies, as a whole, have not retained more than simple interest upon their capital and invested funds. The question has been asked many times, Why cannot this important interest be placed on such foundations as to present a reasonable hope of profit to capitalists on their investment? The chief obstacle to this attainment has been the ignorance of legislators. Every year the fire-insurance interest runs the gauntlet of the legislatures of all the States, protecting themselves from attacks made with a persistency born of ignorance, suspicion, and prejudice. Every recurring legislature is freighted with schemes without number to "regulate" the fire-insurance business. To the average legislator there is just enough mystery about the business to tempt him to the same mental exertion he displays on the "Thirteen Puzzle" and in squaring the circle.

Every insurance company must exhibit for publication its premiums and losses in every State where it transacts business, and every detail of its management is open to public inspection. It is a blow to all originality, a handicap to enterprise, when skill and knowledge gained by experience are thus given to every competitor; but this, even, does not satisfy our lawmakers. Various schemes of taxation are devised, State and municipal, to which are added all the forms of restrictive legislation that the mind of man can conceive. In many States insurance companies are denied recourse to the United States courts, must submit to policy forms drafted by the various legislatures, and are compelled to adopt such methods of loss adjustment as can be comprehended by the feeblest lawmaking mind. The history of fire underwriting for the past century is a record of the incapacity of American legislators.

The aggregate fire premiums collected annually in the United States amount approximately to $140,000,000. This is a tax levied upon every property owner in the United States. If complaint is made of the expense of continuing the fire-insurance business, it should be recalled that the fire-insurance capital of the world is at the command of the resident of the smallest village. With few exceptions, the largest manufacturing plant can secure in the village in which it is located ample insurance from the strongest companies in the world; and if loss occurs, the same is adjusted and paid on the ground. To afford these facilities vast and expensive organizations are necessary. Every important insurance company has a large staff of special agents and adjusters, and in addition to this there are many associations to advance the interest of associate companies. Among these is the National Board of Fire Underwriters, composed of the leading companies of the country, which was organized in 1866. The chief work of this organization is on the line of public benefit, such as the recommendation of proper building laws to the various municipalities of the country; the inspection of all fire departments, with suggestions for their improvement and the increase of their efficiency; and the arrest and punishment of incendiaries. Through the efforts of this board the people have been educated as to the true economy of good building laws and efficient fire departments. Within the past few years the board has maintained an electrical bureau, and by experiments and investigation has done much to minimize the hazard incident to the general use of electricity for light and power. With great labor and expense it is endeavoring to awaken public interest to the great drain on the national resources by the annual fire waste, so large a portion of which is due to careless building and lax municipal administration. In addition to this organization the fire underwriters maintain in every State and in every town local boards of underwriters, for the collection of statistics, upon which equitable rates can alone be predicated.

Through the influence of the New York Board of Fire Underwriters a paid fire department for the city of New York was secured. The fire-insurance companies are also maintaining, at their own expense, fire patrols in thirty of the large cities. These patrols are established by law, and supported entirely by the fire-insurance companies transacting the business in their several localities. New York City was the pioneer in the establishment of these organizations, and they are organized to protect life and property at fires, regardless of the insurance interest therein; and the New York Board of Fire Underwriters has already distributed numerous gold medals to its patrolmen for heroic efforts in the saving of life. Fire underwriters stand unrivaled by any form of purely business association in their successful efforts for the general good.

Reviewing the history of fire underwriting for the past century, there can be observed a steady advance in the methods and practice of the business. There must always be an element of chance in its conduct, but there has been a gradual advance to a more scientific basis of action. In the past fifty years there has been a complete change in the controlling principles of the business. The older method was to "accept the risk as you find it," and charge accordingly. The more modern method is to suggest improvements, with a view to a lower rate and larger liability. To make this more clear, in days past, underwriters would accept a small "line" on a poor risk at a high rate; but the present method is to decline it altogether and suggest improvements, and, when made, give a lower rate and larger line.

The fire underwriters now maintain several very expensive organizations of expert surveyors for the sole purpose of instructing manufacturers as to the best means of fire protection, that the lowest rate of fire-insurance may be secured. This entire change of method is due to the influence of the New England system of mutual insurance; and it is but simple justice to these companies, of which Edward Atkinson is now the official head, that this recognition should be made.

The conflict between projectile and armor-plate is no more interesting than the constant combat between increase in the size of buildings and growth of cities, and the improvement in fire-extinguishing facilities shown by the development of the New England system. The inception of this system was due to the lack of proper recognition by stock companies of improved appliances for the-extinguishing of fire. A manufacturer, having introduced a fire-pump in his mill, asked for a reduction of rate for this appliance. It was denied. Other manufacturers were interested, and, having equipped their mills with fire-pumps, a mutual company was organized; and from that time there has been a constant study to reduce the fire hazard, and to secure insurance indemnity at least cost by the agency of a mutual system. From a simple pump to perforated sprinklers, thence by various improved devices to the present perfected automatic sprinkler head, were gradual steps in the line of defense against fire.

The general introduction of automatic sprinklers has not only reduced the fire waste, but will eventually (with slow-burning construction) revolutionize the practice of fire underwriting; for, with less liability to fire, the stronger companies will increase their acceptances on individual risks, thus concentrating the business in a smaller number of companies, and reducing competition and expense.

Starting from the change in the conception of the province of the underwriters, the advance to the present practice is plain and logical. In former times the underwriters would promulgate minimum rates for various classes of merchandise—sole-leather, package dry-goods, etc. Upon each of these various classes a uniform rate would be made for brick and frame buildings. Assuming the rate to be adequate to pay the losses and a profit on this class, this system was clearly inequitable. If the stock of one merchant was in a two-story brick building of small area, with no open skylights, etc., it was certainly unfair to charge him the same rate as the merchant whose stock was in a higher and larger building, with skylights, wood cornice, and well-holes. To rectify this and similar cases of inequality a plan of schedule rating was put in force by General Arthur C. Ducat, of Chicago. While surveyor of the Chicago Board of Fire Underwriters he formulated a plan of schedule rating, constructing a theoretically perfect building, and adding for deficiencies of construction. Within the past few years this system of schedule rating has been elaborated by President F. C. Moore, of the Continental Insurance Company, of New York. A universal mercantile schedule has been devised by him, which adopts the same principle for various classes of towns and cities. This system has already been adopted by local underwriters in several of the larger cities. The application of this principle will lead to a gradual improvement in the construction of buildings, and ultimately to the modern "fire-proof," or, more correctly, "buildings of slow-burning construction." In the line of schedule rating, and a corollary thereto, is the general introduction of the "coinsurance clause." With the improvement in the construction of buildings and the increased efficiency of fire departments, and with the aid of fire patrols, it is expected (and to some degree realized) that the percentage of loss by fire will be reduced—a fact that many property owners have not failed to appreciate, and many have inclined toward a reduction of the percentage of insurance carried to valuation.

Fire-insurance rates, to be equitable, must not only be predicated upon the construction and environment of each building insured, but must also have relation to the percentage of insurance to value carried by the merchant. The sole object of the various forms of coinsurance clauses insisted upon by fire underwriters is to secure a uniform practice upon the part of property owners as to the percentage of values insured.

Each State has an insurance department, to which all classes of insurance companies doing business in the State must make an annual statement of their financial condition. The head of such department is charged by statute with the duty of determining the solvency of every company applying for permission to transact business in his State, as well as at the time of the renewal of the annual license. The system of State supervision was first adopted by the States of New York and Massachusetts; and the policy adopted by William Barnes and Elizur Wright, respectively superintendents of the insurance departments of the States named, for the government of such departments has been generally followed, and in the main the standard of personal and official probity established by these gentlemen has been observed, with a few monumental exceptions. There is no class of government officials, either State or national, in whom is vested such autocratic power as is accorded the superintendents of the insurance departments of the various States. This power, exercised wisely in the protection of the public against fraudulent institutions, is beneficent and mutually advantageous to the reputable companies and the public; but when exerted in securing and publishing the smallest detail of management, it is a barrier to proper development, and when exerted corruptly it becomes legalized blackmail, of which, unfortunately, there have been a few instances.

The business of insurance supports many trade papers, many of them useful and edited with great skill and ability. The "Insurance Cyclopedia" (published by the "Weekly Underwriter," one of the best insurance journals) gives a list of fifty-one such papers now regularly issued. Fire-insurance is now conducted throughout the United States by thousands of agents, and the percentage of funds lost through misappropriation is infinitesimal. These agents, as a rule, are selected with great care. From the ranks of insurance agents have sprung governors of States, judges, senators, and foreign ministers.

At the present time there are five British companies engaged in the business of fire underwriting in the United States that have been continuously in business for over a century, to wit: London Assurance Corporation, organized 1720; Norwich Union Insurance Company, organized 1797; Phœnix Assurance Company, organized 1792; Sun Fire Office, organized 1710; Union Assurance Society, organized 1714. To-day the fire-insurance companies of foreign countries transact twenty per cent. of the entire business of fire underwriting in the United States.

The distribution of the risks assumed by the fire-insurance companies doing business in the United States is shown by the following table of the amount at risk and premiums collected in 1894:

	Amount at Risk.	Premiums.
Alabama	$66,828,364	$1,067,445
Alaska	1,110,545	23,726
Arizona	4,310,368	105,454
Arkansas	32,620,429	705,398
California	377,813,892	6,336,734
Colorado	85,894,340	1,422,026
Connecticut	221,828,297	2,171,851
Delaware	19,679,838	176,117
District of Columbia	75,148,286	475,502
Florida	26,698,005	596,775
Georgia	138,769,873	1,905,826
Idaho	5,907,466	151,079
Illinois	946,661,803	11,805,170
Indian Territory	4,570,368	125,614
Indiana	268,107,483	3,480,419
Iowa	232,011,959	3,867,475
Kansas	140,109,802	1,961,450
Kentucky	187,397,787	2,605,337
Louisiana	197,442,627	2,649,323
Maine	94,894,475	1,477,289
Maryland	214,414,675	1,859,261
Massachusetts	687,413,281	7,648,298
Michigan	283,738,338	4,302,988
Minnesota	233,942,097	3,680,966
Mississippi	37,951,832	787,985
Missouri	348,602,501	4,903,494
Montana	26,852,407	626,905
Nebraska	107,641,249	1,816,538
Nevada	4,182,969	119,813
New Hampshire	64,784,571	853,963
New Jersey	433,453,659	3,735,983
New Mexico	7,302,979	147,579
New York	3,078,604,705	22,339,420
North Carolina	48,274,243	783,751
North Dakota	18,088,057	390,576
Ohio	564,925,910	6,749,335
Oklahoma	4,438,202	114,075
Oregon	45,287,428	936,068
Pennsylvania	886,271,730	9,808,572
Rhode Island	90,434,532	940,054
South Carolina	43,057,308	639,698
South Dakota	18,745,334	396,047
Tennessee	115,880,325	1,784,281
Texas	179,937,487	3,217,273
Utah	20,644,800	357,886
Vermont	33,878,289	512,612
Virginia	110,663,406	1,598,356
Washington	54,018,972	1,181,901
West Virginia	39,034,554	476,487
Wisconsin	255,243,795	4,237,866
Wyoming	6,922,024	132,262

The history of American marine insurance begins in 1793, when the General Assembly of Pennsylvania chartered the Insurance Company of North America. This company is still in existence, and its long life is in a measure due to its special charter privileges of being able to conduct a marine as well as a fire insurance business. In 1796 the second marine-insurance company was formed under the name of the New York Insurance Company, with a capital of $500,000. Since that time twenty-seven other marine companies have been organized and commenced business in New York State, and of this number only one, the Atlantic Mutual, which was chartered in 1842, is still in operation.

New York's marine-insurance history is that of all the other seaboard States, for in nearly all marine insurance once flourished, but has now succumbed to English competition. The golden period of American marine insurance was between the years 1840 and 1860, when the clipper sailing ship was developed and perfected. In those times the leading merchants owned their own ships, and frequently a member of the firm would go to China or the East Indies to supervise the proper distribution of the cargo, and to secure a remunerative one for the return. The ship and cargo were insured with an American company, and as it might be as long as nine months before the vessel was heard from, the risk was considerable and rates were high. As much as five or six per cent. was charged for insurance in those times. The rate on dry-goods from Liverpool to New York in the old packet sailing ships was placed at two per cent. This trade was carried in American ships, and the insurance, both on the vessel and on the cargo, was naturally placed in American companies.

But the rates of insurance have changed with the transformation of the ocean carrying service. The East India goods are now shipped across the Pacific to San Francisco, and thence East via rail. The cost of insurance on these is now only three quarters of one per cent. Rates on the Atlantic have likewise declined. Insurance on dry-goods and like merchandise carried in the modern "liners" is placed at two tenths of one per cent. In other classes of goods depreciation in rates is in like proportion.

Marine underwriters do not ascribe the decline in American marine insurance to any trouble from unwise laws or legislative interference, but to the changed business conditions and to English competition. The bulk of the carrying trade of the world has passed into British hands, and a British merchant and ship owner insures in a British company. The English marine companies have, as well, invaded American soil, and have secured a large portion of the American business. When the English companies first established themselves in America, along in the early seventies, they began cutting rates. The American companies did not effect any combination to prevent this, but followed their example. The American companies were also placed somewhat at a disadvantage by the laws governing the admission of foreign marine-insurance corporations. The foreign companies are required to make a deposit before they can write American business; but in New York State, which has stringent insurance laws, the amount is fixed at the minimum capitalization allowed a home company, viz., $200,000. So much of the carrying trade of the world is done under the British flag and with the aid of British credit, and with countries under British control, that the American underwriter, working against all these disadvantages, is seriously handicapped. Therefore, there being no national or local tariff associations among marine underwriters, the American companies are worsted in this rate war. There are now not enough of them to form any sort of an association which would wield much power.

Despite the uphill work of the American companies to hold their own, through loss of prestige on the ocean and active rivalry on land, there are a number of stock and mutual American marine-insurance companies which continue to do a flourishing business. The largest and one of the oldest is the Atlantic Mutual, of New York, which has over $12,000,000 of assets, and has been most carefully managed throughout its career. It was formed in 1842, at the time when many stock companies were turned into mutual companies, and by which change the profits accrue to the policy holders instead of the stockholders. The company is noted for retaining its faithful and tried officers until their death. The late John P. Jones was connected with the company for fifty years, and was its president for forty. In his life-work of building up the company he was ably assisted by Vice-Presidents W. H. H. Moore and A. A. Raven, who have been with the company thirty and forty years respectively. Among the other large companies which still do a thriving business are the two Boston corporations, the China Mutual and the Boston Marine.

There have never been many marine Lloyds in the United States, though this form of marine insurance has been most in vogue in marine underwriting in Great Britain. The origin of the term is both

SUMMARY OF RISKS IN FORCE AND PREMIUMS CHARGED THEREON DECEMBER 31, 1889, BY THE FIRE, OCEAN MARINE, AND INLAND NAVIGATION AND TRANSPORTATION INSURANCE COMPANIES TRANSACTING BUSINESS IN THE UNITED STATES.

BY CLASSES.

Classes and States in which Home Offices are Located.	Number of Companies.	Fire, Ocean Marine, and Inland Risks in Force, and Premiums charged thereon, December 31, 1889.	
		Amount in Force.	Premiums Charged.
Total	1,926	$18,691,434,190	$211,424,242
Class 1	434	15,413,429,842	174,201,696
Alabama	7	30,789,209	428,382
Arkansas	1	696,999	14,061
California	11	383,678,288	5,803,335
Colorado	1	4,788,204	74,907
Connecticut	10	1,359,878,764	16,399,218
District of Columbia	11	37,754,794	198,455
Georgia	[1] 7	29,431,941	453,182
Illinois	8	342,381,186	5,459,474
Indiana	[1] 6	10,172,607	99,630
Iowa	10	173,392,934	3,243,525
Kentucky	12	65,045,177	908,167
Louisiana	[1] 16	144,181,430	2,161,380
Maine	2	1,885,379	126,526
Maryland	14	111,536,402	820,519
Massachusetts	15	406,517,661	5,597,740
Michigan	3	59,517,482	764,025
Minnesota	4	113,469,208	1,506,046
Mississippi	[1] 3	5,038,207	108,940
Missouri	4	76,252,301	1,028,840
Nebraska	4	46,163,699	885,966
New Hampshire	[2] 9	163,398,665	2,062,401
New Jersey	10	282,878,026	2,884,863
New York	57	4,965,230,523	46,021,786
North Carolina	3	2,787,430	60,413
North Dakota	1	8,300	304
Ohio	[1] 29	213,216,829	2,623,036
Oregon	[1] 6	22,147,389	655,945
Pennsylvania	[3] 42	1,785,670,413	24,211,683
Rhode Island	3	136,689,339	1,679,380
South Carolina	1	62,406	840
South Dakota	[1] 6	16,636,119	405,580
Tennessee	14	32,484,808	525,685
Texas	2	8,898,345	223,219
Utah	[4] 1	....	....
Vermont	1	2,805,495	31,279
Virginia	8	33,316,514	663,102
Washington	[5] 6	2,092,760	53,677
West Virginia	[3] 9	14,997,402	611,252
Wisconsin	4	207,431,944	2,698,181
Foreign	[5] 73	4,120,105,263	42,706,752
Class 2	3	25,360,152	464,512
Iowa	1	3,512,380	218,118
Massachusetts	2	21,847,772	246,394
Class 3	51	591,745,356	10,596,879
Georgia	1	525,221	5,172
Illinois	8	31,989,479	926,303
Indiana	[3] 3	576,650	20,585
Iowa	1	1,628,000	70,100
Kansas	1	535,725	111,772
Maryland	1	1,287,253	128,712
Massachusetts	8	242,331,706	5,341,230
Michigan	3	6,101,882	158,722
Minnesota	2	7,189,441	865,984
Ohio	4	6,699,941	93,775
Pennsylvania	5	14,448,211	171,130
Rhode Island	12	273,449,172	2,546,264
Wisconsin	2	4,982,675	157,130
Class 3 A	5	$127,613,864	$1,730,377
Maine	1	1,748,406	135,000
Massachusetts	2	7,949,890	194,076
New York	2	117,915,568	1,401,301
Class 4	152	971,866,938	23,600,007
Connecticut	1	9,277,077	256,294
Delaware	3	25,988,388	93,406
District of Columbia	2	13,715,239	25,688
Georgia	1	20,435,693	241,213
Illinois	[1] 11	33,321,034	1,191,233
Indiana	[1] 2	4,040,998	327,800
Iowa	5	22,476,902	1,207,608
Kansas	2	4,391,567	84,217
Kentucky	3	5,709,452	37,933
Maryland	10	47,297,788	920,895
Massachusetts	21	269,167,557	4,013,430
Minnesota	2	12,062,998	612,156
Missouri	12	54,330,327	1,778,083
New Hampshire	7	11,481,171	189,053
New Jersey	10	31,118,584	2,265,924
New York	12	145,245,931	1,354,681
Ohio	[3] 17	75,075,375	1,001,589
Pennsylvania	[3] 19	99,510,249	2,590,723
Rhode Island	1	19,291,414	175,023
South Carolina	1	3,543,955	60,305
Tennessee	[4] 1	....	....
Texas	[4] 1	....	....
Vermont	2	49,999,981	5,005,211
Virginia	3	11,121,594	45,822
West Virginia	1	79,350	692
Wisconsin	2	3,184,314	121,028
Class 5 [6]	1,281	1,561,418,038	830,771
Connecticut	16	78,308,021	....
Delaware	3	2,889,971	....
Illinois	[1] 187	84,166,658	....
Indiana	[2] 60	30,261,418	....
Iowa	127	65,200,389	....
Kansas	11	3,063,307	....
Kentucky	5	10,433,819	....
Maine	[3] 29	11,250,866	....
Maryland	7	36,528,277	....
Massachusetts	19	102,592,626	....
Michigan	60	165,412,143	....
Minnesota	[3] 86	23,979,024	....
Missouri	[5] 27	6,778,874	....
Nebraska	10	6,336,415	....
New Hampshire	30	11,781,011	....
New Jersey	17	36,456,381	....
New York	[2] 113	136,919,530	....
North Dakota	[3] 4	342,074	....
Ohio	86	106,461,569	....
Pennsylvania	[2] 178	462,333,093	830,771
Rhode Island	4	35,312,684	....
South Carolina	1	818,775	....
South Dakota	[1] 8	640,334	....
Virginia	[1] 11	22,047,364	....
West Virginia	1	610,000	....
Wisconsin	[7] 181	120,493,415	....

[1] Includes 1 company for which no report is made.
[2] Includes 3 companies for which no report is made.
[3] Includes 2 companies from whom a statement of risks in force could not be obtained.
[4] Only 1 company reported and that too incompletely to tabulate.
[5] Includes 4 companies which could not report risks in force.
[6] The companies of this class, as a rule, charge no premiums, but assess for losses.
[7] Includes 6 companies from which no report was received.

interesting and peculiar. The name of Lloyd originated in old Lloyd's Tavern, in Tower Street, London, far back in the days of good Queen Anne. It was the practice of many ship owners and traders to drop in at the tavern and talk over their prospective profits; and gradually a custom developed of inscribing their names on a blackboard, certifying that the men signing would be jointly liable for the loss of a vessel during a certain voyage. From this crude beginning have grown the world-famous associations in the British Isles. In the United States there are a few Lloyds, two of the principal ones being located in New York City—the United States Lloyds and the New York Marine Underwriters.

The scope and definition of a marine policy is, of course, entirely different from a land fire policy. The risks insured against are many, and may be summarized as including all perils of the sea. There are two classes—a voyage and a time policy; the former is generally used in insuring vessels, and the latter for cargoes. There are naturally many clauses governing marine-insurance policies, such as capture, seizure, war, and so on. The life of the insurance on a ship begins at the port from which it is insured until moored for twenty-four hours at the port to which it is insured. When an insurance is made on freight to be carried under a charter, the policy attaches as soon as the vessel sails, although she may be destined to a distant port for her cargo.

Though single losses to marine underwriters have been small, compared with some of those of fire underwriters, there have been shipwrecks that have lived in marine-insurance men's memories. One of the greatest losses to American marine insurance was that of the American steamer *Central America*, which foundered off the Cuban coast in September, 1857. The *Central America* was bound from Aspinwall, now Colon, to New York, and was loaded principally with treasure from the California gold-mines. She carried insurance amounting to between $700,000 and $800,000, all of which had to be paid by American underwriters. Another notable loss was that of the steamer *Erie*, which sailed from Pernambuco, Brazil, loaded with coffee, on January 1, 1893, and was burned at sea. Coffee prices were high in those days, and the *Erie* went down with $500,000 insurance.

Two losses which not only made inroads on the American marine companies, but which also seriously crippled the growth of American steam transatlantic service, were the sinking of the steamer *Arctic*, off Newfoundland, in 1854, by collision, and the disappearance of the steamship *Pacific*, which sailed from Liverpool for New York in January, 1856, and was never heard from. Both steamships belonged to the Collins Line, which was the first one to put on steam-vessels for the Atlantic trade. These early losses were particularly detrimental to American marine insurance, because the companies carried extremely heavy lines in those days. Among the recent heavy losses was that of the steamer *Oregon*, which was run into and sunk off the Long Island coast in 1886. American marine underwriters had between $700,000 and $800,000 on the *Oregon's* cargo. The loss of the *Oregon* also showed underwriters how quickly even a properly constructed iron ship sinks. The introduction of iron in place of wood for building vessels has not made any material difference in the rates of insurance, for iron has hazards which wood has not, and vice versa.

As to the future of American marine underwriting, it is difficult to prophesy. As trade follows the flag, so marine insurance flourishes in the country with a prosperous merchant marine. The United States is again forging to the front as a great shipbuilding nation, and this gives American marine underwriters hope that American marine insurance may follow in the wake of the growth of American ship building.

The United States census of 1890 gives the statistics of the fire-insurance interest at the close of that year, which may be found in the table on page 6.

The following classification is employed in that table:

Class 1.—Companies having a joint-stock capital, and doing either a fire, ocean marine, or inland navigation and transportation insurance business.

Class 2.—Companies having guaranty capital, and doing either a fire, ocean marine, or inland navigation and transportation insurance business.

Class 3.—Companies doing a fire-insurance business on the mutual plan and insuring only manufacturing property.

Class 3A.—Companies doing a marine-insurance business on the mutual plan and insuring ocean-marine risks.

Class 4.—Companies doing a fire-insurance business on the mutual plan and insuring all kinds of property on land.

Class 5.—Companies doing a fire-insurance business on the mutual plan and insuring only dwellings and contents and farm property.

Henry H. Hall

CHAPTER XV

LIFE-INSURANCE

IT is a singular fact that the doctrine of chances, upon which the science of life-contingencies is based, had its origin in the solution of problems connected with games of hazard. It happened in this way. In the year 1654, the Chevalier Méré, of Paris, an ardent gamester, applied to the celebrated Abbé Pascal for solutions of two problems for which he himself was unable to find answers.

His first problem was to ascertain in how many casts of two dice one might bet with advantage that two sixes would be thrown. The second was to find a rule for dividing the stakes between two players, should a game of hazard be interrupted, in the exact proportion to their relative chances of winning at the moment of interruption. Pascal considered all possible combinations in casts of two dice, and all possible changes which might occur in an unfinished game, and was thus enabled to solve the two problems. He illustrated his solution by casts of dice. While in a single cast the chance that an ace would be thrown is just one out of six, in a sufficiently large number of casts the number of aces would be precisely one sixth of the whole number. Generalizing, Pascal proved that, by observing a sufficiently large number of happenings in the past, he could, with great precision, predict the number of happenings which would occur under similar circumstances in the future, and he thus enunciated the theory or doctrine of chances. Thus, if it were ascertained that out of a large number of persons of a given age, similarly situated as regards health, occupation, climatic influences, etc., a certain number had died in one year, the percentage of deaths in a given time, under similar circumstances, could be predicted with precision, provided the number were large enough to secure a proper average. Hence the solution of problems connected with trivial games of hazard led to the discovery of the laws of chance, upon which, as an exact science, was built up not only the theory of life-contingencies, but also of all astronomical calculations. By means of careful observations as to the rates of mortality which have prevailed among a vast number of insured lives, at all ages and in different circumstances, we can foretell, with almost absolute accuracy, the rates of mortality which will be experienced under similar conditions in the future. In other words, while nothing is more uncertain than the duration of a single life, nothing is more certain than the number of deaths which will happen in a given time, among a large number of persons under known conditions.

Hence life-insurance has for its basis an exact science, depending upon inflexible laws of nature; so that it has been well said by the late Professor De Morgan, of London, an eminent authority, "There is nothing in the commercial world which approaches, even remotely, the security of a well-established life-office."

In an abstract or mathematical sense, life-insurance is a bet or a series of bets. The individual bets the insurance office that he will die within one year; the office bets the individual that he will not die within that time. The stakes, called the premiums, are accurately and equitably adjusted—one is bound to win, the other to lose. The office gives to the individual the right to make a series of similar bets during each of the remaining years of his life, or for a limited period.

In a concrete or moral sense, life-insurance is precisely the reverse of gambling—unless, indeed, the individual who neglects to protect those dependent upon him from pecuniary loss in the event of his own death, and thus assumes the risks of loss to them, is a gambler.

Life-insurance is one of the most beneficent devices of modern civilization. By its means the pecuniary loss and hardship which would result to a family from the death of its natural protector are assumed by a vast number of persons, upon each of whom such loss falls lightly. It is benevolence without ostentation, and charity without humiliation. It is practically a fulfilment of the divine injunction to "bear one another's burdens," and is therefore an evidence of the highest Christian civilization.

Important as was this discovery by Pascal, it attracted but little attention until 1671, when the Grand Pensionary De Witt, of Holland, celebrated alike as a statesman and a mathematician, conceived the idea of applying the doctrine of chances to the valuation of annuities. From the registers of births and deaths in several towns in Holland he deduced rates of mortality, or probabilities of living and dying for each age. In a report to the States-General in April of that year he computed the value of annuities for the several ages. This report is valuable as the first instance of the application of scientific principles to the solution of questions depending upon the contingencies of living and dying, combined with the improvement of money by interest. De Witt's report was lost to the public for one hundred and eighty years, or until 1851, when it was recovered through the perseverance and skill of Mr. Augustus Hendricks, actuary of the London, Liverpool and Globe Insurance Company, and at one time president of the Institute of Actuaries, London.

In 1693, the illustrious Halley, astronomer royal of Great Britain, constructed the first complete table of mortality, in a form which has ever since been followed, showing for each age the chances of living and dying, with various monetary values deduced therefrom. Halley's table was based upon the records of births and deaths in London and in Breslau. It was more than half a century afterward before Halley's labors were applied to any work of importance. As life-insurance became better known and appreciated the necessity of accurate tables of mortality became more evident. The following list comprises the principal mortality tables which have at any time been used by life-insurance companies:

1. The Northampton Table, based upon an enumeration of the deaths in that town for the forty-six years prior to 1780, constructed by Dr. Richard Price. As the number of persons living in these years was not known, but merely assumed, this table was quite inaccurate; yet it was used as a basis of values for many years by insurance companies, and by courts of law in the determination of insurance premiums, annuities, and rights of dower. It was used in the determination and distribution of the surplus of the Equitable, of London, as late as the year 1889.

2. The Carlisle Table, based upon the numbers of both living and dying in the city of Carlisle during eight years prior to 1787. This table was constructed in 1815 by Joshua Milne, actuary of the Sun Life-Office, and was, for a full half-century, the standard adopted by British and American life-insurance companies. A great variety of monetary values were computed upon this table, and a vast number of insurance contracts were based upon it.

3. The Actuaries' or Combined Experience Table, deduced from the mortality of seventeen British life-insurance companies, embracing 83,905 assured lives. This table was constructed in 1845, by the late Jenken Jones, actuary of the Guardian Assurance Company. It is valuable as being the first important table based upon the actual mortality among persons whose lives were insured. Although the Actuaries' Table has long since become obsolete in Great Britain, it has been adopted, and is still used, as the official standard of valuation by Massachusetts and by several other state insurance departments.

4. The H^M (Healthy Male) Table, based upon the later experience of twenty British companies, embracing the mortality among 147,000 insured lives, and completed in 1869, under the supervision of a committee of the Institute of Actuaries. Elaborate monetary values have been computed upon this table, which are embodied in the "Text-book" by George King, actuary of the Atlas. This table has long been the vade-mecum with actuaries, and until it shall be superseded by tables based on later and more extended observations will be the most reliable standard of value in Great Britain.

5. The American Experience Table (so called), constructed by the writer, and based upon the mortality experience of the Mutual Life-Insurance Company, of New York, during its first fifteen years. Confirmed as it has been by later and more extensive observations upon the mortality in that and in other American companies, this table is unquestionably the best exponent of rates of mortality which may be expected to prevail among insured lives in the United States. Rates of premium and estimates of the value of contingent insurance liabilities in nearly all American companies are based upon this table, which is also the official standard of insurance valuations in many of the States.

The origin of life-insurance is lost in antiquity. At a very early period the lives of masters of vessels and of merchants voyaging with them were insured, always for brief periods and generally by individual underwriters, against death or captivity by pirates. In the middle of the sixteenth century, lives of persons were insured for short periods by individual underwriters, who divided the risks among themselves very much in the manner of the modern Lloyd's.

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The earliest life-insurance policy on record was issued June 15, 1583, by the Office of Insurance within the Royal Exchange, London, upon the life of one William Gybbons. The insurance was for twelve months for £383 6*s.* 8*d.*, at a premium of eight per cent. The policy was underwritten by thirteen different persons, who guaranteed sums varying from £25 to £50 each. The oldest existing office, which transacted at any time a life-insurance business, is the Hand-in-Hand, London, chartered in 1696; but its first life-insurance policy was not issued until 1836. The earliest purely life-insurance company was established in 1699, under the name of the Society of Assurance for Widows and Orphans. This association had a brief existence. The celebrated Amicable Society for a Perpetual Assurance was chartered March 25, 1706, by Queen Anne. This society carried on the business of life-insurance for one hundred and sixty years, or until 1836, when, under an act of Parliament, it passed out of existence as a separate institution and was merged into the Norwich Union Life-Office. In the year 1721, there were founded two insurance offices, still existing, the Royal Exchange and the London Assurance Corporation, each of which at once issued life-policies, and each has continued to do so until the present time. They are therefore the oldest existing offices writing life-insurance contracts, but their principal business has always been that of marine and fire insurance. All of the offices above named charged a uniform rate of premium for all ages of about five per cent. until after the commencement of the present century, and their business was conducted upon methods very similar to those practised by modern assessment associations.

In 1762, the famous Equitable Society for the Assurance of Life and Survivorship, of London, commenced business. This society was founded upon the recommendation of Dr. Richard Price, with the view of charging rates of premium adjusted to chances of living and dying at the different ages. In other words, its business was from the first conducted on sound principles. The society has had from the outset a phenomenal success. It has never employed agents or paid commissions or solicited business. It has always been managed with great ability, and is still pointed out with pride as the "Old Equitable." It has led the way in many of the advances and improvements in the system. In the amount of business transacted it has been distanced by many modern offices; and although its volume has greatly diminished since its maximum, about 1816, it is now increasing quite rapidly. The Equitable, of London, is not, however, as has generally been assumed, the oldest office in existence doing a purely life-insurance business. That honor is due to a little American office in Philadelphia, Pa., called the Presbyterian Ministers' Fund, organized in 1759, or three years before the Equitable, of London. It has, for one hundred and thirty-six years, pursued quietly, unostentatiously, and without interruption the business of life-insurance. In the Papers and Transactions of the Actuarial Society of America, No. 2, page 83, may be found a facsimile of a policy issued by the Presbyterian Ministers' Fund, dated May 22, 1761, on the life of Rev. Francis Allison. In consideration of a premium of £6 annually, it provided for the payment, after his death, of £20 annually, for a stated number of years, to his widow and orphans. The premiums were based upon the hypothesis of De Moivre, the rates being level for life. It is, therefore, the oldest purely life-insurance company in existence. It has ever kept pace with modern improvements in the science of life-contingencies, and is to-day in a sound condition, with every prospect of continued success.

After the formation of the Equitable, of London, in 1762, came the Pelican, in 1797, the London, the Provident, and the Rock, in 1806, and new offices were started in almost every subsequent year. There were founded during the present century, in Great Britain, about three hundred and seventy life-offices, out of which only eighty-eight, according to the Parliamentary Return for 1894, remain. The others have had, generally, an ephemeral existence. Some have been wound up voluntarily, some by processes of law, some have been merged into stronger or better-organized institutions, and all have suffered penalties from the violation of sound principles of science and commercial experience.

On the continent of Europe, life-insurance has been a plant of slower growth and development. Many strong offices have been built up in France, Germany, Holland, Belgium, and Austria, with a few in the other kingdoms. It is in the United States and in Great Britain, however, that the system has flourished and attained its highest development.

In the United States, the Presbyterian Ministers' Fund was, as stated, organized in 1759, and is still in existence. The Baltimore Life was organized in 1831, and was merged into the Equitable in 1860. But modern life-insurance dates from 1843, when the Mutual Life-Insurance Company, of New York, first commenced business. This great company, in volume of assets the largest in the world, issued its first policy February 1, 1843. It is organized upon the mutual plan, having no capital, and its enormous accumulations ($203,822,134 on December 31, 1894) have resulted entirely from insurance premiums and interest thereon, after deducting payments for death-claims and expenses.

This company was organized by friends of the late Morris Robinson, solely to give a position to that gentleman. Its affairs were managed with great skill by him and by his successors in the office of president, the late Joseph B. Collins and Frederick S. Winston. Under the present incumbent, Mr. Richard A. McCurdy, the business and accumulations are rapidly increasing. The history of the Mutual Life-Insurance Company is a record of phenomenal success, resulting from the application of science and sound business principles to the most important economy of modern times, by men of exceptional ability, energy, and business training. The American Experience Table of Mortality, so called, constructed, in 1858, by the writer, and since adopted by all American companies and by many of the States as a standard of valuation for premiums and liabilities, was deduced from the mortality records of this company. The "Contribution Plan" of dividing surplus equitably among the members of a life-insurance company was first applied by the writer in the distribution of the surplus of the Mutual Life in 1863. When we consider the vast amount of surplus now held for policy-holders by American companies, amounting to more than $112,000,000, in addition to over $325,000,000 of surplus already awarded and paid to them under the "Contribution Plan," one may appreciate its importance and value.

In the report of the Massachusetts Insurance Department for 1868, the commissioner, Hon. John E. Sandford, states:

"The forty-seven life-insurance companies doing business in this State, or rather twenty-one of them, were fortunate enough to find themselves during the last year in possession of divisible surplus to the amount of more than seven and one half millions of dollars ($7,595,671.97). The whole of this magnificent fund was made up of the overpayments of individual policy-holders, or was the surplus earnings of their money held in reserve by the companies. They were consequently entitled to have it divided among them by some rule or method of distribution. The propriety of so dividing it that each policy-holder should receive his own — the share of it which belonged to him, neither more nor less — is too plain to need argument or illustration.

"How, then, shall it be divided? This is not a question of usage, of precedent, or of convenience, but of equity and right — of right to property, to one's own money; and involving, as it does, millions of dollars annually, it is a question of the first importance.

"As a practical question, at the present time, it resolves itself into the discussion of two essentially different methods of distribution, which, with some variance of detail, appear to divide the practice of all the mutual companies. (1) The 'Percentage Plan' distributes the surplus by a uniform percentage of the annual premium — assuming, apparently, that this premium fairly represents, for the current year, the whole capital or stock in trade of each policy-holder in the joint concern, on which his share of the profits or savings for the year is to be computed. There is no other assumption on which such a mode of distribution is intelligible. (2) The 'Contribution Plan,' rejecting the annual premium as the measure of distribution, inquires for the *sources* of the surplus — how much of it is traceable to the surplus earnings of each one's share in the accumulated reserve of previous years, as well as of the current premium, and how much to each one's share in the savings on the payments for losses and expenses — and professes to return to each what he or his money has actually *contributed* to make up the sum total of the surplus which is to be divided. If one of these methods is right in principle, and the other wrong — and they cannot both be right — the sooner it is known and admitted the better.

"We think it admits of demonstration that the percentage plan ignores the origin of the surplus; that its idea is radically wrong, and discordant with the theory and methods of life-insurance; that it gives money which belongs to one policy-holder, without reason or right, to another, subtracting from the dividend to which the longer insured is entitled, to make for the newly insured an equal dividend to which he is not entitled; that it does this uniformly and inevitably, and does it on an extensive scale. The equity of the uniform percentage plan in dealing with the money of the insured is like the hospitality of the famous old robber of Attica, who, if the legs of his unwilling guests were too long for his bed, lopped them off, and stretched them to the requisite length if they were too short.

"The contribution plan, on the other hand, recognizes the constant sources of surplus — a higher rate of interest than was assumed, a lower rate of mortality than was expected, and a less percentage of expense than was provided for — in establishing the premiums and reserve of the company. These sources yield a surplus which varies with the reserve on each policy, with the age of the insured, and with all the terms and conditions of the insurance. The system adapts itself to the incidents of each policy, and returns the surplus earnings from interest, and the excess of the payments for mortality and expenses, which belong to it. In a word, it seeks to give to each of the insured the surplus which his money has earned or created. It requires no other statement than this to demonstrate its theoretical equity. The actual adaptation of the plan is demonstrated by the fact that its formulas are deduced from and harmonize with the fundamental processes of life-insurance, while no mathematics either suggest or justify the percentage plan.

"In this country, where every improvement is eagerly sought and usually accepted, its essential features have received the indorsement of the most eminent actuaries, and it has been already adopted by a majority of the participating companies. The statutes of this State have been amended in order to admit of its adoption by our own companies. Actual trial, which is the best test of its merits, seems to have approved its equity and the practicability of its use. Other companies, whose practice has sanctioned thus far the older plan, are known to be considering seriously its adoption. A firm belief in its superior equity and in the general good results to be expected from its use cannot fail to induce the hope that this, with every other improvement that science or experience suggests, may be ingrafted on a system whose present success and beneficent future are cherished and believed in with a strong and abiding faith. Life-insurance claims an alliance with interests too high and sacred to be persistently guilty of systematic wrong."

The New York Life-Insurance Company commenced business in 1845. It was the first to introduce the system of non-forfeiture, since adopted by all other American companies. By this concession, policy-holders, who are unable or unwilling to continue their contracts, are guaranteed an equitable surrender-value in paid-up insurance or in cash. The company owes its success largely to the ability and energy of its former president, the late William H. Beers. Under its present able executive, the Hon. John A. McCall, its business is growing with great rapidity.

The Equitable Life-Assurance Society of the United States was organized in 1859, by Mr. Henry B. Hyde, who, although declining to be its first president in favor of Colonel William C. Alexander, has been the guiding spirit from its organization to the present day. Under the superb management of Mr. Hyde, the Equitable has surpassed its two great rivals, the Mutual and the New York Life—which started respectively sixteen and fourteen years prior—in the items of income, volume of business, and surplus. In one respect the Equitable is unique among all large life-companies, and that is in the fact that it has always remained under the management of one man from its organization to the present day. These three American offices are by far the largest in the world. Want of space prevents mention of other American life-companies by name.

The remarkable progress of life-insurance in the United States may, perhaps, be best illustrated by the following statistics, compiled from the reports of the Insurance Department of Massachusetts for the years ending December 31, 1859, and December 31, 1894. The list includes all companies which reported to that department at the two dates named.

MASSACHUSETTS INSURANCE REPORTS, 1859 AND 1894.

	Commenced Business.	Amount Insured.		Assets.		Premium Income.		Surplus—Combined Experience. 4 per Cent.	
		1859.	1894.	1859.	1894.	1859.	1894.	1859.	1894.
		$	$	$	$	$	$	$	$
New England Mutual.	1844	13,041,484	93,868,387	1,347,637	24,252,829	347,717	3,079,506	533,711	1,697,009
State Mutual........	1845	2,876,591	52,909,932	351,617	9,893,072	57,429	1,849,884	147,950	1,053,008
Berkshire...........	1851	1,787,650	38,159,229	106,685	6,430,146	52,565	1,455,372	115,007	598,083
Massachusetts Mutual	1851	4,210,380	89,877,280	183,516	15,653,367	109,387	3,109,360	134,905	1,033,620
Mutual Life, N. Y....	1843	37,235,392	854,710,761	5,840,150	202,494,184	1,032,663	36,123,164	1,518,868	15,089,823
Mutual Benefit, N. J..	1845	22,559,177	209,369,528	2,800,717	55,656,860	649,157	7,626,152	886,387	3,577,984
Connecticut Mutual ..	1846	22,701,294	156,686,871	2,528,842	62,229,586	709,613	4,677,973	849,599	7,450,858
National, Vermont ...	1850	1,751,540	64,975,950	187,768	11,046,572	46,370	2,472,702	125,891	1,055,001
Union Mutual.......	1849	4,368,542	36,312,041	582,840	6,592,373	167,688	988,582	340,684	260,314
Manhattan, N. Y.....	1850	10,333,644	61,618,675	670,268	13,695,656	308,354	2,056,336	227,716	774,451
Equitable, N. Y.....	1859	808,000	913,556,733	107,974	183,138,559	15,590	36,038,931	91,882	28,115,809

Among the early workers and fathers of American life-insurance who are no longer living, special honor should be given to Judge Phillips of the New England; Guy R. Phelps of the Connecticut Mutual;

Morris Robinson, Frederick S. Winston, Henry H. Hyde, and Professor Gill of the Mutual Life; Joseph L. Lord of the Mutual Benefit; William H. Beers of the New York Life; and last, but not least, the late Elizur Wright, the first insurance commissioner of Massachusetts.

There is one specialty in the larger American companies which is worthy of attention, and that is the very large amount of insurance written upon tontine plans. Tontine assurance, as now written, is simply an agreement by which surplus is retained and accumulated for the exclusive benefit of those policy-holders who survive and keep in force their policies until the end of the tontine period agreed upon—generally ten, fifteen, or twenty years. Upon ordinary plans the surplus is divided annually; upon both plans the full sum insured is always payable at death.

Life-insurance is, in effect, an arrangement or device by which the pecuniary loss to family or dependents, which would result from the death of their protector, is borne by a large number of associates, upon each of whom the burden or loss falls but lightly. In the case, however, of a person who dies after paying one premium, or only a small number of premiums, the pecuniary gain to his beneficiaries is abnormally great, since the amount of insurance is very large in comparison with the premiums paid therefor. To pay dividends, in addition to the insurance in such cases, only aggravates the relative inequality between persons dying early and those who live longer and pay premiums for many years. The tontine system, by awarding and paying surplus to the latter class only, equalizes these otherwise unavoidable and unforeseen inequalities. Moreover, each person should be allowed full liberty in the choice of different forms of insurance, and so-called tontine companies issue all kinds. The fact that such a large number of applicants prefer and select tontine policies may be considered a proof of the confidence of the companies and of their patrons in the system. In the volume of business the tontine companies surpass by far the companies which refuse to issue that class of policies. Incidentally, it is claimed that lapses are fewer among tontine than among ordinary policies, and that there is a great advantage to those who survive the tontine period in the opportunity of closing their contracts by receiving their full equities both of reserve and surplus in cash or in paid-up insurances, or of continuing their policies with greatly reduced premiums.

While many companies in the United States have failed and been wound up, those now doing an active business are believed to be on a sound, healthy basis. The cause of failure in almost every case may be traced to extravagance or inexperience, but not to excessive mortality in any instance. There are at present, in the United States, fifty-six regular old-line life-insurance companies, of which thirty-two only are authorized to transact business in the State of New York. The companies not admitted to that State, however, are mostly small and unimportant. The magnitude of the business in the thirty-two old-line companies doing business in New York may be seen by the following statistics, taken from the report of the Insurance Department for the year 1894. The statistics for the British offices (counting five dollars to one pound) were taken from the Parliamentary Return for 1894, published in 1895. The business of industrial companies is omitted in both cases.

INSURANCE STATISTICS FOR 1894.

		United States. (32 Offices Only.)	Great Britain.
Total insurance in force, December 31, 1894		$4,675,583,046	$2,500,030,330
Total number of policies in force, December 31, 1894		1,780,307	....
Total income from premiums, 1894		205,132,044	91,391,415
Total income from interest, etc., 1894		51,492,434	37,662,580
Total income from all sources, 1894		256,624,478	129,053,995
Payments for death-claims		78,313,162	63,874,645
Payments for commissions	$29,854,751		
Expenses of management	13,672,918		
Total	$43,527,669		12,522,145
Total liabilities, December 31, 1894		916,591,138	....
Total surplus, " "		139,740,544	....
Total assets, " "		1,056,331,682	1,038,626,035
Total number of companies reporting		32	88

In addition to the fifty-six regular old-line companies, there are, in the United States, several hundred coöperative or assessment companies, fraternal and secret associations, in which, generally, the promise to pay the sum insured in case of death is not definite and absolute, but is made contingent upon the result of assessments to be collected from survivors. The exact number of these organizations, with the number of members and the total amount of insurance, cannot be given, but the total insurance in force no doubt exceeds eight and one half billion dollars at the present time, or nearly double the amount outstanding in all the regular life-insurance companies.

Insurance in the old-line companies is secured, almost invariably, through the intervention of soliciting agents or canvassers, who are compensated by commissions on the premiums collected. Men, as a rule, will not seek life-insurance as they seek fire or marine insurance upon their houses and merchandise. They require the urgent solicitations of canvassing agents to persuade them to do what every one, who has a family dependent upon his exertions, should recognize as a duty and a privilege. In the coöperative or assessment companies the expense of procuring business is less, but the quality of the insurance is inferior.

In one respect, life-insurance in the United States differs in a remarkable degree from that in Great Britain, and, in fact, from that in all other countries. Each of the United States, in the absence of legislation by the national government, has power to impose restrictions, conditions, and taxes upon corporations of every other State seeking to do business within its precincts. Each State has its own Insurance Department and its own statutes regulating life-insurance. In consequence, the policy-holders of life-insurance companies are subjected to great hazard, inconvenience, and expense by reason of diverse and oftentimes incongruous legislation. The burden imposed upon the management of our life-insurance companies by reason of the requirements of the different States, and of the necessity laid upon them to protect the interests of the policy-holders by guarding them against unfavorable and unwise legislation, is very serious.

In striking contrast with the American system of State supervision by legislative enactments is the system adopted in Great Britain. There the companies are required simply to file with the Board of Trade sworn statements as to the amount of assets, of income, and of liabilities, giving the table upon which such liabilities are computed; and the public is left to find out their relative merits or standing by such illumination as active competition and public information may bestow. No attempt at supervision of companies is made, and in Great Britain no tax is laid upon life-insurance. It is there assumed, and very justly, that life-insurance is a public benefaction; that it tends to promote thrift and economy on the part of its citizens, and to avoid the burden of paupers upon the state, and as such should be fostered and encouraged by every proper means.

In other words, life-insurance in the United States is the subject of supervision and tax by our legislative Solons, while in Great Britain publicity and natural competition are relied upon to keep the companies in sound condition. The two methods are in sharp contrast. It cannot be denied that the American system has one advantage in the complete published returns, even to the minutest detail, of the items of assets, liabilities, and methods of business, which are open to the inspection of the public. American companies are thus enabled to dispel honest doubts and disarm designing criticism by the simple logic of facts, and to demonstrate beyond question their claims to the confidence of the community.

Sheppard Homans

CHAPTER XVI

AMERICAN RAILROADS

DYNAMICS has never produced a greater power than the locomotive engine. Stephenson's *Rocket* drew in its train results more momentous in their relation to human destiny than any motive force the world has ever known. To-day, railroads, their achievements and their problems, are of vaster importance than any other one factor in economic affairs. Evolved from the discoveries that found steam a force and harnessed it, through the means of applied mechanics, their development has produced those marvelous feats of constructive and engineering skill which distinguish both them and the age alike. Their extension has blazed the path of progress, and as they have built up, so have they bound, the new sections to the old, until beneath their network has broadened homogeneously the greatest nation on the face of the earth.

Transportation, whether of the person or of property, with ease, speed, and safety is the first and most self-evident of the achievements of the railroad. In the administration and regulation of this function questions have arisen, legislation been framed, and experiments made during nearly thirty years, but with small beneficent result. In the mists of the discussion thus raised the "railroad problem" has ever loomed larger and more distorted than it should appear. Primarily the railroad is based upon certain broad and immutable principles underlying the commercial and industrial system, as an integral part of which its dependence should be at once apparent. That such has not been universally recognized is due to two causes: first, few people except those whose interests and prejudices have moved them strongly either to one side or the other have ever investigated the matter to its ultimate conclusions; second, the railroad system itself, in the strong throes of its formative period, has sometimes seemed to deny its manifest destiny. Unrestrained and ruinous competition, reacting upon itself, has forced rate wars and discriminations, confined to no one locality or territory, but threatening even such results as the diversion of the nation's commerce. That this period, now approaching its end, should give way to better conditions and wiser policies is as inevitable as that iron rails should give place to steel. Potent as the railroad is, it must conform to rather than make conditions. The New York merchant will trade with Chicago if transportation rates leave him a profit; if they do not, his business with Chicago ceases, and the carrier loses. From this it follows that, within the limits of a just and reasonable freight tariff, the equalizing laws of trade must determine conditions for the railroad. With this elementary principle in mind, the "railroad problem" loses many of its difficulties; but it is not the purpose of this article to discuss this question further, except as its effects are seen in tracing the history of the system's development.

The first railroad commonly claimed to have been built in America was in Massachusetts, and ran from the Quincy granite quarries to tide-water at Neponset, a distance of three miles. It was completed in 1826, at a cost of $34,000. Candor compels the statement that this much-vaunted bit of road was neither more nor less than an ordinary tramway for horse-power, such as had been common at the English coal-mines for many years before that time. Waiving, then, the claims of the Quincy road, as well as those of the Mauch Chunk switchback road, built in 1827, the record shows the first railroad in this country really entitled to be called such, and the first on which a locomotive was actually run, to have been the Carbondale Railroad, built in 1828, by the Delaware and Hudson Canal Company, from their coal-mines to Honesdale, Pa., a distance of sixteen miles. In 1829 a locomotive built in England from the plans of Horatio Allen, an American engineer, was brought over, and in August commenced running regularly on this road.

That locomotive, called the *Stourbridge Lion*, was the first ever used in the United States, and was imperfect even for those times. The multitubular-boiler engines which succeeded this type were perfected by Stephenson, and the *Rocket*, the first of this new class, was successfully tested over the Rainhill track in the same year.

The *Rocket* was to the railroad what the *Clermont* was to steam-navigation, and to its inventor, as to Fulton, should be accorded the full measure of glory for the achievement. At the same time, in this case again, as in that of Fulton, the idea thus perfected and demonstrated practicable was not a new one. Little known as the fact is generally, an American was the first to conceive the locomotive engine. His name was Oliver Evans, and in Philadelphia he perfected in 1782 a steam-carriage, consisting of a high-pressure engine placed on wheels. This machine, when exhibited during that year, was found capable of running a mile and a half at a single stretch. From this time the records show no further attempts in this direction for twenty years, or until 1802, when Richard Trevethick, an Englishman, patented a self-acting steam-engine, capable of drawing a light load at the rate of five miles an hour. Two years later this engine was put in use at the Merthyr-Tydvil mines; and the demonstration in 1811, by Mr. Blackett, an English coal proprietor, that weight and friction would suffice, even with smooth wheels and rails, to render the steam-engine self-motive on grades or with heavy loads, caused the further introduction of short lines at the mines. The final triumph in locomotive engineering, and the one which made possible a speed and draft-power of practical utility, was reserved for George Stephenson, the rough and unlettered Northumbrian miner. Passing over his earlier struggles and partially successful models, we find the *Rocket*, in 1829, standing boldly forth as the alpha of the modern railroad.

The first American locomotive did not appear for nearly a year later, and was but a diminutive affair. It was called the *Tom Thumb*, and its inventor was no less distinguished a personage than the late Peter Cooper. The boiler of the *Tom Thumb*, although little larger than that of an ordinary kitchen range, was provided with vertical tubes, thus securing the necessary heating surface; but the waste-steam blast of Stephenson was replaced by a primitive bellows-like contrivance worked by a drum, with a belt which passed over one of the wheels of the carriage. Notwithstanding its crudity, this little locomotive, which was run by its inventor over the tracks of the Baltimore and Ohio,—then operated by horse-power,—was capable of a very fair speed.

Mr. Cooper's retirement as a locomotive engineer came about too speedily, however, for his genius in that line to be thoroughly tested. It was due to an amusing circumstance, which caused the late venerable philanthropist much mortification for many years. While out with a party of friends exhibiting the *Tom Thumb*, Mr. Cooper met, at a spot where the road and railroad tracks paralleled each other, the proprietor of the great stage-coach line of that part of the country. This gentleman, who was waiting with one of his fleetest trotters, proceeded to demonstrate the superiority of horse-flesh over steam. He would scarcely have been able to do this but for a mishap, as Mr. Cooper fired up his tiny furnace and ran steam far above license limits, while the diminutive *Tom Thumb* trundled along at a rate that after the first quarter was placing steam-power well in the lead. Slowly the engineer-fireman-inventor saw his engine drawing away from the wearied horse, and victory seemed certain, when suddenly the belt, before mentioned, ran off the drum, the fires slackened, and the race was lost. Mr. Cooper felt his defeat keenly.

The second American locomotive was built at the West Point Foundry near Cold Spring, N. Y. (where the Parrott guns were cast during the War of the Rebellion), after plans by E. L. Miller, and was equipped with a common vertical boiler. Despite this drawback, this locomotive, which was called the *Best Friend*, did attain, unattached, a speed of thirty to thirty-five miles an hour, and with a train of five cars fifteen to twenty miles. This locomotive was built for the South Carolina Railroad, which ran between Charleston and Hamburg, and with the consideration of which is fairly begun the history of American railroads.

On the fifteenth day of January, 1831, or precisely four months after that memorable day when George Stephenson, standing on the foot-board of the *Northumbrian*, had started the first train, on board of which was the Duke of Wellington, over the Manchester and Liverpool Railroad, the stockholders of the South Carolina Railroad celebrated the first anniversary of the opening of their road by introducing steam motive power. The *Best Friend* was the locomotive, and by means of it a train of two pleasure-cars, carrying a band and 150 stockholders, together with a specially fitted up carriage bearing a detachment of United States troops and a field-piece, went down the road on a grand excursion. This was the inauguration of the passenger railroad system of the country, and it followed very closely, as can be seen, upon the English beginning made by the Stockton and Darlington road in 1825. The fact that the road was a year old before steam was introduced illustrates a point which every student of American railroads has had brought to his attention and consideration, viz., that America, as though foreseeing the final triumph of the locomotive, commenced her railroads some time before this motive power was developed. As an example of splendid assurance, the action of this same South Carolina Railroad in voting, on January 14, 1830, that "steam" should be the only motive power used on the road stands unequaled. Other roads were similarly forehanded in laying their tracks in anticipation of the locomotive. The Baltimore and Ohio, begun in 1828, was operating by horse-power a short stretch of road fifteen miles long, from Baltimore to Ellicott's Mills, in 1829, and carried as many as 80,000 passengers and 6000 tons of freight during the year 1831. A year later, when the line had been extended to Frederick, steam was introduced as the motive power. In 1831 the South Carolina Railroad had progressed to a point where it originated the four-wheel car-truck, and had replaced the primitive old *Best Friend*—which had unfortunately suffered from a boiler explosion early in its career—by locomotives of more improved construction and design. In connection with the apprehension caused by the bursting boiler a curious custom developed on this road. This was the introduction of a car loaded with several bales of cotton, and known as the "barrier car," between the locomotive and the passenger-cars. Behind this the early Carolina traveler felt comparatively safe.

Among others of the very early roads were the Baltimore and Susquehanna, dating from 1830; the little four-and-a-half-mile line between New Orleans and Lake Pontchartrain, starting the same year; the Boston and Lowell, incorporated in 1830; the Boston and Providence, and Boston and Worcester, incorporated in 1831; and the Mohawk and Hudson, which commenced running in September, 1831. Of all the early roads this latter is probably the best known, through the numerous old prints that have been preserved of the *De Witt Clinton* puffing along, with a train of most extraordinary cars in the rear. These were nothing more or less than ordinary stage-coach bodies mounted on trucks, coupled together with chains. The track consisted almost universally of wooden rails, laid upon stone or timber ties, and having an iron bar or "strap," of from one half to five eighths of an inch in thickness, spiked along the top on its inner edge, on which the wheels ran. The early American locomotive engine, of which the *De Witt Clinton* may fairly be said to be typical, was a small, rather rickety affair, weighing from three to three and one half tons, with a detached tender carrying pitch-pine for fuel, and capable, when driven, of making thirty miles an hour. The spark-arrester for smoke-stacks was unknown, and outside passengers escaped lightly if their clothing caught fire no oftener than once or twice during a trip.

The English locomotives built by George and Robert Stephenson at Newcastle-on-Tyne were heavier and better machines. The first of these, brought here before the *Rocket* model had been perfected, was landed at New York in 1829, and set up in an iron-yard on the East River, where it was exhibited as one of the mechanical marvels of the time. This engine, however, was little, if any, better than the home-made ones; but in 1831 there was imported another of the improved models, which weighed seven tons, and was considered a most powerful machine. This engine was for the Mohawk and Hudson road, and cost when delivered, with all charges paid, $4869.59. Its general appearance and effectiveness will be easily imagined by those who saw at the World's Fair at Chicago the famous old *Johnny Bull*, of the Camden and Amboy line, of historic memory. This engine, a great machine in its day, was landed at Philadelphia in August, 1831.

Almost the first improvement made by American engineers upon the English models was the introduction of the swivel fore-end truck, suggested in 1831 by Horatio Allen, of the South Carolina Railroad, but first perfected and adopted by John B. Jervis on the Mohawk and Hudson road, in the same year. This change, so absolutely necessary in a country where railroad companies had neither money nor time to spend in avoiding heavy gradients and sharp curves, gave the American machines an advantage over the rigid English locomotive which they have ever since maintained. Even to-day a billiard-table road-bed is essential in obtaining good results from machines of English make. The equalizing-lever, patented by Joseph Harrison, Jr., of Philadelphia, was the second improvement, and was absolutely demanded by the rough-and-ready nature of the work required on American railroads. It gave greatly increased stability, and lessened to a large extent the danger of derailment. The idea of two pairs of driving-wheels was patented in 1836 by Henry R. Campbell.

The railroads of the country were growing, meanwhile, and those already mentioned and a few others were either undertaken or in view within twelve months of the day that the *Best Friend* pulled the first passenger-train out of the Line Street station in Charleston. In 1830 there were but 23 miles of railroad in operation in the United States. Within a year this had been increased to 95, and a year later still to 229—a wonderful record, considering the undeveloped resources of the country at that time. It cannot be claimed that these railroads were such as to compare even distantly with those in England. They were but primitive constructions at the best, cheaply built, poorly equipped, faultily designed, and, briefly, such only as a young country commanding the crudest of mechanical appliances could produce. Then, as in later times, it was the practice of railroad managers to construct their lines as quickly and as cheaply as possible, leaving their improvement to the future, when its necessity should have been demonstrated, and the expense could be borne by the earnings and surplus funds. This policy, avoiding enormous initial outlay, is still working itself out, as has been seen so plainly of late years in the gigantic undertakings by which the Pennsylvania road is straightening its crooked course, and the New York, New Haven, and Hartford is obviating highway crossings at grade. In England, on the contrary, construction has always proceeded upon a different plan. Heedless of obstacles, regardless of expense, and careless of time, engineers have gone slowly forward. Had Edinburgh and London been as far apart as New York and San Francisco, they might not yet have had a rail connection. The Manchester and Liverpool, the second English railroad opened, well illustrates this. It approached very nearly to those attainments of engineering skill which characterize construction today. George Stephenson, who had invented the locomotive, also carried out the building of its pathway; and in this road, with its underground tunnel, high embankments, deep cuttings, lofty viaduct, and buoyed road-bed across the quaking bogs of Chatmoss, he achieved a distinction as an engineer that was second only to the greater glory of his mechanical inventions.

America, slow though she necessarily was at first in developing the resources which were essential to perfect railroad construction and equipment, was behind no nation in her realization of the economic value of this new method of transportation. Her initial crudity, even if the circumstances of the time did not sufficiently excuse it, may perhaps be pardoned when it is considered what sacrifices the proprietors have made in later years in order to overtake and outstrip every other nation on the face of the earth. The American railway system stands forth to-day as the most stupendous and progressive, and among the most perfect, in the world. But this is outrunning history. Sixty-five years ago, the great mass of the people never dreamed, wonderful as they believed the railroad to be, of the extended achievements of to-day. Only by a few men of great minds was the true significance of this new factor in affairs properly appreciated. Long after the excitement and novelty attending the opening of a new road or the trial of a new locomotive had worn off through the very frequency of its occurrence, they were planning and working toward great ends. They saw that the canal system must give way before the new force as soon as the public needs demanded that speed and convenience should replace the old-time delays and discomforts. With it all, the men who had made New York the great commercial center of the country, and who, down the long Erie Canal and the broad waterway of the Hudson, had led to their city the produce of the great central and lake region, then known as the West, saw their commercial supremacy menaced. Nor did they realize the danger more quickly than did the enterprising spirits of the other great rival seaports—Boston, Philadelphia, and Baltimore—recognize their opportunities. The Erie Canal, striking to the very heart of the continent on the line of least elevation above tide-water, had settled the question, until then contested, as to which of the great Eastern cities should become the national port of entry and distributing center. Away down in New Orleans, reaching up with the long arm of the Mississippi, as well as in all the Atlantic seaports, had been felt the diversion of the stream of Western trade; and it was, in fact, the effort to recover this lost ground that caused one of the earliest of the railroads, the great trunk-line of the Baltimore and Ohio, to be projected. Between Baltimore and her hopes, however, stretched the rough barrier of the Alleghanies, and the engineering skill of those days was scarcely sufficient to compass all at once this difficulty. Philadelphia, too, actuated by the same motive and attempting reprisal by the same means, found herself balked by the same great wall. Still, these delays were recognized as being only temporary, and already, by 1835, Boston was seen to be reaching out over the Boston and Worcester to cross the previously supposed insuperable barrier of the Berkshire Hills and enter Albany. This, we know, was accomplished in 1841; but long before that time, in 1836, the great trunk-line of the Erie Railway was commenced, and the foundation laid for New York's greatness as a railroad center. The completion of this road to Dunkirk in 1851, and its opening for through traffic, marks the inauguration of the trunk-line system.

Another great railroad power, active during all the earlier period in behalf of New York, was the New York Central, which was formed in 1853 by the consolidation of five small railways. This shows how, before its future great president, Commodore Vanderbilt, entered on his successful career as a manager, others appreciated the axiom that competition among railroads cannot exist where combination is possible. Commodore Vanderbilt was, however, well known before that as an important factor in the business of conducting transportation. In the very earliest days of railroads, when the Boston and Providence, in 1835, established the first link in the rail connection between New York and Boston, his steamboats afforded the complementary transportation. It would be far too tedious, and require too great a space, to trace in detail the fortunes of the American railroads through the disconnected links of short lines which began in 1831 to spring up all over the country. As an evidence of the number and comparative insignificance of these roads, it can be stated that in 1832, when the total mileage of the country was only 229, there were no less than sixty-seven separate railroad companies in the State of Pennsylvania alone. In this multiplicity of beginnings a general idea of the growth of the railroads of the United States can best be derived from the following figures, which give the total mileage of the country by demi-decades from 1830:

MILES OF RAILROAD IN OPERATION FROM 1830 TO 1894.

Year.	Miles in Operation.
1830	23
1835	1,098
1840	2,818
1845	4,633
1850	9,021
1855	18,374
1860	30,626
1865	35,085
1870	52,922
1875	74,096
1880	93,296
1885	128,361
1890	166,706
1891	170,795
1892	174,750
1893	170,607
1894	175,441

Omitting for the present the consideration of the later figures, the proportionate importance of the early increase as expressed in percentages is seen at once. From 1835, when the first 1000 miles of railroad were in operation, the increase for each established period of five years varies but little from one hundred per cent. until the time of the Civil War. With the railroads of the country thus doubling twice in every ten years, it is easy to understand that conditions must have been more or less chaotic so far as rates and facilities were concerned. Towns reached only by a long, tiresome, and expensive wagon-ride one year were placed in close communication with the outside world the next. The communication naturally established trade relations; a new market and a new source of supply were concurrently developed, and the effect could not be anything but stimulating to the industrial condition of the country.

There was much unevenness in this early development, however, and much inequality; not only was one town favored at the expense of another, but even the favored ones found themselves confined within the limits of a system that was ignorant of coterminous facilities, and jealous to an extreme degree of joint traffic. In such conditions, therefore, it was some time before the many links began to realize that they were but part of what must eventually be a great chain. It was not until so late as 1860 that the railroad chain was complete and continuous along the Atlantic coast and to the South, and that Bangor, Me., and New Orleans were at last at the ends of a connecting system.

In the West, prior to 1850, there were, broadly speaking, no railroads. The first ones to be built on the farther side of the Alleghanies were, singularly enough, in the extreme Southern States of Louisiana and Mississippi. These roads were the Clinton and Port Hudson, incorporated in 1833, and the Bayou Sara and Woodville road, incorporated as the West Feliciana Railroad Company in 1831. They were operating before 1840, and have continued ever since, enjoying the distinction of being the pioneer Western railroads. For ten years thereafter no new ones entered the field, but by the middle of the next decade a network of them was stretching across the face of the great central region. A system of land grants did much to foster this growth in the West. The general government allotted certain alternate sections of the public lands to the several States in the West, and these States ceded them under certain conditions, in the nature of a subsidy, to the railroads. The Illinois Central and the Mobile and Ohio were the first railroad corporations to gain the advantage of these grants.

It was during this period that the far-reaching effects of the railroads began to be appreciated in the fuller significance to which their extension has brought them to-day.

The intervention of the five years of war and turmoil which came coincidently with this realization prevented the immediate carrying out of the plans then formed. Nevertheless men were planning all through that dark and disturbed time, laying the foundations of those gigantic undertakings the beginnings of which were made almost before the dawn of peace at Appomattox was saddened by the death of Lincoln. By 1866 the spirit of railroad extension was spinning the shining network of its rails throughout the land; by 1869 it reached dimensions wonderful to behold, 8000 miles in each of the two succeeding years being the rate of increase. Profits satisfying the grasping hopes of avarice beckoned capital on, and, with small regard for consequences to themselves, the railroad managers plunged recklessly into competition. Existing lines were paralleled; territories already covered by one system were invaded by rivals, and the great war of competition began in earnest.

This weakness of unlimited competition, coupled with the extreme sensitiveness of the railroad to industrial and commercial changes, found it more than vulnerable when the crash of 1873 came upon the country. In view of the disastrous consequences of the failure of Jay Cooke & Company, in the troubles of that time, the railroad may fairly be said to have aided in bringing about its own decline, since it was in attempting to carry singly the enormous financial burden of the Northern Pacific construction that this great house went under. Within the next two years railroad increase dropped off seventy-five per cent. Then, responding to improved conditions, it started again on the wonderful career which ended early in the eighties, when enterprise, having overdone itself in such follies as the Nickel Plate and the West Shore bubbles, fell from sheer exhaustion. Recovering therefrom within the short space of three years, a fresh start was taken, at a pace that placed the record for annual railroad extension at nearly 13,000 miles. This was between 1886 and 1887, and was followed by a normal growth lasting until the financial troubles and industrial depression of 1893, when for the first time in the history of railroads in the United States the number of miles of road operated decreased. The discussion of this phase of the subject, bringing us as it does to the present time, will properly come later. Reverting, then, to the period immediately following 1869, extending, with the brief interruption already noted, to 1883, we find an idea of the pace at which the great systems of the country were evolving in the figures for the single decade between 1869 and 1879.

INCREASE OF SELECTED SYSTEMS, 1869 TO 1879.

Name of Road.	Mileage, 1869.	Mileage, 1879.
Pennsylvania R. R.	538	4,000
N. Y. Central and H. R. R.	593	2,500
Chicago and Northwestern	1,150	2,158
Chicago, Milwaukee, and St. Paul	839	2,250

This increase is not, of course, to be set down wholly to structural extension, which was in fact but one factor in the growth, and scarcely more important than several others. Consolidation, or acquirement by lease or purchase, has much to do with the formation of great lines. This policy was undoubtedly based in its conception upon the fallacious idea, generally held by railroad managers at that time, that it was possible for a road, by exclusive control of territories, to obtain advantages in the dictation of rates and facilities that would enable it to maintain itself upon the arbitrary basis of charging "all that the traffic will bear." Undertaken in this spirit, however, the great systems, coming to understand more fully the limitations of their power, have applied themselves to the problem as it actually exists, and in the constantly decreasing rates of transportation, made possible by the economies of concentration and latter-day improvements, they have given that stimulation to trade which is at once the encouragement of the merchant and the advantage of the carrier. To illustrate the growth that has resulted, the increased mileage of the following large systems in the period from 1883 to 1894 is given:

GROWTH OF SELECTED SYSTEMS, 1883 TO 1894.

Name of Road.	Mileage, 1883.	Mileage, 1894.
Atchison, Topeka, and Santa Fé	2,510	9,345
Baltimore and Ohio	1,554	2,907
Central Pacific	1,213	1,428
Chicago, Burlington, and Quincy	3,322	5,730
Chicago, Rock Island, and Pacific	1,381	3,572
Illinois Central	1,927	4,296
Lake Shore and Michigan Southern	1,339	1,476
New York, Lake Erie, and Western	1,025	2,061
Northern Pacific	2,546	4,457
Southern Pacific	990	6,651
Union Pacific	1,820	4,469

Sketching thus in outline the history of the railroads down to recent times, one branch of the subject has been omitted until the last in order that its importance might have the full consideration that it deserves. This is the transcontinental system. Its conception, its accomplishment, and its development are the glory of American genius, and its union of the most distant bounds of this great nation the bond which makes one in material fact a nation that must ever be one in sentiment and purpose. So early as April 1, 1850, there met at Philadelphia a convention called to discuss the feasibility of a railroad to the Pacific coast. The discovery of the California gold-fields, and the rush thither in the years preceding, had turned men's minds as they had never been turned before toward that wonderful country so lately won from Mexico by the aggressive patriotism of Commodore Shubrick. From a little-known region where traders bartered for hides with the indolent and suspicious Mexicans, California had become the El Dorado where hundreds of thousands longed to go, and thousands already there clamored for the supplies the East would so willingly have furnished them. But there were no means of getting there except by the long sea-voyage, either crossing the Isthmus or around Cape Horn, or by the equally slow and far more perilous voyage in the prairie-schooner across the plains and mountains, where hostile Indians, starvation, thirst,—every danger, in short, that an unknown and arid land could offer,—awaited the traveler. Could a railroad but be built, these gentlemen who gathered at Philadelphia in 1850 felt how great would be its achievement and how instant its success. They were ahead of their time, however, and the project was too vast for immediate acceptance. Man had not then become accustomed to working miracles, as he has in these days, when no project is too immense or chimerical to have its stock subscribed for at some figure. Accordingly nothing was done beyond the mere exploiting of a great idea; but perhaps that was the best thing that could have been done, inasmuch as it familiarized men's minds to the contemplation of the thing as possible. The second great step in the preliminary endeavors toward transcontinental railways was made during the administration of President Pierce. The War Department, at whose head was Jefferson Davis, organized and carried out a great survey, laying out several railroad routes across the continent. The report of these governmental engineers still further interested the country in the subject.

The idea first enunciated in 1850 was twenty years in coming to its full fruition. The conditions caused by the war, and the necessity, more strongly felt than ever, for close communication with the great Western regions and the Pacific slope, were powerful motive forces in the direction of such an undertaking. California had built her first railroad in 1856, and was as eager to reach the Atlantic as the Eastern States were to arrive at the Golden Gate. With a united sentiment in its favor, and a government ready to aid by every means in its power, the stupendous project was inaugurated on July 1, 1862, by the incorporation by Congress of the Union Pacific, which in its junction, seven years later, with the Central Pacific near Ogden, Utah, completed the first railroad line across this or any continent. The government, as its share in the undertaking, granted subsidies of enormous value. To the Union Pacific—the main line of which ran from Omaha, a straggling frontier town, to Ogden, Utah, a distance of 1033 miles—was granted a subsidy in bonds of $16,000 per mile from the Mississippi River to the base of the Rockies. Across this almost impassable barrier the amount was raised to $48,000 per mile, and between there and the Sierras lowered again to $32,000 per mile. In all, 1038 miles were subsidized, at an expense to the government in bonded indebtedness of $27,236,512. In addition to this the company was granted, subject to securing patent, no less than 12,000,000 acres of land.

The Central Pacific, in its turn, with a subsidized mileage of 737, cost the government in bonds issued $25,885,120, and received land grants amounting to 90,000,000 acres. The first rail on the Union Pacific was laid in July, 1865, and between then and May 15, 1869, when the junction with the Central Pacific was finally made, the work was carried on amid difficulties such as can scarcely be understood to-day. Surveying parties, cut off by Indians, perished miserably; construction camps harassed, stock driven off, stragglers cut down almost within hearing of the clicking picks and striking shovels; constant alarms and wearying watchfulness—all these things made up the price which the white man paid the Indian for passage across his lands. Nor were these the only difficulties. Nature herself opposed her most formidable front to the invaders of her solitudes—deserts parched and alkaline, rivers rock-walled and turbulent, valleys to be crossed, hills to be cut down, mountains to be wound about in snake-like, tortuous curves. Now clinging to the side of a sheer precipice, now spanning a fathomless chasm, now diving beneath some

Stuyvesant Fish.

huge spur barring the way across the everlasting heights, slowly the twin threads of steel crept on. Men who had shriveled with fever on the sun-baked levels shivered with the deadly cold on the cloud-girt heights, and hundreds fell. But the Rockies were crossed at last; to an altitude of 8205 feet above sea-level the long roadway climbed, falling thence slowly to the plateau beyond. It was the greatest engineering feat man had ever achieved, and marks an epoch in the progress which there began to stretch beyond the accepted bounds of human limitation. The Central Pacific crossed the Sierras in a similar manner at an altitude of 7042 feet, and dragged for hundreds of miles through the Humboldt Desert, and the work was done. There is no need to enlarge upon the importance of what is self-evident. The correlation of Occidental development and Eastern prosperity is too well understood to require demonstration, and even if it were not, the results which the brief quarter of a century of transcontinental communication has effected speak far beyond the power of either words or figures.

Others of the early transcontinental lines speedily followed on the commencement just related. Long before the first through train from East to West was run, new companies had been chartered, and long construction trains, laying their roads before them as they went, were crawling across the continent. The Northern Pacific, chartered in 1864, was organized to construct a line from Lake Superior to Puget Sound, a distance of 1800 miles, with a branch 200 miles in length to Portland, Ore. The land grants obtained by this company aggregated 47,000,000 acres. The Atlantic and Pacific Railroad, chartered in 1866, obtained grants of land based on mileage; 12,800 acres being allowed per mile in the States, and 25,600 acres per mile in the Territories. This line in connection with the Atchison, Topeka, and Santa Fé, and the St. Louis and San Francisco Railway, made practically two routes across the continent. The Texas Pacific, which was incorporated in 1871 to extend from New Orleans to Sierra Blanca, a distance of 1068 miles, joined there the Southern Pacific, which ran to San Francisco, and the rail connection was opened on October 15, 1882, thus perfecting the union of the Pacific coast with the country at large, and more fully binding it in the following year by the further junction of the Southern Pacific with the Galveston, Harrisburg, and San Antonio road to the Gulf.

It would be impossible to trace further, even if space allowed, the progress in detail of that most complicated organism, the American railroad system, toward its present condition. By just what steps the advance, undeniably making toward homogeneity and a concentration of control, is to be brought about is a question hard to answer, and admitting of explanation based on varying opinions. It is unquestionable that this potent force steadily working is the one in which the final solution of the so-called "railroad problem" will be found. It is a power best observed in the results following its manifestations as railroad history knows them, and therefore best studied in the abstract rather than in the detailed enumeration of the absorption by the XX line of the YZ road, and so on through all the permutations of railroad evolution.

The constructive period of the railroad in the United States may be said to have ended in 1869, assuming our definition of this period as that during which extension was purely on legitimate lines, with new fields for all, and non-competing roads the rule. This period, being naturally one of great prosperity for existing lines, became through this very reason the cause of their own undoing. It showed men where money was to be made, and regardless of the fact that where one man may live in plenty two men may find but scanty rations, and four men starve, they rushed into the new field. Thus was inaugurated, almost imperceptibly at first, but more and more impetuously as it went on, the era of unchecked competition, through which it seems to have been necessary that the railroads should pass. The very swiftness with which it came on only aggravated the distemper. Industrial and commercial conditions found it impossible to keep up with the facilities that the railroads were offering. Manufactories were only producing such an amount as trade demanded, and trade, in its turn, was only of such volume as consumption, regulated by existing conditions, required. In the handling of this internal commerce, transportation facilities as they then existed sufficed.

Into this seemingly well-balanced order was suddenly injected the new element of vastly increased transportation capacities. Competitors built rival roads side by side with the old ones, and tapped from opposing sides the tributary territories. Then, that they might secure business, rates were lowered and the war fairly begun. Where one railroad had been able to handle the traffic of a given section, two now divided between them the same traffic. Commerce could not double itself at a bound; it had to grow. Furthermore, it saw its advantage in this struggle of the railroads, and so in turn crowded each of the competitors to a fresh concession, which was at once used as the lever to screw down again the rival. This state of affairs could not last, and its effects were soon seen in the bankrupt roads that began to appear. These only brought a fresh complication to a condition of affairs that was fast becoming alarming to the longer heads who were managing the great lines. Thus was demonstrated the fallacy that competition, free and untrammeled, could work no evil. With nothing in their treasuries and profit earning impossible, the only resource of the bankrupt roads was to secure business at any price in order to live, and they did it, and kept on, while the solvent lines became poorer.

From such a state of affairs there was but one issue—natural, but distasteful to a degree to men who were jealous of their company's exclusive sovereignty, even to the extent of refusing joint traffic. This issue was combination, and the lukewarm manner of its early adoption made it but a poor remedy. Furthermore, the public, ever ready to view with alarm the harmony of great interests, saw in this only a gigantic scheme of the railroads to monopolize power. The very men and communities who had thrived by the discriminations forced by a fierce competition were loudest in protesting when a more equitable adjustment was proposed. Towns fifty miles apart and connected by two or more roads could exchange their goods at a less rate of freight than was paid by the shipper in the small half-way town who had only one road to depend upon. By such a system as this the railroad managers sought compensation for the slaughter of rates, and the secretly favored shippers acquiesced silently. From those who paid full rates in the less favored towns, however, there was no such approbation. They were undoubtedly discriminated against, and instead of recognizing that it was the inevitable result of that competition so universally applauded, they regarded it as the deliberate persecution of great corporate interests.

In the West this feeling was most intense, and the Granger movement, which began in Illinois in 1870, and attained the dimensions of a political power three years later, attests its violence. Of the legislation growing out of this agitation in the West there is little need to speak. The railroad commissions, as at first there organized, were too extreme in their partisanship to exert great remedial influence. Drastic laws enacted by the legislatures, scaling arbitrarily all rates to the basis of the competitive rate, nearly ruined the railroads. Taxes, wages, and fixed charges had to be met, and rates on that basis could not accomplish it. Capital became frightened and withdrew, and development in those sections was arrested to such an extent that even the legislatures themselves became alarmed, and where the Granger movement had flamed the fiercest it died the soonest, and within three or four years less arbitrary laws were passed, and the commissions became less bitter in their antagonism.

Early commissions in the East were more fortunate, owing to the fact that the resident ownership of railway stocks and bonds made their spirit more temperate and their powers less arbitrary. Of this early appearance of the State regulation of railroads, afterward developed in 1886 to national proportions, the scope of this article prevents extended mention, the subject falling more strictly within the lines of the chapter on "Interstate Commerce."

Adhering, then, to the original lines of railroad discussion, we come in 1873 to that epoch-marking event, the Saratoga Conference. Competition was verging on chaos. The solvent lines, having competed until combination had been forced as the alternative of ruin, now sought to present a united front to the bankrupt and reckless roads, whose motto was "business at any price." The five great trunk-lines connecting the Eastern seaboard with the interior were the Baltimore and Ohio, the Pennsylvania, the Erie, and the New York Central, and north of all these the Grand Trunk, a Canadian line. Agents from the first four of these lines had from time to time met at regular intervals and published agreed rates. In the summer of 1873, however, Commodore Vanderbilt being at Saratoga, representatives from the Erie and the Pennsylvania met him there, and an arrangement was entered into by which, in addition to agreeing upon tariffs, the roads in question were to establish a board of arbitration to adjust disputes. President Garrett, of the Baltimore and Ohio, absent from the original conference, but consulted later, was the only dissentient American. He refused to submit the independent action of his road to any board of arbitration. A rate war with his nearest neighbor in the combination, the Pennsylvania, was therefore begun, which resulted in the undoing of the work of the Saratoga Conference, and all four of the American lines going back to the old arrangement of a mutually agreed-upon freight tariff and independent action.

The Grand Trunk, coöperated with by numerous small Western roads, started one of the most momentous railroad wars ever known, and one that bade fair for a time to transfer to Boston the commercial supremacy previously enjoyed by New York. The terminals of this line, by virtue of its connections, were Milwaukee and Boston, and between these points rates were fixed at a figure that was shortly diverting from Chicago and New York the great stream of traffic, hitherto uninterrupted, between these great centers. Neither Milwaukee nor Boston being competitive points for the other four great trunk-lines, these roads were disinclined to commence a ruinous rate war; but the divergence of New York's trade to Boston became at length so alarming, in the winter of 1875, that the New York Central was forced to take action, which it did with an initial and sweeping cut of sixty per cent. Following the invariable rule in such cases, the warring parties soon reached the point when an agreement was necessary, and a sort of truce was patched up in December, which, after enduring a few weeks, ended in a general mêlée, in which the Erie, the New York Central, and the Grand Trunk were the most prominent, although after about eight months the entire five trunk-lines were ready for almost any sort of an agreement.

The significance of this earliest rate war, by which Boston had benefited so greatly, was not lost upon Philadelphia and Baltimore, and all through the succeeding struggles the underlying motive was found in the desire of one of the three other great seaboard cities to surpass New York. With the exception of Boston, already sufficiently favored by the Grand Trunk, both Philadelphia and Baltimore had always been conceded a slight differential advantage in rates to neutralize the difference in ocean freights their location imposed. New York found herself unable to concede the advantage longer when her rivals began their war for supremacy, and various more equitable substitutes were proposed and tried. Nothing availed, however, to avert one final struggle between all the lines; and after rates had sunk to from 2.8 mills to 3.5 mills per ton per mile between the East and West, the roads at length wearied, and the joint or "pool" system was for the first time adopted on the great trunk-lines in 1877; Colonel Fink, who had originated and successfully carried out this idea two years before in the Southern Railway and Steamship Association, being called upon to take charge. Under the terms of this first "pool" the Baltimore and Ohio received but nine per cent., the Pennsylvania twenty-five per cent., and the New York Central and the Erie thirty-three and a third per cent each.

The important relation which these four great trunk-lines concerned in the East and West traffic bear to the railroad system causes them to serve most readily the purposes of illustration of the tendency toward closer relations displayed by the American railroads in their advance toward the homogeneous, even if not united, system of the future. Through wars almost numberless the outcome has been seen in every case to have been the assumption by the competitors of some mutual obligation for the sake of peace. The "pooling" idea thus traced to its first great manifestation has not been, however, of such recent growth as might be supposed. It was introduced into New England at an early date, and quietly used for a long time. The celebrated Chicago-Omaha pool of 1870 and the Southern organizations also preceded the Trunk-Line Association; but all of these were largely experimental, and certainly lacked the coherence arising from the discipline of an actual central authority. When, after years of the bitterest war, however, the great trunk-lines finally came to adopt it, men realized that it had been inevitable. To-day, while rate wars and the tactics of competition are by no means ended, nor ever will be so long as many interests compete for similar ends, their effects are no longer so ruinous as twenty years ago. With the great corporate interests vested in the railroads joining with one another for mutual protection and advantage, that thing most vividly pictured by the demagogues has never come to pass. Instead of a great monopoly crushing the public rights underfoot is found a condition of things so vastly improved since 1873 that it seems scarcely possible that railroad science can have advanced so greatly in so short a space of time. Rates have fallen to a point absolutely impossible before the era of improvement, and both freight and passengers are now transported for less money, and with more safety, speed, and convenience, than in any other country on the face of the earth. Freight rates, which in 1873 averaged 1.985 cents per ton mile on the great trunk-lines, fell in the twenty years ending in June, 1893, to .8 of a cent per ton mile, a reduction of nearly sixty per cent. In the West and in the South the reduction has been much greater. In order to better understand the tremendous significance of this decrease a further reference to the figures will be useful. The shippers of the country paid in round figures the sum of $808,000,000 for the transportation of their freight in 1893. Had the rates of twenty years ago still prevailed, the sum of $2,020,000,000 would have been required to meet these charges. Thus the people and the commercial interests of the United States were saved an annual amount of $1,212,000,000.

Such a tremendous falling off in rates has, of course, only been withstood by the railroads by the exercise of the most rigid economies, the adoption of every improvement tending to minimize the cost of operation, and an adaptation to latter-day needs, which, on the closest of profit margins, demand a volume of business of gigantic proportions in order to balance the long account of the fixed charges. Nor has this wonderful change in railroad conditions come about without injury to the corporations engaged. No less than forty per cent. of the mileage, representing about thirty-one per cent. of the property valuation of the railroads, has been forced into bankruptcy during this period. The lines that have survived the strain have done so only by the expenditure of millions in the improvement of their properties.

One of the greatest, as it is perhaps the most important, of all these changes has been the introduction of steel rails in the place of the old iron ones. In the twenty years following the adoption of these rails on the New York Central the volume of traffic increased from 400,000,000 ton miles to 2,000,000,000 ton miles. With the old iron rails such an enormous traffic would have been practically impossible, and its cost absolutely prohibitive. Beginning with a rail but little heavier than the iron ones then in use, the weight has been gradually increased as its economy was appreciated. To-day the 100-pound rail is in not uncommon use on lines of heavy traffic, especially on curves and grades, and it has been found one of the most potent factors in reducing cost both in draft-power required and in diminishing wear and tear on rolling-stock. The increased use of steel in place of iron for rails, resulting in the practical displacement of the latter by the former, is best shown in the figures giving the annual production of railroad bars during the period covered by the change.

PRODUCTION AND DOMESTIC CONSUMPTION OF RAILROAD BARS.

Year.	Iron.	Steel.	Total.	Retained for Domestic Consumption.
	Tons.	*Tons.*	*Tons.*	*Tons.*
1873...	679,520	115,192	794,712	794,371
1875...	447,901	259,699	707,600	706,598
1880..	440,859	864,353	1,305,212	1,304,181
1885...	13,228	963,750	976,978	973,009
1890...	13,882	1,871,425	1,885,307	1,869,426
1892...	10,437	1,541,407	1,551,844	1,536,146

The tons in this table are figured at long weight, 2240 pounds.

A still clearer idea of the increase in the use of steel rails, expressed in mileage, may be had from the fact that where in 1880 there were 81,967 miles of iron to 33,680 miles of steel rails, there were in 1892 only 38,641 miles of iron as against 182,858 miles of steel rails, an increased percentage of steel from 29.1 to 82.6 of the total mileage.

The direct result of the introduction of steel rails was an increased weight of rolling-stock, and an increase in more than an arithmetical proportion of the carrying capacity per car. The freight-car of a capacity of 30,000 pounds, used a few years ago, is obsolete and wasteful, while those of 60,000 pounds and of even greater capacity are now in general use, and may be classed as standard. As cars increased in weight so did the locomotives. With the heavy steel rail came of necessity the weightier and more compact road-bed, and stone-ballasted ways succeeded the old dirt embankment. Over this, immense weights can roll freely, and the locomotive has become a mammoth. In place of the little one-ton *Tom Thumb* of Cooper, or the heavy seven-ton engines of the Stephensons, are found to-day the sixty and seventy ton passenger-fliers and the eighty and ninety ton freight-engines. One giant of the modern rail is a ten-driver freight-locomotive of the Lake Erie and Western, which weighs, as it couples to its train, 115 tons, and could draw the combined rolling-stock of every road existing in the United States in 1835.

Important as track and road-bed are to this development, they are but a part; and as the strength of a chain is that of its weakest link, so would the modern railway fail were it not for the improved bridge construction which has also come during the past quarter of a century. All bridges in the earlier days of the railroad were of wood, and the long trestleworks with which the old engineers crossed uncomfortable swamps are still well remembered. Apart, however, from the question of its structural strength, the wooden span was dangerous from other reasons: it would decay in the weather; it would burn if a hot coal dropped; and it would warp and shrink if the material used in its construction was unseasoned. Even an improved truss, obviating to a certain extent the latter fault, was insufficient to make the wooden bridge either a safe or a profitable feature of railway construction, and by 1870 it had begun to retreat before the iron bridge. This latter material has now so nearly superseded wood in the bridges of the country that it is scarcely necessary to discuss it. The many designs of truss and span give wide variety in its application, from great suspension-bridges to lofty viaducts. One of the latest, and perhaps the greatest achievement of the bridge builder's art, is the so-called cantilever, which may fairly be claimed as an American invention, since the first suggestion of it came from Thomas Pope, who proposed in 1810 a cantilever bridge across the East River. The first cantilever bridge built for railroad traffic was across the Kentucky River, C. Shaler Smith being the engineer. Since then there have been some wonderful examples of this style of construction.

The bridges and road-beds, improved as outlined above, have constituted lines over which the enormous traffic of to-day passes easily and cheaply. Single locomotives now draw trains weighing 2500 tons. Huge palace-cars, weighing as much as a whole train did in the earlier days, are now whirled along at a rate that fifty years ago would have been considered beyond mortal attainment. Still engineers and railway officials are not satisfied, and there is a never-ceasing endeavor on all sides to advance still further. The introduction of electricity as a motive power, already heralded by the Baltimore and Ohio in their Baltimore subway, and by the line at Nantasket, Mass., is the first step in what many able engineers believe will be an advance to speed in comparison with which that of to-day will seem as little as already does the "frightful velocity" of forty years ago, when a traveler held his breath if the speed was greater than thirty miles an hour.

A very natural query raised by the discussion of speed on the modern railway is how it has been accomplished concurrently with perfect safety. That traveling is nearly as safe as remaining at home is generally conceded, and in the United States especially fewer deaths are placed against the railroads in proportion to the miles traveled than in any other nation. Even with this favorable showing the laws are so rigid in holding railroad corporations to the strictest liability that nearly $2,000,000 annually are awarded in death-claims and damages against them. Spurred on by the strictness with which they were held to account, and, little as it may be believed, actuated also by humane motives, the railroads have adopted every new and improved appliance tending to increased safety.

Since the first use of the telegraph on the line of the Baltimore and Ohio, everything tending to place hundreds of miles of road under central and systematized observation and control has been adopted as it appeared. The train despatcher, with his numerous assistants, in the great union station, now directs the movements of every train. Not a driving-wheel turns but by his orders, nor a moment of lost time is noted that is not at once explained to him. The great switch-towers, where scores of levers concentrate the directing force of acres of steel network, are the development of the interlocking-switch system. Air-brakes, torpedoes, flags, lights, semaphores, electric enunciators, derailment guards and split-rail switches, safety-bolts, and, last and greatest of all, the block system, guarding both ends of the flying express at once, are some of the methods and devices by which safety has been secured. Of these, next to the block system, the air-brake, which was first applied to passenger-trains in 1868, is perhaps one of the most notable advances.

The evolution of the rolling-stock of the railroads, particularly as it is connected with the passenger service, began almost with the introduction of train service. The English compartment coach was quickly superseded by the so-called American car, with its central aisle, side-seats, and undivided space. The first sleeping-car, which was simply an ordinary passenger-car fitted with rude wooden berths, was run on the Cumberland Valley Railroad of Pennsylvania from Harrisburg to Chambersburg in 1836. Sleeping-cars continued of the same crude sort until 1864, when George M. Pullman built the first of his modern coaches in the shops of the Chicago and Alton road. This car, named the *Pioneer*, was both too heavy and too wide for the roadways of that day; but a special car being required to convey the body of President Lincoln after his assassination, the *Pioneer* was taken, and the Chicago and Alton altered its road to suit its dimensions. Later, when President Grant traveled through the West, this car was taken, and several of the other roads made the changes necessary to its passage over their lines.

Thus the Pullman car was introduced, and the Pullman Car Company was organized in 1867. The Wagner palace-car was also early in the field, especially on the Vanderbilt lines. The first hotel or buffet car was built in 1867, and the *Delmonico*, the first Pullman dinner-car, was run on the Chicago and Alton road in the year following. The vestibule, making a safe passageway between the cars of a moving train, was first suggested by a sort of canvas diaphragm used to connect cars on the Naugatuck Railroad in Connecticut in 1857, but it was not until 1887 that the first vestibuled Pullman train was operated. To-day a vestibuled limited express has several luxurious sleeping or chair cars, a dining-car, smoking-saloon, library and writing-room, with stenographers and type-writers in attendance, bath-room, and barber-shop. The old-time method of tickets issued by each line separately, involving change of cars and several payments of fare, is now done away with by the system of coupon tickets, in regulation of which the passenger-agents department of the different railroads has assumed a complexity of detail second only to that in the freight department.

The government's use of the railroad for the conveyance of the mails is too generally understood to require more than a brief mention. Congress, on July 7, 1838, constituted every railroad in the United States a post-route. For this service a stipulated amount per pound has always been paid the railroads as common carriers of freight mail-matter. A special compartment in the baggage-car served for many years for the mail; but in 1864 Colonel Armstrong introduced the railway mail-car, as had been suggested two years before by W. A. Davis, a clerk in the St. Joseph post-office. The first fast mail-trains were run in 1874 by the New York Central, and a little later by the Pennsylvania. The receipts from the mail service, together with those from the express companies, etc., make up about five per cent. of the revenues of the railroads, and the passenger service contributes about twenty-five per cent.; while the transportation of freight, which is the bulk of the business, adds seventy per cent. to the incomes of the railroad corporations.

The rolling-stock necessary to the transaction of this business, as apportioned among the different branches, is as follows:

Passenger-cars	27,909	
Baggage, mail, and express cars	7,937	
		35,846
Freight-cars		1,191,884
Total cars		1,227,730
Locomotives	36,293	

The freight service being, therefore, the most important function, financially and commercially, of the railroads, it has attained an economic importance of the first magnitude. In this phase it has already been considered, but in its practical working there has been developed a system of such far-reaching scope and immense potentiality that it deserves description. The days when no road allowed its freight-cars to leave its own tracks have long since passed. The expense and delay incident to the frequent transhipment of through freight became insupportable, and the commercial world rebelled. The adoption of a standard gauge and the acceptance of the principles of joint traffic began directly after the Civil War, and have extended until they have reached the present conditions. Freight is now loaded in a car at New York and not unloaded until it reaches San Francisco. Each line over which the car travels on its journey charges its own rates and receives its due proportion of the total charges. The road owning the car in which the goods are shipped receives in addition from three eighths to three fourths of a cent per mile from the other roads, for whatever distance the car may travel on their lines. The theory is that the Eastern car, when it reaches San Francisco and is unloaded, is to be returned to its home line as soon as possible. Unfortunately in practice this results but unsatisfactorily, despite the thorough organization of the modern car-accountant's department. Delays in unloading, reloading for a point on the homeward journey, reloading consigned to order, and hundreds of other causes contribute to make more than problematical the date of return of a car that has once got out of home territory. Plans to remedy the detention and "to order" abuses have been proposed and tried in great number, the per diem plan of demurrage or car rental, advocated by Mr. Fink, and introduced for a short time on the trunk-line roads in 1888, being about as successful as any.

The so-called fast freight lines are an important feature of this branch of railroad transportation. They are of two kinds. The first is simply the development carried a little further of the system already described—the application of the coöperative principle among a number of roads. The second is the operation of cars by a private corporation deriving its revenue from the same mileage charge with which the railroads compensate one another for the use of their rolling-stock.

Through all these various channels the great volume of the country's traffic flows steadily back and forth. If our system is not the best in point of routine detail and administration, it is still easily first in that far more important consideration of cost. Nowhere in the world is freight hauled so cheaply as it is in the United States. The average cost of transportation per ton mile is, as has already been stated, .8 cent. In Europe it is two and one half times as much, or two cents per ton mile. The difference amounts in the annual aggregate to millions of dollars, the greater part of which represents an actual saving to the people of the country on the standard articles of consumption and necessaries of life. The actual value in dollars and cents which this saving represents can easily be figured from the totals given by "Poor's Manual" for 1895: the number of tons of freight moved was 675,129,747, and the average length of haul 121.89 miles, giving

82,289,400,498 ton miles. Estimating the average difference between American and European rates at 1.2 cents, the difference in total charges, accruing as a clear saving to the public, is $987,472,805.97.

The strikes and labor troubles from which the railroads have ever suffered are scarcely to be discussed within the limits of this article. The first great strike appears to have been that on the Baltimore and Ohio in 1857, and the last was the uncalled-for and disastrous Chicago riot of 1894. It is scarcely possible to measure in money the damage done, since, apart from the losses sustained by either party to the dispute, is the loss to the business interests of the country through impeded transportation and obstruction of the mails. Any one branch of business that employs, as the railroads do, 2,000,000 people is, of course, liable to labor troubles; but in view of the relations held by the railroads to the general interests of the country, it is scarcely reasonable that the conveniences and necessities of nearly 70,000,000 should be disregarded, even if the interests of the other 2,000,000 were being thereby advanced, which is by no means so certain as labor leaders would make others think.

The growth of the railroads of this country, coincident as it has been with Western development, has witnessed a steady march of the mileage center in the direction popularly supposed to be taken by the star of empire. This advance, together with the relative growth of railroad mileage of the different groups of States, is shown by the following tables:

MILEAGE CENTERS.

1840	25 miles west of Mauch Chunk, Pa.
1850	25 miles northwest of Williamsport, Pa.
1860	60 miles south of Mansfield, O.
1870	Paulding, O.
1880	30 miles northwest of Logansport, Ind.
1888	90 miles south-southwest of Chicago, Ill.

MILEAGE INCREASE BY GROUPS OF STATES.

	1850.	1860.	1870.	1880.	1890.
New England	2,507	3,660	4,494	5,982	6,831
Middle States	3,202	6,705	10,964	15,872	21,536
Southern States	2,036	8,838	11,192	14,778	29,209
Western States and Territories	1,276	11,400	24,587	52,589	62,394
Pacific States and Territories	....	23	1,677	4,080	9,804

The last subject to be taken up in the discussion of the American railroad falls more properly within the domain of the financier. When it is remembered that $5,075,629,070 capital stock and $5,665,734,249 of bonded indebtedness are represented by railroads in this country, the importance of the financial interests involved becomes readily apparent. Financing has come to be as essential a department of railway management as any other, and is, generally speaking, more complicated and less capable of explanation. Historically considered, railroad securities, which have been for years the most prominent feature of the money market, have had numerous ups and downs.

In the very earliest days, when all roads made money freely, and the field had not yet become overcrowded, investors subscribed for railroad stock almost as fast as it could be issued. The crisis of 1857, with its demonstration of the liabilities of stock under the bondholders' mortgage, caused a sudden and violent reversion of public sentiment in favor of the latter class of securities. Here again the pendulum swung too far in the opposite direction. It was a simple matter for unscrupulous men to organize a company and pay in a small fraction of the stock and float their bonds. The bonds once floated, some favored construction company would be given the contract to build the road at a price from ten to forty per cent. in advance of its real cost. Then the first reverse threw the road into bankruptcy, and under their mortgage the bondholders would take possession, thus securing a road worth far less than the face value of its bonds, and, as shown, from ten to forty per cent. less than the investment made at the price for which these bonds had been floated.

The crisis of 1873 brought the abuses under the bond system home to many, but the bitter days during 1885 were necessary to fully impress the lesson upon the public mind. Since then a better understanding of conditions has prevailed, and under responsible managements the securities of the railroads have come to represent intrinsic values, reliable and stable, except so far as all great interests are subject to prevailing national conditions.

The present condition of the railroads of the United States is thus summarized in a statement of their revenues and expenditures in "Poor's Manual" for 1895:

STATEMENT OF RAILROAD CONDITION AND REVENUES.

Capital stock	$5,075,629,070
Funded debt	5,665,734,249
Unfunded debt	383,567,232
Current debt	440,669,656
Total liabilities	$11,565,600,207
Cost railroad and equipment	$9,789,543,001
Real estate, stocks, bonds, and other invest's.	1,167,879,162
Other assets	240,526,350
Current accounts	226,502,371
Total assets	$11,924,450,884
Excess assets over liabilities	$358,850,677

Statement of Railroad Condition and Revenues.—*Continued.*

Passenger-traffic earnings	$276,031,571
Freight-traffic earnings	700,477,409
Other traffic earnings	91,134,533
Elevated roads (New York)	12,661,502
All other receipts, including rentals received by lessor companies	96,477,443
Revenue	$1,176,782,458
Interest on bonds	$237,620,367
Other interest	7,464,971
Operating expenses	757,765,739
Dividends	85,278,669
Rentals, tolls, etc.	60,900,454
Miscellaneous	38,220,492
Payments	$1,187,250,692
Excess of fixed charges and miscellaneons payments revenue	$10,468,234

Pacific coast roads were the heaviest sufferers. Consumption had almost ceased in the articles which were superfluous, or purely for ornament, and the demand for other articles ceased as far as was possible. Under these circumstances manufacturers had little to deliver, and merchants and dealers found it impossible to pay for more than a moiety of what they had required in previous years. In the face of this tremendous decline in receipts the railroads set themselves to a retrenchment of expenses that resulted in reducing the net loss in earnings to a point where, in some few notable cases, the net income increased. How vast these economies were is best shown in the following table, including a selected number of the larger and better-known roads:

ECONOMIES OF RAILROADS, 1894.

Railroads.	Decrease in Gross Earnings.	Decrease in Net Earnings.	Economies.
Pennsylvania (three roads)	$12,794,499	$2,445,129	$10,349,370
Atchison, Topeka, and Santa Fé (four roads)	7,965,956	5,706,743	2,259,213
Chicago, Burlington, and Quincy	6,841,605	1,453,723	5,387,882
Philadelphia, Reading, and C. and I.	6,083,823	1,742,612	4,341,211
Delaware, Lackawanna, and Western (three roads)	5,732,111	1,203,734	4,528,377
Chicago, Milwaukee, and St. Paul	5,386,656	1,453,355	3,933,301
New York Central and Hudson River	4,913,080	704,562	4,208,518
New York, Lake Erie, and Western	4,888,272	2,572,317	2,315,955
Chicago and Northwestern	4,680,638	2,491,366	2,189,272
Union Pacific (eight roads)	4,607,006	3,477,057	1,129,949
Illinois Central	3,695,638	2,311,809	1,383,829
Southern Pacific (six roads)	3,571,791	2,092,716	1,479,075
Baltimore and Ohio (two roads)	3,485,692	1,245,263	2,240,429
Michigan Central and Canada Southern	3,478,000	363,000	3,115,000
Northern Pacific	3,046,726	1,520,518	1,526,208
Delaware and Hudson (four roads)	2,604,099	1,083,515	1,520,584
Chicago and Alton	1,274,604	247,202	1,027,402
Manhattan Elevated	1,149,659	1,021,711	127,948

The financial and commercial troubles of 1893 developed in the railroads a new phase of administrative excellence that is the highest tribute that can be paid, in closing this article, to the men who are in practical charge of the great railroads of the country. By the report of the Interstate Commerce Commission, the year ending June 30, 1894, witnessed a shrinkage of $840 per mile in the gross revenues of 570 roads, representing a total mileage of 149,559. Dividends on these roads fell off $3,999,169, and there was a total deficit in their accounts of $28,255,121. The Southeastern and

To treat the vast subject of the history of American railroads exhaustively in an article the limits of which are circumscribed by the exigencies of space would be manifestly impossible. If I have succeeded in conveying a picture to the mind, although set in a small frame; if I have succeeded in demonstrating the importance of our railroad system as a matter in which every patriotic and intelligent citizen is deeply concerned; and if I have, by telling what has been done, foreshadowed the unlimited possibilities of the future, I shall feel satisfied with my effort to cover the ground of American railway history, however briefly.

Stuyvesant Fish

CHAPTER XVII

AMERICAN CAR BUILDING

THE memory of men still living is sufficiently elastic to stretch back to the beginnings of steam-railroads in this country, and to comprehend the various changes by which the modern railway has become a highly organized and elaborately equipped mechanism. We borrowed the railway from England, but developed it on our own lines. The invention of the locomotive at first simply furnished a mechanical power to transport freight in cars that had formerly been hauled by horses. Tramways were in use in the Hungarian mines during the sixteenth century; and Ralph Allen's English stone-car of 1734, with its flanged wheels and its hand-brake, is clearly the forerunner of the freight-cars of to-day.

The term "railway" was invented in 1775, when it was first used in Smeaton's reports on English transportation, a quarter of a century before steam was applied to locomotion. Thanks to the recent researches of Mr. Clement E. Stretton, we now know that the first persons ever conveyed by a locomotive on rails traveled, on February 24, 1804, behind Trevethick's locomotive on the Pennydarran cast-iron plateway or tramroad to Merthyr-Tydvil, in Wales, a distance of nire miles. In order to transport long bars of iron and timber, the cars were made in pairs, coupled together by an iron draw-bar having a joint at either end. The cars had no sides, but in the middle of each was fixed a center-pin upon which worked a cross-beam or bolster, and upon this cross-beam the timber or bars of iron were placed. On the occasion adverted to the trucks were loaded with ten tons of iron bars, and seventy persons stood on the iron. Here we have the origin of the bogie or truck, the invention of which has been claimed for this country, as we shall see hereafter. Also the capacity of the freight-car, fixed at the beginning at ten tons, remained at that figure for half a century or more.

In 1812, John Blenkinsop, of Leeds, had a private car built to carry himself and his managers to his Middleton colliery, while the workmen rode on the coal-cars. On July 27, 1814, George Stephenson's first locomotive, *Blucher*, drew over the Kenilworth colliery line a passenger-car made by placing the body of Lord Ravensworth's four-in-hand coach on a wooden frame fitted with flanged wheels. This car was used for twenty years. On September 27, 1825, the Stockton and Darlington Railway was opened, and trains of coal-cars were run, with one passenger-coach, named the *Experiment*. This was the first passenger-car to be run regularly for the use of the public. It was placed on four wheels, and had a door at each end, with a row of seats along either side and a long deal table in the center. This car was operated ten days, until the novelty was worn off; and then the faster stage-coaches carried the passengers. It was not until September 15, 1830, that the Liverpool and Manchester Railway opened its line with a train carrying 600 passengers, and immediately thereafter began to run the first regular passenger-trains.

It is a striking fact in the history of car construction that the English invented both the truck and the long passenger-car with the door at each end; and that these forms, once invented, were almost immediately discarded in England, so that it was left for this country to reinvent them and to make them the distinguishing features of American car building as contrasted with English construction. Indeed, it has been with great reluctance that we have ceased to claim them as original discoveries.

The fact that passenger-trains, by displacing stages, threw out of use many of those vehicles, coupled with the other fact that the stage owners, submitting to the inevitable, often became railroad promoters, furnishes a reason why the early masters of transportation both used the stage-coach body as a matter of economy, and also built their new cars on the model in which the conveniences of travel had been most highly developed. The first passenger-coach used in Pennsylvania in 1832 was a stage-coach slightly enlarged. To be sure, the early prints show that in 1830 Peter Cooper's first locomotive hauled an open boat-shaped car from Baltimore to Ellicott's Mills, on the Baltimore and Ohio Railroad; but this model must have been adopted for economy's sake, because in 1833 that railroad placed in service the *Ohio*, a stage-coach in shape, with seats on top as well as inside.

As President Mendes Cohen well observed in his address before the American Society of Civil Engineers in 1892, the first important modifications in car building were called forth by the speed developed in the locomotive. Naturally the wheels first demanded attention. The names of four men are connected with early wheel improvement. Mr. Knight improved the shape of the tread and flange; John Edgar and Ross Winans developed the chilled features; and Phineas Davis further improved and perfected the wheel by altering the disposition of the metal in the tread and the angle of the flange, and by introducing within the cast-iron wheel a wrought-iron ring of five eighths or three quarters of an inch round iron, which both perfected the chill and also added strength to the wheel. Mr. Winans's shops turned out thousands of these wheels for use not only in this country, but also in Germany and Switzerland. From 30,000 to 50,000 miles represented the capabilities of a Winans wheel.

With increased speed came the need for increased steadiness, and it occurred to Ross Winans that by adopting the device of the bogie, or swiveling truck used in the transportation of freight, he could build an easy-riding passenger-car. In 1833 Mr. Winans constructed three long houses on wheels, each capable of seating sixty passengers. Having patented his invention, he was confronted by the fact that the principle he had used was one that had been utilized frequently on tramways, and particularly on the famous Quincy granite railroad, built to transport stone for the Bunker Hill Monument. At the end of protracted litigation the courts annulled the patent.

We now know that prior to 1830 England had three bogie-engines at work; that in 1831 Stephenson's *John Bull*, built for the Camden and Amboy road, was made into a bogie after it reached this country—a fact made patent by the famous run of that engine from New York to Chicago in 1893; that Horatio Allen used a bogie-engine on the South Carolina Railroad in 1832, the same year in which the bogie-locomotive *Experiment* was built for the Mohawk and Hudson Railroad. Moreover, the bogie principle was patented in England in 1812. Yet, whatever may be the legal aspects of the case, it is certain that the American passenger-car of to-day originated with the three passenger-coaches built in Ross Winans's shops in 1833. England discarded the bogie principle for engines in 1830, and did not return to it until 1876; and that country to this day has not adopted the bogie for passenger or freight cars. In 1889, the Paris, Lyons and Mediterranean Railway adopted the bogie for certain passenger-cars; and this year (1895) the Great Western Railway of England has begun to experiment with the bogie-truck. In America the Winans passenger-coach almost immediately supplanted everywhere the stage-coach form, which England still retains in a modified shape, excepting only on the Pullman cars, introduced into that country in 1874. With us not only the passenger-cars, but the baggage, mail, and freight cars, all were placed on swiveling trucks.

That the early railroads of this country were designed to carry passengers rather than freight is to be seen by their reports. The Baltimore and Ohio road, from January 1, 1831, to October 1st, carried over its thirteen miles of track 5931 tons of freight and 81,905 passengers; and so late as 1839 the Camden and Amboy carried only 13,520 tons of merchandise as against 181,479 passengers. In fact, the railways as freight carriers could not compete with the canals, which in those days were the traffic routes. In 1831 the Tuscarora and Port Carbon Railroad could not meet canal rates by thirty-nine and one quarter cents per ton, the railway charges being forty cents, plus a toll of fifteen cents per ton, while the canal rates were ten and three quarter cents, plus five cents toll.

Mr. John Kirby, describing from memory the freight-car of 1848, says that it was the same square box it is to-day; its capacity was from six to ten tons; the roof was covered with cotton duck painted and sanded. The hot sun cracked this covering and let the water in on the freight, an annoyance common also to passenger-coaches of that day. Few freight-cars were used in New York State at that date, the Erie Canal being sufficient for summer freight. Wood was the universal fuel, so there was no coal transportation. Wooden brake-heads were used, and it required three men to turn the screw that pressed the wheels on and off the axles. The ripping of planks was done by hand, as was also the dressing up; and when one man had tools to grind, a fellow-workman turned the stone. Carpenters and car builders of six years' experience commanded \$1.12½ a day wages.

Viewed from the standpoint of to-day, the passenger-car of the early fifties, built at a cost of about \$2000, was a combination of inconveniences. The cast-iron stove in the center of the car broiled those who sat immediately around it, while the unfortunates one seat removed from its satanic glare shivered and froze. In summer the dust was intolerable, and, notwithstanding elaborate devices for ventilation, the dust problem did not begin to be solved before the appearance of the monitor roof in 1860. Hot-water heating and the abolition of the deadly car-stove came with the Pullmans.

In 1856, Captain (now Sir) Douglas Galton, of the Royal Engineers, was sent to America to investigate our railways. His report to the Lords of the Privy Council for Trade gives a straightforward and unbiased account of his investigations. Perhaps there is extant no other report which so comprehensively discusses the railway situation in the United States about that date.

"The practice of constructing railways [in America] in a hasty and imperfect manner," says Captain Galton, "has led to the adoption of a form of rolling stock capable of adapting itself to the inequalities of the road; it is also constructed on the principle of diminishing the useless weight carried in a train. The principle is that the body of the car is carried on two four-wheeled trucks, to which the body is attached by means of a pintle in the center, the weight resting on small rollers at each side. The framing of the truck is supported on springs resting on the axles, and the pintle and rollers are fixed to a cross-beam, which is attached by springs to the main framing; so that between the body of the car and the axles are a double set of springs. India-rubber springs are in general use, but they often become hard; consequently sometimes steel springs are used, with great advantage. Any side movement which might result from the slight play allowed to the cross-beam is counteracted by springs placed between its ends and the framing. An iron hoop attached to the framing passes under the axle on each side, so as to support the axle in case it should break."

The bearings Captain Galton found not unlike those used in England, but the use of oil as a lubricator was novel. He was told that under favorable circumstances the oil in an axle-box needed to be renewed but once a month; but that it was difficult to obtain good oil. The wheels were of cast-iron, with chilled tires; they were from thirty to thirty-six inches in diameter, weighed rather more than 500 pounds, and were without spokes. When made by the best makers they would run from 60,000 to 80,000 miles before the tires were worn, and they cost from £3 to £3 10*s*. each. The iron used in making wheels was of very superior quality; and so great was the practical skill required that but three firms in the United States could be relied on to furnish wheels of the first grade.

The most approved form of draw-bar was continuous under the car, and was attached to the elliptic springs, acting in both directions. The iron shackle was in general use, but some railways preferred an oak shackle eighteen inches long, two inches thick, and six inches broad. This block was bound with an iron band divided on each side at the center, so that a car on leaving the rails would break the shackle transversely.

Already the automatic coupler for freight-cars was prefigured in a device by which the pin in the bumper of one of the cars was supported by means of a ball, so that the shackle of the on-coming car pushed back this ball and let the pin fall into its place. All passenger-cars and most freight-cars were supplied with brakes; and the Philadelphia and Reading Railroad was endeavoring to anticipate the day of train-brakes by an invention whereby a sudden check in the speed of the engine applied the brakes to the wheels of all the cars. The saloon, the car-stove, and the ice-water tank all had established themselves in the best cars, and were novelties to the visiting Englishman.

On the Illinois Central, between Cairo and Dubuque, some of the cars were filled with compartments in which the backs of seats turned up and so formed two tiers of berths or sofas, for the accommodation of persons who might wish to lie down and were willing to pay for the privilege. The passenger-car had attained a length of sixty feet, though the thirty and forty-five foot cars were more common; the baggage-cars, with their compartments for mail and express, were thirty feet long, and the freight-cars from twenty-eight to thirty feet. In those days the freight-cars were constructed more strongly than were the passenger-coaches; a Baltimore and Ohio freight-car twenty-eight feet long, and with a capacity of nine tons, itself weighed six tons.

In summing up the result of his observations as to the rolling stock in this country, Captain Galton notes that the Americans appear to have taken their ideas more from a ship than from an ordinary carriage, and to have adopted the form best calculated to accommodate large masses, with a minimum of outlay for first cost; and that while the cars had been designed with a view to avoid every appearance of privilege or exclusiveness, or of superiority of one traveler over another, they had been constructed so as to secure to every traveler substantial comfort and even privacy.

"There is but one class," he said; "but as the cars are designed with more regard to comfort than English railway carriages, this class is much superior to our second and third classes, and is inferior only to the best first-class English carriages. Notwithstanding the superior comfort of the American railways, the rates of fare averaged lower than the second and sometimes even the third-class fares in England."

Of necessity progress in car building had to wait for the development of the railroads. The original roads were not constructed as through lines between the larger cities, but as the connecting-links between natural waterways, answering to the portages or carrying places of the old days when commerce was conducted in canoes. Often built as the result of local or State enterprise, a short line was sufficient to use up the scanty capital available, or to exhaust the willingness of the people to be taxed for public improvements. The great systems of to-day represent survivals of the fittest early ventures, and development according to environment. Thus the various small roads which traversed the present main line of the New York Central were not consolidated until 1853, and the same year the roads between Philadelphia and Pittsburg came under one control. So late as 1862 there were five separate companies operating the lines between Lake Erie and Lake Michigan; and as each road had a gauge of its own, it was regarded as a triumph in car construction when freight-cars of compromise gauge were built to run over all five roads. In 1869, however, the Lake Shore and Michigan Southern lines came under a single head.

When, in October, 1865, a combination was formed among eight railroads to establish a fast freight line between New York and Boston and Chicago, the maximum difference in the gauges of the several lines was one inch; and this was compensated for by a broad tread-wheel. Each company contributed a number of cars proportionate to its mileage, one car for every three (afterward increased to one for every two) miles. In 1865 the quota of the Lake Shore and Northern Indiana was 179 cars; while in 1894 that road's quota of Red Line cars was 2200.

In 1862 the United States government conducted the greatest railroad business known up to that time. With headquarters at Nashville, the government operated 1500 miles of road with 18,000 men, whose monthly wages amounted to $2,200,000. The rolling stock consisted of 271 engines and 3000 cars. No entirely new locomotives were built, but the 3000 men employed in the locomotive repair-shops pieced out fully equipped engines founded on a serviceable boiler or a pair of sound driving-wheels.[1] Among the triumphs of the national car-shops were, first, a headquarters car for General Thomas, the car being fifty feet long, iron-plated, and provided with a kitchen, a dining-room, a sleeping apartment, and an office; and, secondly, the hospital-trains, in which the jars and jolts were reduced to a minimum. It was during the year 1864 that General McCallum and Colonel Wyman came to Detroit and summoned the managers of the Michigan Car Company to stop all building then in progress and to work solely for the government. They gave a contract for a number of box and flat cars to be operated on Southern roads; and inasmuch as the gauge differed from that of the Northern roads, the new cars were loaded on flat cars and sent to Cincinnati. The government officials fixed the price of the cars and made payment in certificates, some of which the company exchanged for materials, and the remainder were held until money could be obtained for them.

The enormous transportation business developed by the war, together with the labor conditions and the paper-money issues, combined to raise the price of cars; so that the standard freight-car of 1864, a car twenty-eight feet long and with a capacity of ten tons, cost $1000 or more. To-day a car thirty-four feet long, with a capacity of thirty tons, and provided with automatic couplers, air-brakes, and other improvements, can be purchased for about $500.

When the war ended the managers of railways were called on to face a heavy decline in both freight and passenger traffic, due to the disbanding of the armies. Money was not plenty, cars were very expensive, and the mania for extending lines into new territory had begun. Under these conditions the roads began a system of borrowing cars from the builders or from car-trust companies. My impression is that the Michigan Car Company was the first to make contracts on a car-loaning basis; be that as it may, this company had at one time

1 "Development of Transportation Systems in the United States," by J. L. Ringwalt (1888), p. 210.

James McMillan.

loaned to railroads between 6000 and 7000 cars, payment being made according to the car's mileage. With better times and better credit the roads began to buy cars for cash or on long time, as was most convenient; and loaning freight-cars to railroads on a mileage basis practically has been discontinued. A majority of the refrigerator-cars, however, are still owned by private parties, and are run on a mileage basis. The recent reduction in the mileage rate from three fourths to three fifths of a cent has practically killed the business of private ownership, since the new rate does not much more than pay for the repairs.

The sleeping-car had its beginnings as early as 1838. The Baltimore "Chronicle" for October 31st of that year described one such car that had been put on the line between Baltimore and Philadelphia. The enthusiastic reporter related that the car had berths for twenty-four persons, and that for a small consideration the weary passenger might spend the six hours of travel between those cities as pleasantly as if he were asleep in his own bed. Nothing then seemed to be wanting except dining-cars, and those were promised for the near future—a promise, alas! not fulfilled for many a long year.

Twenty years later, in 1858, George B. Gates invested $5000 in two sleeping-cars to run between Cleveland and Buffalo; but passengers could not be persuaded to use them. The same year the line between Toledo and Chicago was equipped with two sleeping-cars built by the Wason Company, of Springfield, Mass., and owned by Mr. Bates, of Utica, N. Y. These cars were fifty feet long, with sixteen sections in summer and fourteen in winter. When not in use, the bedding and curtains were stored in an end section; and a single wash-basin and one saloon furnished the toilet conveniences for the forty-eight persons the car was expected to carry. A sofa along the side of the car formed the lower berth, the middle one was hinged to the window-casing, and the upper berth rested on cleats fastened to permanent cross-partitions. It was while traveling in one of these cars, in 1858, that Mr. George W. Pullman began to plan the sleeping-cars that have revolutionized railway travel in this country, and are making their way in Europe, where comfort is less an essential to the traveler than it is in America.

In 1859 Mr. Pullman transformed two Chicago and Alton coaches into better sleeping-cars than any others; but it was not until 1863 that the *Pioneer*, the first Pullman, was placed on the road. The car cost $18,000—an astounding price in those days. It was higher and wider than most roads could admit, and it was not until President Lincoln's funeral that the roads between Chicago and Springfield narrowed their platforms and adapted their bridges so as to allow the *Pioneer*, carrying the funeral party, to pass over their lines. Shortly afterward General Grant's trip from Detroit to Galena, Ill., in the same car, opened those lines to the *Pioneer*. After that time progress was rapid. The Pullman Company was organized in 1867, and its success is too well known to need comment here. From the palace sleeping-car to the parlor and the dining-room car is a short step. But a long jump was taken in the vestibule, invented by Mr. Pullman in 1887, by which trains are made solid and the platform is robbed of the last of its terrors.

In the winter of 1868–69 the first Westinghouse air-brake was used on the Steubenville accommodation train running on the Pittsburg, Cincinnati, and St. Louis Railroad. The Pennsylvania road adopted it, and since the automatic feature was added, in 1873, it has come into almost universal use on passenger-trains, while by far the larger proportion of new freight-cars built are equipped with it.[1] In 1887 a train of fifty freight-cars made a triumphal tour of the great lines, and by repeated tests, under varying conditions, proved that the Westinghouse brake can stop a train in one tenth the space required by the hand-brake. In 1867 Colonel Miller placed his patent platform, buffer, and coupler on three cars building in the shops at Adrian, Mich.; and with great rapidity the dangerous old platform, with its loose link-coupling, disappeared. In 1860 the Post-Office Department began to demand more room from the railroad companies, and year by year the mail-cars were increased from seventeen to twenty feet in length, then to thirty-five, and finally to sixty feet. The "Fast White Mail" now requires two trains each way between New York and Chicago. Each train is made up of six mail-cars, and the second train leaves New York three hours before the first train reaches Chicago.

The interchange of cars among the various roads made it necessary to adopt standards in car construction, in order to facilitate repairs to cars when away from the home road. Some authority, too, was needed to settle disputes between roads, arising from charges for repairs; to investigate new brakes and couplers; and, in general, to keep the work of construction fully abreast of the times. The Master Car Builders' Association, organized in 1867, amply

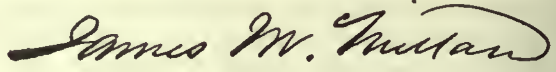
[1] Out of 331,094 freight-cars fitted with train-brakes up to June 30, 1894, 315,729 had the Westinghouse brake.

fills this need; and the reports of its annual meetings contain the latest word on all subjects relating to car building. Its arbitration committee also acts as a court of conciliation for the various roads.

Few railroads in this country build their own cars, most roads finding it cheaper to buy of car companies, and to confine their own work to repairs. There are some exceptions. The Pennsylvania Company, which is a large purchaser, in 1894 built 1963 cars to replace its worn-out and damaged equipment, besides repairing 66,437. The maximum capacity of the Pennsylvania shops is twenty-eight cars a day, or about one half that of the largest works not conducted by a railway company.[1] In June, 1894, there were in the United States 33,018 passenger and 1,205,169 freight cars, besides 39,891 cars used in the service of the roads, and also the privately owned cars. Of the freight-cars, 25.20 per cent. are fitted with train-brakes, and 27.23 per cent. with automatic couplers.

Prior to the panic of 1873 all the car-works were busy. That panic caused the failure of a large number of new railroads, which, in turn, forced into bankruptcy and eventual reorganization many car companies. From 1873 to 1879 the car-shops throughout the country were practically idle; but with the revival of business in 1878–79 the car-works again became busy, and, with the exception of a slight dullness in 1883–84, did a large and profitable business until 1893. The effect of the recent business depression on car building may easily be seen from the fact that in 1890, 103,000 freight-cars were built by fifty companies; in 1893 the output of forty-three companies was only 51,216 cars; and in 1894 the twenty-seven companies operating their plants turned out 17,029 cars. Fifteen companies that built 3000 freight and 300 passenger cars in 1893 built not a single car in 1894.[2] The seventh annual report of the Inter-State Commerce Commission is authority for the statement that the increase in the total number of cars during the fiscal year 1894 was but 4132, as against 58,854 in 1893. With the revival of business the car companies are again starting up. The average life of a freight-car being from fourteen to twenty years, at least 75,000 cars must be built each year to repair the ravages of time; besides the cars required to make good the losses by accidents and for the increase in mileage and business.

The transportation of various kinds of products, such as live-stock, dressed meat, oil, and timber, has called into being cars especially adapted to each class of freight, so that scores of different kinds of cars are now constructed to answer the demands of the shippers. Within the past year electricity has been used as a motive power for both freight and passenger cars, and possibly in the future each freight-car will be equipped with an overhead trolley whereby it can move independently of the train on branch roads and for switching purposes. At all events, if the future is to be judged by the past, great changes in transportation are likely to come suddenly, and to secure wide-spread adoption in the minimum of time.



[1] "Railway Car Journal," March, 1895.

[2] These figures are only for cars built by companies reporting their output, and the statements, therefore, are comparative.

CHAPTER XVIII

AMERICAN SHIP BUILDING

THE revival of American shipping has been scarcely more than a hope of the American people for more than thirty years. By a revival of this industry is meant the reappearance, in frequent and constantly increasing numbers, of American-built ships for our commerce with other nations, rather than for our own internal or coastwise trade. This has been a theme, and more or less a dream, for statesmen, capitalists, manufacturers, and all patriotic citizens. All have recognized that complete national independence without a merchant marine proportionate to our standing as a nation is impossible. All thoughtful citizens understand that, so far as our foreign commerce is concerned, we are to-day, as we have been for a long time, practically in subjection to the trade impulses of Great Britain. If England should place an embargo upon us we should be practically helpless—for a considerable time, at least—in our trade with other nations. All agree that American shipping should be revived. It is as to the best method of reviving it that we disagree. There can be no doubt that this disagreement has been a national misfortune.

The creation of a new navy, or, strictly speaking, the beginning of a new navy, and the recent building of two notable specimens of marine architecture for the transatlantic trade, have caused many persons to think, and a few to assert, that the revival has come already. Every one wishes that this were true. The fact is, these are simply indications of a revival of this splendid art and trade. We have shown most emphatically in the last ten years that we can not only build ships equal to the best of foreign construction, but actually superior to them, ship for ship, in finish and in results. Moreover, we have so wonderfully progressed in these ten years that we can now actually build ships at only a trifle more in first cost than the most progressive of foreign ship builders.

Nevertheless we cannot say truthfully that American ship building has revived. As a people we have risen to a height from which we can see the promised land. We have yet to enter into it. Except for the creation of this new navy, and for the insistence of such men as Secretaries Whitney and Tracy, of our Navy Department, that our war-ships should be entirely of American make, notwithstanding that at first they would cost more than if we had them built in England, the ship-building industry of this country for foreign trade would be practically paralyzed to-day. The most, therefore, that can be said is that we can now build our own ships, and that manufacturers are ready at any minute to enter upon the work. This of itself is a tremendous gain, and is the first step—the one of greatest importance, perhaps—toward the completion of our independence of all other nations. The situation is, therefore, one of promise.

Ship building began in this country in the earliest colonial times. It was fairly well established in New England in 1640. It began on the Delaware in 1683. The conflicts in Europe made it necessary for the early Americans to build their own vessels. The industry had its vicissitudes, like the colonists themselves, for a century. In 1740, however, New England had no less than 1000 sail in the fishing trade. In 1770 Massachusetts built nearly one half of the American ships. At the beginning of the Revolution the American tonnage amounted to 398,000. It comprised nearly one third of Great Britain's entire tonnage. Philadelphia had then come to be the leading center of the industry here. The trade of this country was then largely with the West Indies, and Philadelphia was a most accessible port for the products of those islands.

In 1793 Philadelphia built double the number of ships that any other place in the United States furnished. In 1800 the tonnage of American shipping was put down at 669,921. The War of 1812 caused a sharp decline, but in 1815 there came a great revival. It dropped in 1820, and recovered somewhat in 1830. In 1835 it went lower than for any other year of the century, but forthwith there came the greatest time of prosperity in the industry, which culminated in 1855. The tonnage for representative years of these periods is recorded: 1820, 47,784; 1830, 58,094; 1835, 46,238; 1845, 146,018; 1850, 272,218; 1855, 583,450.

Then came the decline for twenty years. It was about as rapid as the increase for twenty years had been. In 1855 we built 381 ships and barks, and 126 brigs. In 1875 we built 114 ships and barks, and 22 brigs. In 1885 we built 11 ships and barks, and no brigs. We built no steamers for foreign trade. The last census showed that there were more than 1000 ship-building plants in the United States. Most of them were small affairs. They were occupied in building all sorts of craft for our own waters, chiefly for the large landlocked commerce of our lakes, and, of course, scarcely enter, so far as their product is concerned, into a consideration of the revival of American shipping as it is commonly understood.

There should be little need to recount the causes for the decline in this country of this noble industry. Nature intended us to be a seafaring people, and for eighty years we were such. In the beginning of this century we not only surpassed other nations in the quality of our ships, but we could build them cheaper than England could build her vessels. We had splendid forests and hardy, fearless sailors. Year by year we increased our output in this industry, so that when the decade from 1850 to 1860 was reached we were second in rank in this industry, and in 1860 so close to England that there was practically no difference between the two nations. Soon after the year 1840, however, England's forests had begun to show serious depletion. It became necessary, after a time, for her to import the greater part of her materials for building ships. Tools were then invented for the working of iron for ship building. She had plenty of iron in her hills, and forthwith the iron ships began to appear, slowly at first, but none the less surely and steadily.

There was no such incentive in this country for iron ships, the feasibility of which had been demonstrated for forty years or more. Our forests were still plentiful and close at hand. Our experience with wooden ships had been profitable. The industry was increasing all the time. There was little need for a drastic change in our system of manufacture. The gold fever was upon us, and the tide of immigration was sweeping to our shores in a mighty current. There was no time for any change in our methods, even had we been inclined to make one. From a fleet of 201,562 tonnage in 1789, we had grown to a fleet of 5,353,868 tonnage in 1860. In the latter year, the entire tonnage of the whole British empire was only 5,710,968. Truly an impressive showing was ours.

The Civil War came. For a time our shipping showed no marked decline. Then it began to go down. The Confederate privateers, built in England, began to sweep the seas. American ships with hundreds of thousands of tonnage sought the English flag for protection. Year by year we built fewer ships. When the war ended we had practically ceased to be a maritime nation. We were at the threshold of a magnificent interior development of our own country. Our capitalists could not begin to furnish the money needed in this work. We had to go to England, even as we have been doing in recent years, to borrow money to build the intricate and amazing network of our railroads. New methods had come into the ship-building industry. The business had become revolutionized. England had taken full advantage of her opportunity. She had fostered the industry by placing her government work in private yards. Her plants had been established on a broad scale, and a resulting cheapening in cost of production had followed. The United States was out of the race. Her forests near the coasts were depleted. When we built our first battle-ship, the *New Ironsides*, in 1863, the timbers used in her were cut within twenty-five miles of Philadelphia. The great interior development of the country had swept all such forest supplies away. Labor was costly. This made the product of our iron-mines most expensive, and as a people we found that one of the results of the great Civil War was the destruction of our shipping industry, and, deplorable as it well may seem, and not yet fully understood by all our people, we were commercially dependent once more upon Great Britain. The rising cloud of our internal prosperity hid this from the eyes of most of our people, but fact it was and is nevertheless.

England had become mistress of the seas. With an eye single to her commercial interests—at once the explanation of all her statecraft—she resolved to maintain her supremacy. To-day she is as resolute in her purpose as she was thirty years ago. Her shipping is the sign whereby she conquers in the mercantile world. It is the standing proof of her national prowess and independence. With keen

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foresight she resolved that this conquering industry should not become stagnant. She enrolled certain of the steam-craft in the reserve force of her navy, paying the yearly rate of twenty shillings per ton to their owners. She established liberal subsidies for carrying the mails. She recognized that a ship carrying the British flag was something more than the private property of the individual owner. The nation had a share of ownership in every such vessel.

Recognizing that this country could never have complete national independence without a merchant marine, American capitalists in 1870 decided to make a start in bringing about a revival. Four vessels were built for the transatlantic trade in the Cramp shipyard. They were the *Ohio*, *Indiana*, *Pennsylvania*, and *Illinois*. They were equal to any vessels of their day, and a credit to the industry and to the nation. England met their advent with increased subsidies. The American vessels had no such aid, and had to fight their way in commercial rivalry. It was not a winning fight. Ship building here was confined thereafter to building coastwise vessels. The industry sank to such a low stage that when, in 1882, we started to build a new navy, the English newspapers scoffed at the idea that we could produce either hulls or engines. They finally admitted that we could build the hulls, but for us to make the complex modern marine engine was out of the question. Congress gave the Secretary of the Navy power to get abroad what he wanted in this respect, but Messrs. Whitney and Tracy resolutely refused to take advantage of the privilege.

When we started in this work of building a navy we had no mills in which to roll the plates, no foundries to make the great castings, no forges to fashion the shafts and gun forgings, no plants to supply our armor. It had taken England thirty years or more to equip herself with these appliances. What have we done? In ten years, practically, we have gone to the front. Our marine engines and boilers are and for years have been confessedly the best in the world. Not one of our new war-ships has broken down when put to a test of four hours' work at its maximum power, and none has been injured in the slightest by such an enormous trial of endurance. On the contrary, no English war-ship has been equal to such a task. The English experts freely admit that we have won supremacy in this respect. Our ships are acknowledged to be superior in finish. There is one simple explanation for this: workmen in American shipyards get nearly double the wages of workmen in English shipyards, and a better-paid man always does better work. Our designers have made distinct advances over their English competitors. The *Indiana* class of battle-ships proves this. With vessels only two thirds the size of the English *Royal Sovereign* class, the *Indiana* class has a greater fighting capacity and as much speed and endurance. Moreover, the recent trial of the *Indiana* herself demonstrated that she was a signal success in the one respect where English ships fail oftenest, the matter of stability. Lack of stability has been the crowning fault of foreign battle-ships. No steadier ships will float than these new battle-ships of ours.

In addition to all this, we have produced the two fastest war-ships of large size in the world, the *Columbia* and *Minneapolis*. England became aroused by their appearance, and she answered our success by ordering two vessels of stupendous dimensions, the *Powerful* and *Terrible*, for the sole purpose of outclassing them. The creation of this new navy has stimulated ship building in many yards. On the Pacific coast, in New England, in Maryland, even on the Mississippi River, as well as on the historic Delaware, we have proved our ability to compete with all the world in the making of ships of every kind. Our mills and forges and foundries cannot be surpassed anywhere, and a striking triumph of our skill is shown by the fact that Russia has recently placed two orders for armor in this country, to the exclusion of all the plants of Europe.

Our skill had become so thoroughly demonstrated that three years ago American capital, encouraged by legislation providing for a moderate compensation for carrying the mails,—much less than that which England pays for the same work,—decided to make another start in the revival of our merchant marine. We admitted two vessels to American register,—the *New York* and *Paris*, of the International Navigation Company's line,—upon the express condition that two more vessels equal to them in size and capabilities should be built in American yards. Congress guaranteed a payment of $4 a mile to these ships for carrying the mails to foreign countries, upon the condition that they should show themselves capable of maintaining a sustained speed of twenty knots an hour. As a result of this the *St. Louis* and *St. Paul* were built, and in October, 1895, the mail-carrying contract went into effect. The *St. Louis* and *St. Paul* have shown, in the short time they have been in service, their splendid worth; and the hearty reception given to them by the entire country speaks well for the patriotism of the American people, and is of itself a most hopeful sign. The

St. Louis, on her official trial in Great Britain, made an average of twenty-two knots an hour.

This, then, is the condition of our ship building to-day. In ten years we have built, in round numbers, fifty most creditable vessels for the new navy, and two fine specimens of ocean-going passenger-craft. The reports of the Navigation Commissioner show, as is pointed out by Mr. Chamberlain in another chapter of this work, that, of the ten leading countries of the globe, Italy and the United States alone show a decline in this industry since 1875. The tonnage of Great Britain for 1895 is placed at 27,885,806. That of Germany, now the second maritime power, is 4,065,282. The United States comes next, with a tonnage of 3,261,982, a decline in twenty years of nearly 1,000,000 tons. In twenty years Germany has increased her tonnage nearly 3,000,000 tons. Perhaps an incident in the experience of a young woman who several years ago made a spectacular trip around the world for a New York newspaper will illustrate the extent of the decline of American shipping better than any set of figures. The last instructions given to this young woman were to make note of the number of times and the occasions on which she might see the American flag on vessels during her journey. When she came back she reported that not once did she see a vessel flying the American flag from the time she left New York until she reached San Francisco. Nothing more need be said, therefore, to show the complete prostration of this industry, notwithstanding the fact that we have built the nucleus of a new navy in ten years, and are now in a position to build ships of any kind and any speed within the limits of recognized possibilities.

The great question, therefore, is, How shall our merchant marine be restored? With no desire to manifest a controversial spirit in these pages, I think every one who has studied this question agrees that national legislation of some kind is necessary. On the one hand, some assert that the repeal of the navigation law passed December 31, 1792, is necessary. This act specifically closed American registry to foreign-built ships, except those taken as prizes in war. Its repeal would give us free ships. We could buy vessels, if this act were removed from the statute-books, at English prices. On the other hand, those who oppose the repeal of this act assert that what is needed is government aid similar to that which England and most other nations give to their shipping industries. These advocate the adoption of one or all of three kinds of government assistance. The first is special compensation to special lines of steamships; the next is a general bounty on tonnage to all ships; the third is a liberal compensation to our vessels, according to size and grade, for carrying the United States mails.

Now, eliminating any question of partisanship in discussing this matter, I think that no one will dispute that probably the most powerful incentive to the growth of the shipping of Great Britain has been this matter of government aid. It will also be admitted by all those who have examined the question historically that our law of 1792 was intended to promote our national independence rather than to foster an industry by a protective system. In those days the industry needed no protection, because it was admitted, and had been proved beyond any doubt, that we could build ships cheaper than any of our rivals. In 1789, James Madison, then a member of the House of Representatives, said that our capacity for increasing the tonnage of our ships "gives us a favorable presage of our future independence." Moreover, there is conclusive proof that this navigation law did not interfere with the growth of our shipping. It has been in effect from the day it was passed until now. When we were at the height of our prosperity in shipping the law was in actual operation, just as it is to-day, in the time of the prostration of this industry.

It would seem, also, that we all ought to agree that if this law were repealed these things would happen: England, under our natural desire to buy as cheaply as possible, would unload her poorest vessels on us, and her shipyards would reap a benefit in an enormous activity in building new vessels for her own use. A new market would be opened for the relief of the over-developed English shipyards, now sorely languishing because other nations are beginning to build their own vessels. It ought also to be admitted that in time of war England would be able, by a series of sales easy to accomplish, to transfer her merchant marine to the American flag, and thus escape the terrible penalty that must befall her in case she should enter into conflict with any other nation. Her immense shipping is a perpetual bond upon her not to engage in warfare. If she could make an asylum of the American flag temporarily she could resume control of her shipping when hostilities were at an end.

As to the effect on the shipping industry of this country, it is generally conceded that the repeal of the navigation law would wreck the industry as at present organized here. Those who favor this plan see no reason why the government should foster any single industry. Such vessels as England produces she could build cheaper than we could build them. The argument that our yards would be kept busy with repair-work and building ships for the coastwise trade would fail, because repair-plants are of an entirely different character from constructing plants. If we could import ships for the foreign trade we ought to have the same privilege for our coastwise trade. A discrimination between the two kinds of trade would be absolutely unjust to our mercantile interests. Again, if we could get our ships at English prices, we should be confronted by the fact that England, to retain her supremacy, would doubtless continue to insist on her liberal policy of government aid to her ships, and to hold her own would probably increase that aid at once. It is difficult to see how, under these circumstances, we could compete with her in the commerce of the world. By unloading her least desirable vessels on us she would have better ships, and these, with favoring legislation, would place us at once under a disadvantage.

It is for this reason that the advocates of government aid have declared for a so-called bounty system in this country. We use this system in our inland commerce extensively. We pay large sums every year to the railroads for carrying the mails. In that case we call it a compensation. It is called a "bounty" when we give such aid to ships. Why should subsidies of land be given to the great railroads and not to the ship-building interests? Enormous grants of land have been allotted by the government to the great railway companies, and these very roads, fattened on government patronage, are now giving the preference of business at their terminals to foreign bottoms, to the exclusion of American ships, as is the case at Pensacola, Newport News, New Orleans, and on the Pacific coast. All the advocates of a general tonnage bounty, if such a term is to be used, declare that within ten years after the passage of such a law we should be practically independent of every nation in the matter of ships. Many such bills have been introduced in Congress, but there seems little prospect at present that any such law will be passed. Three years ago we did adopt a scale of compensation for American vessels carrying the mails to foreign countries. The contract has just gone into effect. It requires from two to three years to build ships such as the *St. Louis* and *St. Paul.* The post-office authorities at first reported that the new law seemed to have little effect. By special legislation the *New York* and *Paris* were admitted to American register, and now, for the first time in our history, we are to have an actual trial of the effect of this kind of government encouragement of our shipping industry.

The system is to run for ten years. What the result will be time alone will tell, but this much can already be said: it has added to our naval reserve fleet four magnificent specimens of marine architecture, capable of immense use in time of war as commerce destroyers. The money paid to them for carrying the mails is much less than it would cost us to keep actual war-ships of that grade in commission. It would take only a short time to equip them as war-ships, and plans for that purpose have already been drawn. If a general tonnage law cannot be passed, we are assured of a fair trial of the mail-carrying compensation system. Already in the building of the *St. Louis* and *St. Paul* it has had some effect. It is doubtful if this system of itself will be sufficient to restore the ship-building industry. The fact that our capitalists are willing to try the experiment is most encouraging.

If, however, the matter of government aid, as now constituted, should fail, the future is not entirely without hope. The period of enormous internal development of our country seems to be ending. Our railroads are practically built; our mines are developed. The time for amassing great fortunes may be said to be past. Only in the line of the development of real estate do opportunities for making large fortunes seem to remain. In all grades of mercantile interests there will be close competition. Nevertheless the country has accumulated a vast amount of wealth, and it is beginning to seek investment. The fact of the appearance of the *St. Louis* and *St. Paul* is proof of this. As time goes on it must be that our wealth will increase. As the margin of profits on present investments grows less, new fields will be opened. If it can be shown that a reasonable profit will follow investments in ships, slowly but surely the industry will revive without the stimulus of government assistance. This must needs be a matter of extremely slow growth.

By the creation of a new navy our shipyards may be kept in condition to build this new merchant marine, if it shall come within a reasonable time. Naval work alone, however, is not sufficient to restore our shipyards to complete efficiency. At best there is very little profit in government work. It is surrounded by such a system of slow and intricate inspection and approval, of rigid rules and regulations, that rapid work is impeded, and freedom to make changes in the legitimate line of development of the industry is prevented. Then, too, government work is intermittent in character. Although it is inadvisable to fix a set program of naval development, owing to vast and constant changes that are being made in this branch of warfare, it is a fact that to keep the ship-building industry as at present constituted at its fullest capability there should be a steady and comprehensive advance movement in adding to our fleets. The argument that it is not the province of the government to stimulate any single industry to the exclusion of another and to the private benefit of individuals loses its force when we consider that a merchant marine is necessary to the commercial independence of any country with extended sea-coasts.

It is a fact that cannot be disputed that so timid is capital that it will not invest in ships unless the flag they carry is assured of complete protection by a navy. England's naval policy is to be interpreted alone on these lines. A navy capable of maintaining the dignity of a nation is not a constant menace to peace. It is the best guaranty to the development of commerce that any nation can give. It means, under proper conditions, the prophecy of a merchant marine. The steady development of a well-defined policy in naval construction, therefore, means the maintenance to a certain extent of ship-yards which will be ready to build a merchant marine as soon as there are war-ships in sufficient quantity to protect it, and money and government aid sufficient to start it.

Under present conditions, therefore, the future is one of promise. It may be several decades before our flag is even partially restored to the high seas. The revival of our merchant marine must surely come in time if we continue in the rate of prosperity that has marked our development for the last thirty years. It will come sooner if liberal aid is given by the government. So complex are the subsidiary industries in the present condition of building ships that the revival will affect not only capitalists along the coasts and elsewhere, but will employ a vast army of men in the interior as well as along the seaboard. The probable completion of the Nicaragua Canal will cause, undoubtedly, an immense stimulus to American commerce. Whether those who oppose the system of government aid on general principles, owing to their views as to the proper function of a nation, are right or not, is it not worth considering if it would not be well for especial reasons to be ready to carry this coming commerce of the United States in American ships? Once started on the road to prosperity, who that knows the character of the American people can doubt the result?

A fine specimen of marine architecture is always a standing lesson in patriotism. It is required to display the flag of its country. As it passes from port to port it is more than a mere floating vehicle for commerce. It is a bit of its nation's soil. Around its existence and its journeyings the romance of travel and the dignity of nationality center. No other manufactured thing is so complex or delicate. It tells a story of national progress such as nothing else can tell. It speaks of home to the citizen in foreign lands. It means prosperity for those at home and abroad; for every vessel added to the fleet of any nation means more commerce, more trade. No patriotic citizen should relax his efforts to secure a revival of this industry in this country in some form or other. We have the mills, we have the men, we are just beginning to have the money, and we have the materials in rare abundance. The situation calls for the wisest statesmanship, the loftiest patriotism, the noblest effort.

Chas. H. Cramp

CHAPTER XIX

THE TELEGRAPH

THE first real manifestation of telegraphy as an applied art dates from just one hundred and one years ago, and to Claude Chappe, a Frenchman, is due the discovery of it and its possibilities. It was a visual telegraph or semaphore that Chappe invented, and for the better part of a half-century afterward it was the only quick mode for communicating at a distance that Europe knew. An ingeniously contrived signal-code and perfected mechanical appliances made this semaphore-telegraph not only most useful, but very rapid, a despatch traveling at the rate of from fifteen to twenty miles a minute on the main lines. It was introduced in France in 1794, and, after the populace had destroyed the signal-towers several times, it was finally completed in time for the first message sent over it to be the thrilling news of a French victory. "Conde is taken from the Austrians," came the signaled words from the frontier within three or four hours after the event, and Paris went wild. Chappe was as great an idol as he had before been an object of hatred, and his telegraph became the wonder of the day. Europe followed France in 1802 in introducing Chappe's idea, and England shortly afterward, in 1823, made use of it at home and in India. It was, in fact, the common telegraphic system of the world up to the time when the invention of the electric telegraph upset all previous ideas of human limitations.

The germ of the idea which came, in Chappe's hands, to full development was first seen in the signal used by the Americans during the Revolutionary War. This consisted of a barrel on the top of a high pole or mast, on which was, furthermore, a movable yard or arm to which a basket was attached. To each of the different positions of this arm a meaning was given, and signals could be sent many miles by these means. While it is certain that Chappe never saw this contrivance, the similarity of its elementary design with that of his telegraph gives them a direct connection. The semaphore-telegraph was in use, with an elaborate system of signals, in this country for many years prior to 1850. It was the means for communicating news of incoming ships from the Highlands of New Jersey to New York, where the signal-tower was located in the dome of the old Merchants' Exchange, now the custom-house.

Before entering upon the detailed history of the modern telegraph, a brief diversion will be necessary. No fitting idea of the glorious successes it has attained could be conveyed were the earlier discoveries and experiments in electrical phenomena to be omitted. Electricity is to the telegraph as steam to the motive engine or gravity to the universe—the force that makes it possible. The discovery that amber (from the Greek name of which the word "electricity" is derived) became electrified under friction is an old one, but the reduction of this discovery to anything like scientific analysis or classification only dates from about the middle of the last century. In the list of those whose discoveries have borne the most important relation to the development of this wonderful science the names of Americans are at the head. Europe reverences the glory of Galvani, Volta, Oersted, Arago, Ampère, and Steinheil, while England vaunts her Cooke, Wheatstone, and Bain; but above them all are written the names of Franklin, Henry, and Morse.

It was in 1747, the year after the discoveries which developed the Leyden jar and the principle of the restoration of electric equilibrium, that Benjamin Franklin first interested himself in the phenomena of electricity. A letter from Peter Collinson, fellow of the Royal Society of London, to the Literary Society of Philadelphia, of which Franklin was a member, interested the latter, and he then began by his reply that interesting series of letters, continuing for many years, in which he laid down, and later proved, so many propositions, since become axiomatic, but totally at variance with the accepted European theories of that day. In 1749 he declared electricity and lightning identical, and in June, 1752, proved it by the celebrated kite sent up during a thunder-storm. Franklin was succeeded in America by Professor Joseph Henry, in after years connected so prominently with the Smithsonian Institute. At the time when this distinguished savant was commencing his researches, and just be fore, great discoveries were being made in Europe. Coulomb in 1785 laid the foundation of electrostatics. Galvani, of Bologna, in 1790 discovered by accident that metallic connection between the crural nerve and the legs of a frog caused convulsive action. He ascribed it to animal electricity, and all the physiologists of Europe adopted his theory. The electricians, however, doubted, and in 1800 Professor Volta, of Pavia, demonstrated beyond a doubt that the effect produced was through electricity generated chemically. In proving this he brought out the voltaic pile, which was the first the scientific world knew of any electricity other than static or frictional. On this discovery of Volta, affording, as it did, a current electricity, together with the subsequent discovery of electro-magnetism by Professor Christian Oersted, of Copenhagen, in 1819, is based the electric telegraph of to-day. The voltaic pile, to which improvements were early made by Cruikshank, Daniell, Smee, Bunsen, Grove, Chester, and by many others since, is the battery of to-day; and Oersted's electro-magnetism, in the hands of Schweigger, Arago, Ampère, Sturgeon, and finally Henry, has afforded the electro-magnets, giving the principle on which were based the old English deflecting-needle telegraphs and the present Morse instruments.

These discoveries in electrical science, the latest of which was in 1825, left the field free for the pioneer who should carry forth the telegraph. Many had already essayed this honor, but the man and the time were not yet in conjunction. So early as 1749 Franklin had sent a current through a long wire across the Schuylkill, and in 1753 Charles Marshall, of Paisley, Scotland, had proposed a telegraph with a wire for each letter.

Among the many who have originated forms of electric telegraph are an Englishman named Lomond, who in 1787 is said to have operated a short telegraph line on his front lawn; Reizen, who in 1794 invented the illuminated-letter telegraph by the application of the broken current; Salva, a Spaniard, in 1798, who used electrified pith-balls; Samuel Thomas Sömmering, who in 1809 first applied the current from the voltaic pile to telegraphing; Ronald, in 1816; Gauss and Weber, of Göttingen, who brought out the magnetic-movement mirror and glass in 1833; and Steinheil, who in 1838 discovered the "earth-circuit," which did away with the previously supposed indispensable return-wire to bring the current back to the battery. Steinheil also invented a system of telegraphy, and ran his wires on poles with insulated attachments. Across the Channel, William Fothergill Cooke, having invented a magnetic-needle telegraph in 1836, associated himself with Professor Wheatstone the succeeding year, and introduced his invention to general use. The needle-telegraph in various and improved forms, and Bain's electro-chemical telegraph, continued to be the ones used in England up to a late date, and were supplanted by the Morse system only when the latter became practically universal.

Of the early telegraphers there is one whose name, too nearly forgotten, had almost been written before that of Morse on the roll of fame. This man was Harrison Gray Dyar, and the evidence is strong that so early as 1827 he had erected and operated, upon a certain Long Island race-track, a telegraph line strung upon poles with glass insulators. This telegraph communicated signals by the discoloration produced by the electric current upon a piece of moving litmus-paper, which had been previously moistened. Dyar used only frictional electricity, and was therefore unable to attain results so eminently successful as those of inventors after 1835, who could apply the wonderfully improved device of the Daniell cell in supplying their current. An attempt made by Dyar to introduce his telegraph to general use encountered intense prejudice, and, becoming frightened at some of the manifestations of this feeling, he left the country.

Meantime, while all these claims were advancing, the one preëminently great invention was rapidly maturing on this side of the Atlantic Ocean. In 1832 the transatlantic packet *Sully*, bound for New York from Havre, had on board among her passengers a distinguished historical painter named Samuel Finley Breese Morse. In the long evening talks in the passengers' cabin the subject of electricity and the electric current was brought up one night. A well-known professor of sciences, Dr. Jackson, made the statement that an electric current would manifest itself at the distant end of a conducting wire instantaneously. The remark, made in the course of conversation, impressed Professor Morse deeply, and going to his state-room, he commenced work on the application of this space-annihilating current to the transmission of intelligence. Before the *Sully* reached her dock the thing was accomplished—in the inventor's mind, at least; and certain drawings and explanations made by him at that time, and sworn to by the captain, were later produced before the Supreme Court during the suits by which the validity, scope, and priority of the Morse patents were fully confirmed.

On landing, Professor Morse constructed his first machine, making the type himself for his famous alphabet, which stands to-day as the most wonderful piece of cryptography ever devised. Lack of funds was a great drawback to the inventor, both at this time and for many years to come; but in November, 1835, he successfully exhibited his telegraph in a large room of the New York City University, transmitting a message through a long wire. Among those who witnessed this first exhibition of the electric telegraph were Leonard D. Gale, D. Huntington, O. Loomis, and Robert Rankin. The following year the invention was on public exhibition in New York, and in February, 1837, when Congress passed a resolution requesting the Secretary of the Treasury to report upon some method of electric telegraphing, the claims of Morse were strongly presented, and in April, 1838, the Committee of Commerce of Congress made a unanimous report of the most favorable tenor upon the Morse invention. The chairman of this committee, Hon. Francis O. J. Smith, characterized Morse's telegraph as the "most wondrous birth of this wonder-teeming age." So impressed was Mr. Smith with the great possibilities of the telegraph that he resigned his seat as a member of Congress and purchased a quarter interest in the Morse rights. The other members of Mr. Smith's committee, whose names appear signed to the unanimous and earliest indorsement of the value of Professor Morse's discovery, were S. C. Phillips, Samuel Cushman, John I. de Graff, Edward Curtis, James M. Mason, John T. H. Worthington, William H. Hunter, and George W. Toland.

The recommendation of this committee to the contrary notwithstanding, Congress refused to appropriate the $30,000 asked by Morse to construct an experimental line. Mr. Smith and Professor Morse accordingly sailed for Europe to attempt its introduction there. Their mission proved a failure, patents being refused them in England on the ground that a partial description of the Morse system had been published. In France a patent was issued, only to be withdrawn. Returning to this country, Professor Morse received his letters patent in June, 1840, based on the specifications of his application in April, 1838. In 1842 he again presented his invention before Congress, asking an appropriation of $30,000. The House promptly passed it (see report on the debate, p. 461 of Prime), but the session dragged along and the traditional delay of the Senate kept the bill from reaching a hearing. On the last night of the last day of the session, March 3, 1843, Professor Morse waited in the Senate corridors until late in the evening, when, believing his cause hopeless, he returned to his hotel almost broken-hearted. Had he but known it, one of the last acts of the Senate during the very last hour was to take up the Morse appropriation. Singularly enough, no dignified questioner arose to ask for information concerning the bill, which would have required time and so proved fatal to it, but it was straightway passed, and early the next morning the news was brought to Professor Morse by Miss Annie Ellsworth, to whom the overjoyed inventor then and there promised the honor, which she afterward enjoyed, of sending the first message when the line should be completed.

The condition under which Professor Morse received the $30,000 was that he should use it in the construction of a line of electric telegraph from Baltimore to Washington. He immediately commenced work on this line; but his early efforts were wholly useless, owing to a serious mistake in his plans. He projected a subterranean line, and for this purpose two copper wires covered with cotton and gum lac were drawn through a lead tube. A deep furrow was then made with a heavy plow, and the pipe laid as far as the relay-house, nine miles from Baltimore. (See Cornell's account in the "Biography of E. Cornell.") It was then discovered that an earth-circuit was formed and the wires refused to work. The greater part of the appropriation having been thus unsuccessfully expended, Professor Morse was in great trouble; but finally, by withdrawing all the wire from the miles of lead pipe and stringing it on poles above-ground, the line was completed in May, 1844, and on the 27th of that month the first despatch, "What hath God wrought!" flashed over the wires from Washington to Baltimore, being sent by Miss Annie Ellsworth, as long before agreed. Professor Morse's manipulating assistants at this trial were Mr. Alfred Vail, who in 1837 had invented and patented a printing-telegraph, and Mr. L. F. Zantzinger. The electromagnets used on this line weighed 185 pounds, and for some time after this Professor Morse believed that the wire used in winding them had to be of the same size as that on the line itself. The present fine-wired, compact, and portable electro-magnets, weighing less than a pound, and allowing a man to carry a telegraph office in his pocket, so to speak, were not dreamed of at that early day. This line was also opened with the primitive system of combined circuits, as first proposed by Professor Morse in obviating the difficulties arising from lost strength in the current on long distances. He speedily saw a better way to accomplish this result, however, and in that same year began the experiments which in 1846 were crowned with success, and developed the short circuits and relays which made possible the great main lines and uninterrupted communication of to-day. In 1844 he also invented the "key" which is still in use. Without attempting the purely scientific and technical aspects of telegraphy, we will study at more length the practical and utilitarian application of it to the world of American business and every-day affairs.

The experimental line opened from Washington to Baltimore with the $30,000 appropriated by Congress having proved practical, it was declared ready for public business on April 1, 1845. Alfred Vail was the Washington operator, and Henry J. Rogers occupied a similar position at Baltimore. The tariff was one cent for four characters, and the first four days saw just one message transmitted. Thus did the American people welcome the facilities of the electric telegraph. About this time Professor Morse offered his interest in the invention to the government for the ridiculously low price of $100,000. A brilliant Postmaster-General, however, who saw no value in the invention, saved Morse the loss he was so willing to incur; so other means had to be resorted to in bringing it before the public. The proprietors of the patent at this time were Morse, Vail, L. D. Gale, and F. O. J. Smith. The latter struck out alone, taking the New England States for his field, while the other three, having selected Amos Kendall, formerly Postmaster-General under President Jackson, as their agent, took the remainder of the country. Kendall devoted himself particularly to the South and Southwest, although it was early decided to have the first line run from Washington to New York. In carrying out this plan it was decided further that the first link should be constructed from New York to Philadelphia. The excitation of the public interest in the undertaking, and the consequent raising of capital, were intrusted to Ezra Cornell and his brother-in-law, O. S. Wood. These two opened a small office on Broadway, where they set up their instruments; and having obtained with great difficulty permission to run a short wire over the neighboring roofs, they began exhibiting the telegraph. Interest was roused but slowly, however, and capital was apathetic.

The sum needed for the construction of the line from New York to Philadelphia was $15,000, and it was only after the greatest difficulty, and the granting of two shares for every one paid for, that it was finally raised. There were about twenty-five subscribers, and to them was issued $30,000 in stock, while another $30,000 went to the patentees, making the total capital stock $60,000. The company was organized under the name of the Magnetic Telegraph Company, and its line was completed from Philadelphia to Fort Lee on January 20, 1846. The first New York office was at 16 Wall Street, and later it was moved to Post's Building, behind the Merchants' Exchange. The first clerk was Charles S. Bulkley, and messages had to be sent across the river by messengers, either for delivery or transmission. The attempt to cross the North River by cable failed in this year. Later a detour of 105 miles, by which the line went up the Hudson and crossed on high masts at Anthony's Nose, proved a failure. Various attempts to lay a cable were made, but success was not achieved until February 12, 1856, when S. C. Bishop, the New York manufacturer, provided an armored cable insulated with gutta-percha. The Magnetic Telegraph Company formally organized on January 14, 1846, by the election of Amos Kendall, president; T. M. Clark, secretary; A. Sidney Doane, treasurer; and B. B. French, John J. Haley, John W. Norton, John O. Sterns, William M. Swain, and J. R. Trimble, directors. The line was extended to Baltimore, June 5, 1846, on an issue of $10,000 more stock, and later to Washington. Its cash receipts during the year 1846 amounted to $4,228.77. Six years later, even with the handicap of competing lines, its annual receipts amounted to $103,641.42, which indicates the increasing public favor shown to the telegraph.

In the decade that followed 1845 and the first telegraph, companies started and wires ran over the country at an almost magical rate. Henry O'Reilly, one of the most energetic promoters and builders this continent ever produced, started westward, leaving his lines of wires behind to mark his course. From Philadelphia to Pittsburg he ran the Atlantic and Ohio Telegraph Company, capitalized at $300,000, and completed December 29, 1846.

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From Pittsburg to Louisville he built, in 1847, the Pittsburg, Cincinnati, and Louisville Telegraph Company's line. It was over this wire that, in 1847, using a House machine, O'Reilly sent the first despatch ever transmitted by the printing system. Still further did O'Reilly go, notwithstanding the fact that a bitter legal battle was raging between himself and F. O. J. Smith for the Morse patentees, who claimed O'Reilly had infringed on their rights. From Louisville he boldly struck out for New Orleans via Nashville, and with a branch to Memphis. This line was incorporated as the People's Line, and was completed in 1849; but it was unsuccessful from the start, and nearly ruined O'Reilly. It was later consolidated with the Ohio and New Orleans Telegraph Company; the two organized, January 6, 1860, as the Southwestern Telegraph Company, which was absorbed by the American prior to that company itself being taken in by the Western Union. Among the other early telegraph lines were the following:

EARLY AMERICAN TELEGRAPH COMPANIES.

Name.	Date of Organization.
New York and Boston Magnetic Telegraph Co.	1845
NewYork, Albany, and Buffalo Electro-MagneticCo.	....
Lake Erie Telegraph Co.	1847
New York State Printing Co. (House line)	....
Ohio and Mississippi Telegraph Co.	1848
St. Louis and New Orleans Telegraph Co	1848
New York State Telegraph Co. (Bain line)	....
New York and New England Telegraph Co	1849
American Telegraph Co.	....
Illinois and Mississippi Telegraph Co	1849
Erie and Michigan Telegraph Co	1848
New York and Erie Telegraph Co	1849
Cleveland and Cincinnati Co	....
Maine State Telegraph Co.	1847
Vermont and Boston Telegraph Co	1848
New York and Washington Printing Telegraph Co.	1848
North American Telegraph Co. (Bain line)	1848
Washington and New Orleans Telegraph Co	1846
Western Telegraph Co.	1848
Ohio, Indiana, and Illinois Telegraph Co	1849
St. Louis and Missouri River Telegraph Co	1850
Northwestern Telegraph Co.	1856
Western Union Telegraph Co.	1851

These companies, with the branch lines represented by them, comprised the bulk of the capital invested in the telegraph of the United States prior to 1855. The Magnetic Telegraph Company, as the oldest and for many years one of the most successful, was the first to perceive how essential uniformity was to an economical and at the same time improved service. Under President William M. Swain this company made many advances and also many concessions to other companies to bring about this condition of affairs. To several of the Western and Southern lines it leased wires, thus allowing them to compete for through business. To give itself equal opportunities it leased the Washington and New Orleans lines in 1856, the Western Telegraph Company's lines, including the Marietta and Cincinnati branch, in 1858, and, under the Supreme Court decision upholding the Morse patent rights as against the Bain electro-chemical telegraph, it absorbed the North American Company.

The second great seaboard line and power for consolidation was the American Telegraph Company, with the history of which the greatest telegraphic undertaking ever known—the transatlantic cable—is connected. In 1850 some thoughtful writer pointed out that St. Johns, Newfoundland, being the port for the speediest arrival of European steamships, ought to be the center for the telegraphs of America, in order that the earliest foreign news should be obtained. Acting on this hint, Mr. F. N. Gisborne in 1851 incorporated the Newfoundland Electric Telegraph Company. A short cable was brought from England, but the attempt to lay and operate it was unsuccessful. In 1854, Mr. Gisborne, having sunk all his property in the venture, came to New York seeking capital. He was introduced to Cyrus Field and laid the proposition before him. Field not only grasped the idea, but he carried it further—to its very end, in fact; and then and there he determined that the transatlantic cable should be laid. He interested in the project his friends Peter Cooper, Marshall O. Roberts, Chandler White, and Moses Taylor, and on May 6, 1856, the New York, Newfoundland, and London Electric Telegraph Company was incorporated, with a capital of $1,500,000. Both this government and that of England made valuable concessions and grants to the company.

In 1856 the cable to Newfoundland was successfully laid, and October 31st of that same year the first transatlantic cable was ordered from Messrs. Newall & Company, and Glass, Elliott & Company, of London. This cable was composed of seven small twisted copper wires, surrounded by gutta-percha covered with tarred hemp, and inclosed in an iron armor of eighteen cords of small wire. During this year the U. S. S. *Arctic* and H. M. S. *Cyclops* took soundings along the proposed route for the cable. The United States and England each placed two vessels at the disposal of the company for the purpose of laying the cable. The United States ships were the *Niagara*, carrying one half the length of cable, and the *Susquehanna*, which acted as a tender. The English ships were the *Agamemnon*, having the other half of the cable, and her consort, the *Leopard*, acting as a tender. The shore end of the great cable was landed from the *Niagara* at Ballycarberry Strand, in Valentia Bay, Ireland, August 5, 1857, and two days later the fleet started slowly away for the distant shores of Newfoundland. The first three days all went well; but on the 11th, late at night, there was a sudden jar and shock, and the cable was found to be broken. Three hundred and eighty miles of it had been laid. The fleet returned to England, and the remainder of the cable was stored at Keyham docks for the winter. More cable was provided, and on the 10th of June the succeeding summer the same little fleet left Plymouth, this time for mid-ocean, it having been determined to start both ships, paying out simultaneously. This plan was tried, and twice the cable parted before more than a short distance had been traversed. The third time 142 miles were paid out before a break finally occurred. This time the vessels failed to meet each other, and so returned to Plymouth. Having thus got together again, a last attempt was determined upon, and on July 29th it was made and was successful. Almost simultaneously the two vessels reached the shore and landed the cable, on the afternoon of August 5th, the *Niagara* at Trinity Bay, Newfoundland, and the *Agamemnon* at Valentia Bay, on the Irish coast. Two thousand and thirty-six miles of cable had been laid, and on August 16th the first message was flashed under the ocean, from the Queen to the President of the United States. From the first this cable suffered from defective insulation, and amid world-wide grief it finally gave out, September 1st, after having grown steadily weaker from the moment it was first tested.

The connection of this the first transatlantic cable with the inception of the American Telegraph Company may not at first be seen; but it is direct, nevertheless, and to one who knew the late Cyrus Field and his character, it should be clear. Mr. Field from the first believed fully in his cable project, and, so believing, he was far-sighted enough to recognize the importance of a system of land telegraphs connecting the cable with the great centers. For this reason, when David E. Hughes, who had just invented an excellent printing-telegraph, was introduced to Mr. Field's notice, that gentleman was easily induced to purchase the idea, and despite the fact that the transatlantic cable was still high and dry ashore, he secured the incorporation of the Boston and New York Printing-Telegraph Company. Besides this company others were organized at this time, notably the East and West and the Troy and Boston. The Commercial Printing-Telegraph Company gradually replaced these, and when the American Telegraph was incorporated, May 30, 1858, with $200,000 capital, it had no difficulty in leasing this latter, together with other Eastern lines, such as the Maine State Telegraph Company. The extension of the American Telegraph Company from this time was rapid, and in 1865, when the *Great Eastern* made the third, and unfortunately fruitless, attempt to lay a cable, this company controlled nearly every line on the seaboard east of the Hudson. On July 1, 1866, its $4,000,000 capitalization being replaced by an issue of $12,000,000 of Western Union stock, the American was quietly absorbed into that company.

Scarcely a month and a half later, on August 16th, the Anglo-American Telegraph Company, the successor of the various other cable companies, succeeded in laying a cable from the *Great Eastern* which has worked ever since. The failure of the attempt made by the same ship the previous year was also mitigated shortly after this by the supposedly lost cable being found, grappled, brought up, spliced, and successfully laid.

These momentous events in the story of transoceanic telegraphy were being duplicated on land, however. Five years before the cable of 1866 was even wet by salt water a transcontinental telegraph line was flashing the stirring news of that warlike time from Washington to San Francisco. Hiram Sibley is the man to whom much of the credit for the accomplishment of this great feat is due. So long before as 1857 he had become possessed by the idea of the feasibility of this undertaking, and had proposed it to the directors of the Western Union Company. They were conservative, and a transcontinental telegraph was no light thing in those days. Nothing discouraged, Mr. Sibley laid his idea before Congress, and obtained from that body in 1860 not only indorsement, but liberal concessions as well. Armed with these, Mr. Sibley secured the coöperation of the Western Union, and the Pacific Telegraph Company was organized. The California State Telegraph Company, learning of the plan, agreed to take a share in it, and a company was organized there to build the line as far as Salt Lake City, which was to be the Western end of the Eastern constructors. Everything seemed propitious, and work was begun.

The public fully expected that two years was the minimum time in which the line could be completed, and many well-informed people believed it would take longer. The surprise of the country can be imagined, therefore, when just four months and eleven days from the time work was commenced the lines met and were joined at Salt Lake City, and the first through message sent. This was November 15, 1861. Since then the telegraph across, around, lengthwise, or breadthwise of the land has stretched its threads of steel. The blank refusal with which the New Jersey Transportation Company met the request of grim old Amos Kendall to run the first wires of the Magnetic Telegraph Company along their roadway was modified a year or two later, when the Baltimore and Ohio Railroad granted the first of such permissions; and to-day the railroad and the telegraph are seen to be inseparable. The insignificant sum—less than $5,000—which represented the first year's receipts of the old Magnetic Company has grown to dimensions where even millions have to be reckoned in hundreds.

Prior to 1866, the year that saw the transcontinental line opened, the many companies and small lines divided the business of the country into so many channels that the totals are not obtainable. The advance of system and uniformity through consolidation brought comparative order out of this confusion, and in 1866 figures were made up giving the total wire mileage of the American telegraphs as 75,686, covering an actual line distance of 37,380 miles. There were 2250 telegraph offices open. By 1870 the figures had increased to 112,191 miles of wire, 54,109 miles of line, and 3972 offices, which were doing a business annually of 9,157,646 messages. The year 1880 found an equally marked gain. There were 253,534 miles of wire, 85,645 miles of line, and 9077 offices, while the number of messages annually transmitted had increased to 29,216,509. Six years later and the growth was astounding in its rapidity: 217 telegraph companies existed throughout the country, 20,899 offices were ready to receive or transmit messages, and 671,002 miles of wire, covering 226,308 miles of line, were at the service of the operators. Of this great total the Western Union Company was the chief quantity; 462,283 miles of its wires were included in the 671,002 estimated for the country at large. There were 22,909 people employed in the telegraph business by all the companies.

In the year ending June 30, 1895, the figures for the Western Union Company had reached dimensions scarcely conceivable as the result of a single half-century's improvement. From a total wire mileage in 1883 of 462,283, it had increased nearly 100 per cent., the total in 1895 being 802,651 miles. These wires represented a line length of poles and cables of 189,714 miles, joining in one complete and organized system of communication 21,360 offices. The number of messages transmitted during the year was 58,307,315, or forty per cent. more than in 1883. The expenses of the company in transacting this business were $16,076,629, leaving a profit of $6,141,389. This return for one year's business is a wonderful contrast to that modest little sheet which set forth the first annual balance of the old Magnetic Telegraph Company. The gradual advance by which this tremendous volume of business has been rendered possible is best shown in the following table, giving the mileage of lines operated, number of offices, number of messages sent, receipts, expenses, profits, and average tolls and cost per message, for selected years since 1866.

WESTERN UNION TELEGRAPH COMPANY, 1866 TO 1895.

Year.	Miles of Poles and Cables.	Miles of Wire.	Offices.	Messages.	Receipts.	Expenses.	Profits.	Average Tolls per Message.	Average Cost to Co. of Message.
1866....	37,880	75,686	2,250	....	....	....	....	...	...
1870....	54,109	112,191	3,972	9,157,746	$7,138,737.96	$4,910,772.42	$2,227,965.54	75.5	51.2
1875....	72,833	179,496	6,565	17,153,710	9,564,574.60	6,335,414.77	3,229,157.83	54	35.2
1880....	85,645	233,534	9,077	29,215,509	12,782,894.53	6,948,956.74	5,833,937.79	38.5	25.4
1885....	147,500	462,283	14,184	42,096,583	17,706,833.71	12,005,909.58	5,700,924.13	32.1	24.9
1889...	178,754	647,697	18,470	54,108,326	20,783,194.07	14,565,152.61	6,218,041.46	31.2	22.4
1895 ...	189,714	802,651	21,360	58,307,315	22,218,019.18	16,076,629.97	6,141,389.21	30.7	23.3

The aggregate assets of this company are $125,-966,171, and the capital stock outstanding is $95,-370,000, of which $550,000 was added during the last year for the purchase of the lines and property of the American Rapid Telegraph Company.

To these statistics, in estimating the whole importance of the telegraph in the United States, must be added the business done by the Postal Telegraph-Cable Company, and a few small telegraph systems in various parts of the country. I have at hand no particulars of the amount of that business, but it would, perhaps, be fair to say that the total telegraph receipts in the United States for the year 1895 amounted to about $25,000,000.

The important part played by the telegraph in the development of the world's commerce is so self-evident as to need little demonstration. Facilities for rapid transit such as we have to-day both on land and water would of themselves have accomplished much, it is true, but they would suffer a serious diminution of their usefulness were the vastly more rapid transmission of intelligence impossible. A grain broker in Chicago who had only the railroads and the Atlantic liners as carriers for his queries and the return information would be obliged to wait two weeks at the very least before he could hear from London. Business methods to-day prohibit such delays. The buyer in California must have instant communication with his New York house, which in turn must be equally well aware of what its foreign agents are doing. The telegraph and the cable permit this. In 1840 the total exports and imports of the United States amounted to but $221,927,638. The year the first telegraph line was built, and a year later, showed the totals even less, $219,224,433 being their estimated amount. Since then, while each decade has seen improvement except the one which included the disastrous Civil War, the subjoined summary will show the added impetus given to commercial enterprise, first in the decade between 1845 and 1855, when the telegraph lines of the country sprang into prominence, and secondly in the period between 1865 and 1875, when the transatlantic cable became of every-day use.

EXPORTS AND IMPORTS, 1845 TO 1895.

Year.	Total Exports and Imports.
1845	$219,224,433
1855	476,718,211
1865	404,774,883
1875	1,046,448,147
1885	1,319,717,084
1894	1,547,135,194

These figures, significant though they are, still fail to show the greatest benefit accruing from the telegraph. This is in the money it saves. Every cause and every happening that affect the community, its business, its crops, its affairs, are instantly communicated to the farthest corner of the earth. Nothing need come as a surprise. The distant dealer is as well posted as the trader on the ground, and he operates accordingly, with an intelligence that saves millions every month. All this is in addition to the advantages obtained in social and family life through it, as well as in those occupations which are not primarily commercial.

Twenty-five billion dollars are to-day represented by the internal commerce of this great nation; $1,500,000,000 more are included in our trade with foreign lands; a merchant marine with a carrying capacity of 3,261,982 tons now flies our flag; railways with a mileage of nearly 180,000, or one half the total mileage of the world, gridiron our continent; and a population more prosperous and more enterprising than that of any other country or time is pushing steadily onward. All these have come to fruition since the birth of the telegraph. With their advent and growth that of the great telegraph system of the United States is inseparably linked by the interdependence of a common cause and effect. Each has rendered the other possible. The end, however, is far from being reached; and when the wonders which one short century has worked are considered, the futility of setting limits to the progress of the future is but too apparent. The movement is all in advance, and daily improvements testify to its earnestness; but its ultimate results I must leave to others the chronicle.

Thos. T. Eckert

CHAPTER XX

THE TELEPHONE

THE word "telephone" in its original use was not applied to the transmission of speech by the use of the electric current. The word is much older than the art to which it is now exclusively applied. To an exhibition of the transmission of musical vibrations through solids, given by Wheatstone as early as 1821, he gave the name of "telephone concerts," and certain kinds of trumpets for signaling, used as early as 1845, were called telephones. Indeed, the name was at one time applied by the Germans to the common speaking-tube.

The effort to transmit sounds, and especially musical sounds, suggested the possibility, and perhaps encouraged the hope, of the transmission of articulate speech beyond the limits to which it may be transmitted through the natural medium of its propagation, the air; but the hope was not realized until the invention of Bell, described in his patent of March 7, 1876. In that patent were described and claimed a method of, and apparatus for, transmitting sound by means of an undulatory current of electricity. "This invention solved the problem, long labored upon by inventors and scientific men, of the transmission of human speech by the use of the electric current, and laid the foundation of the art of speaking-telephony, since widely introduced throughout the world."

In 1836, Dr. Charles G. Page, of Salem, Mass., an examiner in the Patent Office and an electrical inventor of note, while employing a rapidly interrupted electrical current produced by the ordinary vibrating spring-tongue circuit-breaker, found that if this intermittent current was passed through the coils of an electromagnet the latter gave forth a musical note the pitch of which corresponded to the rapidity of the interruptions; the law of acoustics being that after air-vibrations have become rapid enough to blend together as a continuous musical sound, an increase in their number per second raises the pitch of the sound. He published this discovery under the name of "Galvanic Music." Although not utilized in the speaking-telephone, this served to attract the attention of many experimenters to the electrical production of sound.

In 1854, Charles Bourseul, of the French telegraphic service, suggested that the circuit-breaking tongue or plate might perhaps be vibrated by the air-waves produced by the voice of a speaker. Would the resulting sound at the distant receiver be articulation? He inclined to doubt it; but he said that our knowledge of the precise nature of articulate sound was too meager to enable us to answer that question *a priori*, and the subject was worth experiment. In the same year, "Didaskalia," a periodical of Frankfort-on-the-Main, published an abstract of Bourseul's article, and Philip Reis, a schoolmaster who lived at Frankfort-on-the-Main, then took up the subject. For his circuit-breaking transmitter he used the membrane diaphragm of the old lover's telegraph or string-telephone, so mounted as to make and break the circuit once at each vibration. For his receiver he employed Dr. Page's singing-magnet. He hoped to transmit speech, and his efforts attracted much attention. But he found that musical sounds or confused noises were all that came from his receiver, and in 1863, having perfected his instrument, he put it on the market as a musical telephone.

Reis's discoveries contributed nothing toward the speaking-telephone, unless it be the suggestion that the diaphragm of the lover's telegraph might be employed as a part of an electrical apparatus. Reis attracted attention to the subject, however, though, on the other hand, the failure of both Bourseul and himself after ten years of experiment must have been very discouraging to others. In 1862 Helmholtz published his great work on sound. In this he showed, by direct experimental proof, that each articulate sound was a composite, made up of a fundamental or principal tone which gave volume and pitch to the whole, while the peculiar character, or, as it is technically called, "quality" or "form," which distinguishes one articulate sound and its air-vibrations from another, is due to the admixture of a considerable number of much feebler tones, called "overtones," of successively higher and higher pitch.

These materials—namely, the discovery by Helmholtz of what articulation is, and the proof by the experience of Reis that the only plan thought of for its transmission was a failure—were needed for the creation of the speaking-telephone. But they had been widely known for a dozen years without leading to that invention, when Alexander Graham Bell, son of an Edinburgh professor of articulation, and himself a teacher in Boston of articulation to deaf-mutes, brought them to bear with success on this problem. In his patent of March 7, 1876, Mr. Bell stated the well-known fact that an intermittent current, such as would be produced by a circuit-breaker, would reproduce musical pitch. Then he showed that a current which, instead of being interrupted, was caused to vary as sound-waves vary, could transmit and reproduce every kind of sound which sound-waves could convey, including vocal sounds and the utterances of the human voice. He defined this current as a current consisting of "electrical undulations, similar in form to the vibrations of the air accompanying said vocal or other sounds," whence it took the short name "undulatory current."

An early and noteworthy public exhibition of Bell's telephone was made shortly after the granting of the patent, before the judges at the Centennial Exhibition. One of these judges, a man of the highest scientific repute, Sir William Thomson, now Lord Kelvin, speaking to a fellow-scientist on the evening of that day, said of Professor Bell's invention, "What yesterday I should have declared impossible I have to-day seen realized." And later, addressing the British Association, after describing the telephone, he said, "Who can but admire the hardihood of invention which devised such very slight means to realize the mathematical conception that, if electricity is to convey all the delicacies of quality which distinguish articulate speech, the strength of the current must vary continuously, and, as nearly as may be, in simple proportion to the velocity of a particle of air engaged in constituting the sound?"

Bell's improved instrument, which was put into commercial use early in 1877, still remains the most perfect articulator in the world. But as all the electricity employed in it is such as the mere force of the voice itself generates,—the current so produced is usually reckoned as not over $\frac{1}{100000}$ part of that employed on an ordinary telegraph line,—its sounds are feeble, its effects easily drowned out by disturbances, and the instrument is therefore not well fitted for ordinary commercial use as a transmitting-telephone, where the listener is in a noisy place, and the earth below and a network of neighboring wires are full of other and more powerful currents.

On April 14, 1877, Mr. Emile Berliner filed in the Patent Office a caveat, and on July 20, 1877, Mr. Edison filed an application, each of which described what we now know as the speaking-microphone. In this instrument the voice, acting to vary the pressure between two electrodes in contact with each other, molds the flow of electricity from a battery into Bell's undulatory, speech-bearing current. The microphone of Berliner, with the addition of carbon contacts, the value of which, as distinguished from metal contacts, was first discovered by Edison, has become the universal transmitter of the world. These inventions have been chiefly used in the United States in the form of the Blake transmitter, an instrument of beautiful organization and construction, devised in the summer of 1878 by Mr. Francis Blake, then, or not long before, in charge of the electrical determination of longitudes for the government. The receiving-telephone, made by Mr. Bell in 1877, still remains the preferred instrument for that purpose.

The telephone was naturally first used over a single wire connecting two stations; but the possibility of a wider use was immediately perceived, wherein a number of such wires, practically unlimited, should be so connected together that a person at any station of such a system could hold conversation with persons at any other station, and the "exchange" arose. The exchange was, naturally, at first confined, or substantially confined, to the municipal limits of single cities or towns. It spread rapidly, until in 1884 there was an exchange in every town or city of 10,000 inhabitants or over in the United States, and of course in many towns of smaller population. The connection of neighboring exchanges with one another by trunk-lines, whereby the subscribers in either exchange could talk with the subscribers in any other exchange of the group, naturally followed, and this in an ever-widening circle, until in 1892 it had become possible for the subscribers to the exchanges in the city of New York to talk with the subscribers to the exchanges in Chicago, and a little later the system of exchanges in New England was connected with New York, and thence to Chicago.

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The line from New York to Chicago was formally opened to the public on the 18th of October, 1892. The connecting of these cities, and the furnishing of apparatus for personal conversation between them, was such an addition to the facilities of business as, by a sort of common consent, to be recognized as a matter of public concern, and the formal opening was made by a conversation between the mayors of the respective cities.

As exchanges have grown and lines have been extended, new questions have suggested themselves and new difficulties have arisen. At the outset, and for a considerable time thereafter, one wire only extended from the central office to the premises of each subscriber, the ground being used to complete the electrical circuit, as in telegraphy. But this opened the door to an amount of interference from other currents,—the earth-currents, so called, and currents like those from electric cars, discharged into the earth,—which, owing to the extreme delicacy and sensitiveness of the telephone, seriously impaired the service, and often rendered conversation impossible. This difficulty has been overcome by the use of metallic circuits; that is, by using two wires to connect the central office with each subscriber's premises, and ceasing to use the ground as a "return." It was found, however, especially in the longer lines, that when a number of wires were strung on the same poles, or when such wires were paralleled by wires carrying electric light or power currents, there were produced—by a subtle sympathetic effect called induction—certain disturbances which confused the speech and often rendered it unintelligible.

This was overcome by changing the relative position of the wires in different parts of the line. As has been explained, each circuit consists of two wires. On each line of poles are a number of circuits. At certain measured distances, determined in accordance with rules deduced from theory and from experiment, each wire crosses over and changes places with the others. The plan is that just as much as one line influences another to generate these counter-currents on one part of the route, just so much shall another part of the same line influence another part of that same other line to generate counter-currents, but in a different direction, so that these "induced" currents shall exactly neutralize and destroy one another. If one will endeavor to think out how, in a long line of fifty or a hundred wires (for some of the larger routes carry that greater number on the poles), each wire can at frequent intervals be so transposed that each line shall thus, by balancing, protect every other one, and shall be itself protected from every other, some idea of the difficulty of hitting upon a perfect plan will be realized. When wires are made up into cables the same result is obtained by twisting each pair of wires together, and then "laying up" these twisted pairs according to a rule which has been carefully studied out to accomplish the desired result.

There was still another difficulty, experienced on long lines especially. The telephone transmitter produces in that part of the line where it is situated Bell's speech-carrying variations of current. These consist of alternate increases and decreases of current exactly corresponding to the ever-varying sound-waves; and when these act upon the receiver the spoken word is reproduced. These changes, necessary for articulation, corresponding to what are called overtones, succeed one another, in telephony, at the rate of, say, 2000 to the second. Now it is found in a long line that this change of electrical condition takes place at the distant end with a certain sluggishness, so that before there has been time for an increase to fully manifest itself there, the succeeding diminution comes along. Thus the rise and fall of current at the end of a long line becomes so insufficient or so inaccurate that the spoken words are not clearly heard. This difficulty, which is due in part to other causes, is known as "retardation." In underground lines, as formerly constructed, the difficulties from both induction and retardation are increased from fifty to one hundred fold for equal distances. To meet the trouble from retardation the character of the lines must be changed, and this has been done.

What the change should be was by no means a simple matter to determine. Diminishing the surface area of the wire per unit of length lessened the evil of retardation, other things being equal. But when a smaller wire was used other things did not remain equal, because the smaller wire would not carry as much electricity per unit of time, and this aggravated the trouble. Proximity of the wires of one circuit to other wires increases the evil; close proximity of the wires to the earth enormously increases it. Wrapping the wires with any of the usual insulating coverings increases it. But the wires cannot be far apart on pole lines, and in a cable the wires must be embedded in an insulator, must be packed closely together, and must be laid under water or underground. The capacity of iron to become magnetized also unfitted it for use in telephony. Balancing all these evils, advantages, and necessities, the plan adopted has been to employ metallic circuits,—that is, two wires for each set of instruments,—to use copper as the material, and to take very large wire for aërial or overhead pole lines, but, on the other hand, decidedly small wire for cables. The size of the wire for overhead lines varies with the length of the line. Thus, while the copper wire used between New York and Boston weighs 172 pounds to the mile, wire weighing 435 pounds to the mile is used between New York and Chicago, so that each of the several metallic circuits uniting Boston with Chicago contains more than a million pounds of copper.

As wires have multiplied there has been a strong public demand that they should go underground, at least in the more thickly settled portions of the larger cities. A beginning on underground work was made in 1884. On the 1st of January, 1885, there were 1225 miles of wire underground, and on the 1st of January, 1895, 149,592 miles of underground wire, in some sixty cities. As already stated, the difficulties experienced from retardation and induction are greatly increased in underground work, and hence the length of buried conductor that can be used is limited.

Experience having made manifest the difficulties which have been detailed, and the remedies having been learned, they were at once applied. But before they were learned much work had been done, and to bring this up to the proper standard a very general rebuilding was entered upon, not only of lines, which had to be changed from iron to copper and converted into metallic circuits, but also of switchboards and other apparatus.

As there has been improvement of lines, there has also been a steady improvement of apparatus, and the result is that it is now possible from any properly appointed station to talk north and east to Augusta, Me., north to Concord, N. H., Buffalo, and Milwaukee, west to Chicago, and south to Washington, Cincinnati, Nashville, and Memphis; and of course to the principal cities intermediate. This system of telephonic intercommunication is by far the most extensive in the world. It may be interesting to note that within that territory live and do business something more than one half of the whole population of the United States, so that it is hardly a figure of speech to say that one half the people of the country are within talking distance of one another.

The development and present extent of the telephone business are clearly shown by an examination of its statistics. On January 1, 1881, there were in use in the United States, for telephone purposes, 29,714 miles of wire. Ten years later, January 1, 1891, the wire mileage had reached 331,642; and on January 1st of the present year it had grown to 577,231. During the current year there has been a further increase, bringing the total above 600,000 miles.

It will be remembered that the electric speaking-telephone became known in the spring of 1876. On December 20, 1877, 5187 had gone into use in the United States. Ten years later the number had increased to 380,277. The number in use October 20, 1895, was, approximately, 660,817.

On January 1, 1881, the total number of exchange subscribers was 47,880. On the same date in 1891 this number had grown to 202,931, and on January 1st of the present year it had still further increased to 243,432.

Statistics as to the number of connections or conversations by telephone between exchange subscribers date back to 1884 only. During 1884 it was 215,280,000, the yearly rate being based on daily use. January 1, 1895, the estimated number of exchange connections daily in the United States, made up from actual count in most of the exchanges, was 2,088,152, or at the rate of about 670,000,000 per annum. Not only has there been an increase in the number of subscribers to the telephone, but there has also been a steady increase in the average daily use by each subscriber. The average number of calls per subscriber per day was, in 1885, five and one half; in 1895, eight and one half.

With these statistics it will be interesting to compare the statistics of the larger features of the business as it has been established in the principal foreign countries. There are in the United States about 250,000 subscribers. The British Isles, with more than half our population, have less than 75,000. France, with a population of 38,000,000, has but 25,000 subscribers, or about as many as New York and Boston combined. Germany makes a better showing, having 90,000 subscribers in a population of 50,000,000; but this is less than one half the number she should have to bring her up to our standard. Austro-Hungary, with 40,000,000 people, has but 20,000 subscribers; and Russia, with over 108,000,000 inhabitants, only 9000.

John E. Hudson.

CHAPTER XXI

THE EXPRESS

THE familiar picture of the old-fashioned stage-coach and horses standing in front of an ancient tavern, ready to transport passengers and merchandise to some distant place, with the driver perched high on the first seat, and seemingly conscious of his individual prominence as the conductor of a very essential method of conveyance, quite clearly brings to view the manner in which the general intercourse of this country was chiefly transacted during its early years; and it particularly suggests, through the personality of the driver, the means by which small parcels were sent, and the various errands or commissions he performed, for they were then customarily intrusted to that channel of communication between localities. The vessels then engaged in the carrying trade along the coast and on the lakes, rivers, and canals likewise afforded a further method of transportation between districts which were more readily accessible by water than by land, and to the masters of such vessels were confided duties similar to those required of the stage drivers.

Such methods sufficed until there came into operation a series of railways, which, with their greater speed and convenience, necessarily displaced the stage-coach lines; and the obligations theretofore assumed by the stage drivers were naturally transferred to the conductors of the railway trains. Many of those conductors had been stage drivers, and they were employed by the railways because of their general acquaintance with the people, and their familiarity with traffic between the cities and towns. The advent of the railways had given an unusual impetus to the commercial relations of the country, so that, on the opening of a through route by water and rail from New York to Boston, the merchants, bankers, or others who wished to send small parcels enlisted the services of not alone the railway and steamboat employees, but the assistance of their friends traveling between those cities; for New York and Boston were then two of the most important places in the country, their interchange of business was large, and no opportunity was neglected to secure its prompt transaction. The general demand thus made upon the time of the railway and steamboat employees ultimately necessitated a division of their labors; and eventually they were required to make a choice between acting as agents of the public or as servants of their respective companies.

One of the earliest railways to enforce this distinction was the Boston and Worcester Railway, of Massachusetts. That road had in its service a conductor by the name of William F. Harnden, who was one among the many conductors employed by it and the public as agents in the transaction of their various interests. Harnden thought best to sever his relations with the railway, came to New York in 1838, and met James W. Hale, then proprietor of a reading-room in Wall Street, which was largely attended by merchants and travelers. With him Harnden discussed the advisability of separating from the general railway traffic the business of carrying parcels and fulfilling orders, and converting it into an individual enterprise. Harnden's previous experience in a similar respect enabled him to perceive a fair opening for his own benefit and for that of the public in the establishment of an independent service between New York and Boston; and, with the encouragement of Hale, the express business, as now conducted, then and there had its conception.

Acting on that determination, Harnden promptly effected arrangements with the railroad and steamboat companies forming the through line via Providence, and on February 23, 1839, published advertisements in the New York and Boston newspapers announcing that on March 4th ensuing he would begin personally to conduct an "express" service between the two cities, which service would embrace the purchasing of goods, collection of drafts, notes, and bills, and the carriage of small parcels. The trip was made from Boston to New York as outlined, and was then followed by a regular service three or four times a week.

Thus the first express, actually known by that name, had its birth. And here it should be stated that, although Harnden was first to start an express between Boston and New York, there were at the same time others engaged in a similar occupation throughout New England, having been attracted to that new field of industry by the opening and extension of railway lines. Among those who then embarked in the business was Alvin Adams, who came from Vermont to Boston early in 1840, and shortly afterward determined upon the introduction of a route between Boston and New York, via the Norwich line. Adams duly advertised his purpose, and on May 4th in that year began the express which, under his name, has since become so widely known.

In a short time the express routes between New York and Boston had attracted considerable attention, their facilities were regularly utilized by the general public, including the financial institutions of both cities, and the transportation companies cheerfully assisted in their operations, for the enterprise had relieved their employees of extra labor, and materially added to their revenues, besides taking from them a large amount of responsibility. The readiness with which the services offered by Harnden and Adams had been accepted, and the confidence displayed in intrusting to them valuable packages and large sums of money for transmission, are particularly noteworthy facts, as those men at the inauguration of the business were almost unknown in mercantile affairs. It was evident they had no financial resources with which to meet losses to property in their care, and their only stock in trade consisted of the special privileges which each had obtained from the railroad and steamboat companies for the transaction of their business; but they soon earned a reputation for efficiency and integrity that was aptly described in the proverbial phrase, "with the promptness and fidelity of an expressman."

The success of those lines naturally led to the formation of others, and from 1840 to 1845 express routes were opened from New York to Albany, Philadelphia, Baltimore, Washington, Buffalo, Pittsburg, Detroit, Chicago, Cincinnati, Louisville, St. Louis, and New Orleans, connected with which were such other expressmen as William B. Dinsmore, Henry Wells, Edwards S. Sanford, Samuel M. Shoemaker, Johnston Livingston, and William G. Fargo.

At that time there were few railroads in the East, and none beyond Pittsburg; and transportation between prominent localities in the West was almost wholly conducted over the great waterways of the Ohio, Mississippi, and Missouri rivers, with their tributaries, which included canals then recently completed in several of the States to connect those rivers with the lakes. These formed the most frequently traveled routes of communication between the West and the East, and the express was duly established thereon. Within the next few years railroad lines were rapidly constructed throughout the country, and by them the express was likewise carried, so that its scope was thus steadily enlarged in all directions. The great trunk-lines which now cover the United States had not then been projected, and such railroads as were at that time in operation consisted of local and independent routes, widely scattered, and without connection except that which might be had by steamboat or stage. The expressmen, observing the necessity for through and continuous facilities from point to point, however distant, arranged to give the public that very essential service; and in bridging these intervals they for a time called themselves "forwarders," in analogy to the forwarding business as theretofore conducted, and which had been the receipt and delivery of merchandise between two carriers not otherwise connected.

The important manufacturing interests, as well as the largest firms, principally located in the Eastern and Middle States, were during this period forwarding supplies for the country in general by railroad freight and by vessel—such supplies being most frequently sent to large cities, particularly in the South and West, for further distribution; but with the inauguration by the express of continuous lines, those shipments were made directly from point to point, so that the outlying sections of the country, which had not theretofore had any considerable business relations with the important cities, were brought into close touch with them. In then endeavoring to increase its business the express naturally became not only solicitor, purchasing agent, and forwarder, but was, in a degree, responsible for any commercial credit that might thus be extended through its influences. The express also undertook the carriage of letters; and the public, quick to appreciate such service, very promptly availed of it in preference to that of the mail; but the venture met with opposition on the part of the government, and was ultimately abandoned.

Soon after the discovery of gold in California in 1848, when great numbers of people went there to assist in developing the resources of that region,—in which the whole country was interested,—the express

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readily anticipated their necessities for prompt and reliable commercial intercourse with the East by opening agencies in San Francisco, and at the various mining camps on the Pacific coast, for the transmission of packages, money, and gold-dust, and for the transaction of a banking business.

For several years just previous to 1854, the tendency of the principal expresses had been toward consolidation of interests, as it was believed that much better, more prompt, and less expensive service could be rendered by such association. Accordingly, in that year, through the efforts of Adams, Dinsmore, Sanford, and others, the routes of Harnden's Express, the lines of several minor concerns in the Eastern States, and those on the steamers running from New York to Charleston, Savannah, Mobile, and New Orleans were combined with the express of Adams & Company, under the title of the Adams Express Company. Alvin Adams became president, William B. Dinsmore vice-president, and a board of directors was formed, of which Edwards S. Sanford, Samuel M. Shoemaker, Johnston Livingston, and others were members. In this year, also, Wells, Livingston, Fargo, and Butterfield, through a similar incorporation of lines extending from the East, via Albany, Buffalo, and the lakes, to the far West, organized the American Express Company, with Henry Wells as president, John Butterfield vice-president, William G. Fargo secretary, Johnston Livingston and Alexander Holland directors, and Daniel Butterfield, James C. Fargo, and Charles Fargo superintendents. Likewise in 1854 the United States Express Company was formed by Kip, Barney, and Marsh, to operate an express over the then recently completed line of the New York and Erie Railway, and other routes extending farther into the West. D. N. Barney was made president, H. Kip became superintendent, and T. B. Marsh treasurer. About that time, also, Wells, Livingston, Fargo, Barney, and others introduced another express on the Pacific coast, under the title of Wells, Fargo & Company, to form a through connection, both overland and by water, with the East. During the next few years several expresses operated stage lines, and the famous "Pony Express," between St. Louis and San Francisco, Wells, Fargo & Company, however, being the most prominent among them; and in 1858 that concern, through an association with such lines, formed the Overland Mail Company, which until the completion of the Union Pacific Railroad exclusively carried the United States mails between the Missouri River and the Pacific coast. In 1855, under the title of the National Express Company, there were organized several express routes which had been operated between New York, Albany, Troy, Saratoga, Whitehall, Rutland, and Montreal. D. N. Barney was made president, J. A. Pullen general manager, and E. H. Virgil superintendent. Some time thereafter, Johnston Livingston and L. W. Winchester, previously identified with other companies, became active in its management.

These consolidations of routes, which connected the principal sections of the country and brought together in a common enterprise such bright and energetic men as those mentioned were known to be, laid the foundation for the thoroughly organized service of the express as it exists to-day. The express had then become a recognized necessity in the commercial and individual transactions of the country; its lines had ramified in every direction, until nearly the whole United States was traversed by them; it had attracted to itself sufficient capital to place it on a firm financial basis, and obligations to insure the safe and speedy transmission of merchandise, valuables, and money were readily assumed, so that when loss or damage did occur, due reparation was promptly made; and it is current history, extending from that time until to-day, that whenever goods or valuables in the care of the express have been tampered with or stolen, it has been swift, sure, and untiring in its pursuit of the offenders until adequate punishment was effected.

In 1861 the Southern Express Company was organized to operate in the Southern States, and Henry B. Plant became its president.

Upon the breaking out of the War of the Rebellion the express was the only means of communication between the soldiers in the field and their friends at home. For certain of the States it acted as the gatherer of the soldiers' votes, and transmitted them to the capitals of such States. The new securities of the government, which were so largely purchased by our people, were forwarded by the government through the express—a choice made with full knowledge of the fact that the express afforded greater safety than the mail. The intercourse thus established was, at the solicitation of the government, continued after the war had ceased, and at its further request a contract was made with the Adams Express Company, acting for itself and the other express companies, by which the transmission of all the securities and moneys of the government was confided to the express. This function of the express was especially noted in the award which was made at the Columbian Exposition to the

Adams Express Company, and the testimonial concluded thus: "The Adams Express Company has, by the faithful performance of every trust reposed in it, and the discharge of duties devolving upon it, enlarged its business to the grand dimensions it now enjoys, and has achieved the enviable position of a pattern and guide for all similar corporations."

The further development of the express is remarkable for the introduction and perfection of a number of facilities necessary to meet the constantly increasing demands of our 70,000,000 people,—features of transportation and attendant services that are peculiarly its own,—and chief among which may be mentioned its wagon service, now to be found on almost every avenue or street of our cities, towns, and villages; and, in conjunction therewith, its employment of special cars or trains for transportation of express matter at high speed between the principal cities. It has to a great extent created the business of transporting varieties of game, poultry, fish, oysters, fruit, and vegetables to localities where they are not usually obtainable; it has originated a novel method of selling goods for merchants, by collecting on delivery the amount of the invoice and returning the cash to the shipper; it has improved the methods of collecting the proceeds of negotiable paper, and assumes therewith the responsibility of an indorser; it has created and affords the only efficient means for the safe transportation of moneys and valuables intrusted to it by the general public, the banks, the railroads, and the government, and, as indicating the general recognition of this specially important feature, it may be stated that during a recent year there were sent through the express $2,500,000,000, and similarly shipped by the government $1,500,000,000, making a total carriage of $4,000,000,000 in money, no part of which was lost in transit; it has introduced at 40,000 agencies the express money-order system, which thus meets almost every citizen of the United States at his residence or place of business, and there affords him a handy and safe means for transmitting his money to any locality, such money-orders being universally convertible into cash—a convenience not otherwise obtainable, for postal money-orders are only purchasable and redeemable at large and important offices. This is an accommodation also impossible for the banks to render, as they are located at less than 8000 points. The express has improved the facilities for immediate transportation of foreign goods from the port of entry to destination, by accepting and carrying them under heavy bonds to the government.

These are some of the features of the express which distinguish its services from mere acts of transportation, and indicate that its facilities cover a much wider range of operations than originally designed, particularly such as are not afforded by any common carrier, and which necessitate the assumption of obligations and liabilities not contemplated by any other agency of commerce.

The great lines of railway communication are a necessary adjunct to the successful conduct of the express business, but they are an adjunct only. Were the express dissolved the railway lines could not supply the needs of the public. There is an interval between the act of transportation and the demands of the public which railway companies do not fill, and were not organized to fill, and which renders the express so essential to the general welfare of the community. The express, in its turn, is among the most efficient supporters of the railway systems; it purchases the right of transportation at wholesale, and sells it at retail to the public, at prices fairly remunerative and universally accepted.

In round numbers, the routes of the express now cover 200,000 miles of railroad, steamboat, and stage lines; the number of packages of merchandise annually carried is over 100,000,000; the number of money packages transported is 20,000,000; the number of money-orders issued is 7,000,000; it employs 50,000 men at 40,000 agencies, uses 15,000 horses and 6000 vehicles, and it has an aggregate capital of over $60,000,000.

And now, when consideration is given to the prominence achieved by the express in the history of this country through the services it has rendered, not alone to the people at large, but to the United States government, there will be no hesitation in acknowledging that its usefulness may not be measured by any ordinary standard of comparison; it has constantly aided commerce by opening new markets for the sale, purchase, and distribution of the products and manufactures of the country, and has promoted individual communications and financial transactions to an extent not attainable by any other means; it is distinctively of American birth, and not elsewhere are there similar instrumentalities so combined in one efficient and complete system.

L. C. Weir

CHAPTER XXII

THE STREET-RAILWAYS OF AMERICA

IT is not necessary to turn back the pages of history a century to present a complete account of the inception and development of street-railways in the United States or the world. The first horse-car ever known appeared upon the street in New York as late as 1832, but the idea of conveying people in vehicles over iron rails was put to very little practical use until nearly twenty years later. The history of street-railways in America, therefore, is practically confined to the last half-century; and yet there are now in the United States nearly 1000 street-railway systems, with a total mileage of nearly 14,000, and a capitalization exceeding the enormous sum of $1,300,000,000. These simple figures, of such magnitude as to be almost impossible of comprehension, are sufficient to indicate the growth and extent of the street-railway service of this country.

This extraordinary development of the idea, conceived by John Stephenson, of placing the wheels of an omnibus upon iron rails instead of dragging them over cobblestones, may be divided into three parts: First, street-railways operated with horses as separate organizations; second, the substitution of mechanical traction by means of a cable; third, the inauguration of electricity as a motive power, with all that the adaptation of this wonderful agency to practical uses conveys both for the present and the future.

Sixty-five years ago, there lived in New York a man who had served his apprenticeship and begun work for himself as a builder of carriages. He was only twenty-four years old. His name was John Stephenson. That he built strong and handsome coaches while engaged in that occupation is evidenced by the world-wide reputation which he subsequently acquired. That he was not content to pursue that occupation in the stereotyped manner of his predecessors is shown by the fact that before reaching the age of twenty-five he conceived the idea of transporting passengers, as millions are transported to-day, over rails laid upon the pavements of city thoroughfares.

The immediate development of this conception was the inauguration, in 1831, of the New York and Harlem Railroad, which obtained a charter to operate a street-car line through Fourth Avenue in the city of New York. This road was constructed and opened in November, 1832, Stephenson building the first car drawn over the track. If a duplicate of that car should be made to-day, and placed upon the street of any city in the Union, it would attract no less attention than a Roman chariot. Prior to that time there had existed only two forms of public conveyance. One was the English railway-coach; the other was the American omnibus. Stephenson's car was a combination of the two. Outwardly it resembled the omnibuses used on Broadway until a few years ago, when they succumbed to the more convenient and comfortable street-cars. Its exterior was divided into three compartments, after the English idea, and it accommodated, when full, thirty passengers, or ten in each compartment, besides affording seats to perhaps a dozen more upon the roof. Over the second door was painted the name of the car, "John Mason," after the gentleman of that name, who was then the president of the new railroad, as well as of the Chemical Bank. Upon the panel of the first door appeared the words "New York"; upon the second, "Yorkville"; and upon the third, "Harlaem," then spelled in the good old Dutch way; and in very modest letters, upon one of the steps between the wheels of this extraordinary vehicle, "Stephenson Patent."

Although this first of all street-cars would probably seem to-day quite as ridiculous as the famous "one-hoss shay," it would be unjust to assert that it was not an exceptionally good beginning. Judging from the picture now before me, there certainly was a dearth of springs; but it must be borne in mind that springs were not so common in those days as they are now, and that passengers were far less exacting. Moreover, the outward appearance of the car, although cumbersome, was certainly handsome. The upholsterings were also said to be of the finest material, and conducive to a sense of luxury. Altogether, therefore, it must be admitted that John Stephenson's first car, considered by itself, was a success. Practically, however, it proved a failure for the time being. Steam had just then begun to be used as a motive power, and all other agencies, including this wonderful car, were superseded by it wherever it could be employed to advantage.

In 1837 horse-car service on Fourth Avenue was abandoned for steam-cars, and was not resumed until 1845, and then in a very tentative and unsatisfactory manner. In 1852 a French engineer, named Loubat, revived the idea in New York city, and a road was constructed upon a portion of Sixth Avenue. During the next eight years about thirty roads for horse-car service were constructed in the United States. Of these probably the most important was the one built from Boston to Cambridge. The company which undertook this project made use of the old omnibus cars that had been used on Fourth Avenue in New York. As the traffic increased they afforded additional facilities by placing upon tracks the omnibuses which they had formerly used upon the road from Boston to Cambridge. It soon became apparent that the new form of conveyance was destined to achieve general popularity, and one improvement after another was adopted until there were produced really very comfortable and attractive cars, exactly balanced upon the best of springs and handsomely finished, such as are in use in all of the large cities of to-day.

Aside from the personality of the inventor there is little that is not commonplace in the history of street-cars operated with horses. They served their purpose as a process of development, but that was all. As a rule, they were operated by separate companies over short lines, and afforded comparatively little convenience to the public. The transfer system, which has since attained such great importance in the large cities, was unknown, because of the separation and, in many cases, antagonism of the various companies. The owners of the roads were not progressive, and instead of endeavoring to afford the public the best possible accommodation, they exerted every effort to obtain the largest revenue from their properties. This short-sighted policy produced the inevitable result of popular dissatisfaction. Nevertheless, there soon appeared in New York a striking illustration of the fact that street-cars had become, and would continue to be, a most important factor in municipal life.

When the elevated railroads were built in this city, many people believed that the end of the surface car had come, but in reality the companies operating lines directly under the elevated structures suffered comparatively little loss even at the beginning, and within a few years they had regained their former traffic, which has since increased, year by year, until it is now larger than ever before in their history. The chief cause of this was undoubtedly the increase in population, but another, hardly less potent, lies in the improvement of service, the change of motive power, and a natural tendency of the public to prefer surface transportation to any other method, above or below. The first great change, and the first really progressive step in street-car service, however, came with the substitution of mechanical traction for horses, and this brings us to the second chapter of our history.

The first cable railroad in the United States was a direct result of physical conditions in the city where it was constructed. If all cities in the country had been built upon marshes and bogs like Chicago, St. Louis, and New Orleans, or even upon moderately level ground, like New York, Philadelphia, and Boston, it is entirely within the range of probability that strands of wire would never have been used for the purpose of drawing street-cars. But there existed in San Francisco a physical configuration of ground which made it impossible to transport people from one part of the city to another, from the wharves to Nob Hill, by means of horses. Necessity, therefore, became the mother of this invention, as of most others, and the native Californians, being both quick-witted and enterprising, were not slow in the exercise of ingenuity.

To Andrew S. Hallidie belongs the credit of adapting the theory of cable traction to successful practical use. In 1872 he obtained a patent upon a cable grip. Meanwhile he had prepared plans for the building of a cable road, and far-seeing capitalists of San Francisco had pledged the requisite financial support for its construction. The work was pushed forward with the energy characteristic of the far West, and in September, 1873, the pioneer cable railroad of the world was put into operation on Clay Street, San Francisco.

Many doubted the success of this new method, and more questioned its safety. The road was only about a mile in length, and yet rose from a low level terminus to a height of nearly 300 feet. It is said the first gripman who operated a car over this road alighted at one stage in its descent and insisted that he could not, in justice to his family, proceed further unless there should be attached to the car a steel rope above the surface of the ground which he could actually see and rely upon to save a corporation from the payment of his life-insurance. This difficulty having been overcome, either by the attachment of the rope or by persuasion and threats — upon which the history of California is less specific than might be desired — the car continued without accident, and after a few days a service was given of sufficient regularity to make certain the success of the experiment.

This result accomplished one immediate effect. It proved beyond a question that heavy cars loaded with people could be drawn by cable up and down the steepest grades, without the expenditure of an extraordinary amount of money, and without menace to the lives of passengers. Unfortunately for the quick development of the new idea, this was the only problem solved by this first cable road. It was a perfectly straight track, containing none of the curves, depressions, and tortuous routes necessarily used or followed by street-car lines in the majority of large cities. For this reason the experiment attracted no more interest than that which for several years naturally attaches to a novelty; but the people of San Francisco, daily seeing and understanding the merits of the new system, appreciated its advantages over the old, and in 1876 supplemented the Clay Street road with another on Sutter Street, and three years later with one on Union Street.

In 1882 Chicago, either from jealousy of another western city winning the laurels of a first effort in any direction, or from the reputed far-sightedness of its capitalists in taking advantage of public needs, inaugurated a cable railroad considerably more pretentious than the one which had been built in San Francisco. Charles T. Yerkes was the leading spirit in this enterprise, achieving not only a success for the city, but a fortune for himself. A year later, slow-going Philadelphia followed the lead of Chicago and built a cable railroad two and one half miles in length, which has since given way to the invincible power of harnessed electricity.

New York, more conservative than any of its sister cities, and notoriously jealous of experiments upon its streets, finally accepted the tests in San Francisco, Chicago, and Philadelphia as satisfactory, and authorized the construction of the present cable railroads on Broadway and Third Avenue. Here, for the first time, was introduced the duplicate system which has since become a practical necessity upon lines where traffic is heavy, and where an interruption, even for the fraction of an hour, is extremely costly to the operating company.

Other cable railroads were built in every section of the country except New England, and there are now in operation in the Eastern States, 157 miles; in the Central States, 252 miles; in the Southern States, 6 miles; and in the Western States, 217 miles; — making a total of 632 miles of cable railroad now in operation, although soon, in my judgment, to be superseded by the more tractable, more economical, and less objectionable electricity. If this prediction should prove to be correct, it is obvious that the invention and use of the cable as a motive power deserves no more attention than it has received, for the reason that it will have been only tentative and a filling of the gap between the quadruped and the magic fluid.

Far more important than the success, however great or small, of this method of traction, was the fact that its discovery led directly to the consolidation of distinct street-railroad companies in such a way as to enlist more capital, more brains, and more energy in the development of street-car service. Just as the primary credit for introducing the cable-system belongs to Mr. Hallidie, so does the yet greater credit, so far as practical results are concerned, of working out the idea of efficient consolidation, belong to Henry M. Whitney.

There were at that time innumerable street-car lines in Boston, operated, as in all other cities, as separate organizations, and affording accommodations wholly inadequate to the demands of the public. Mr. Whitney conceived the idea of a general consolidation of all these companies in such a way as to make possible the substitution of a better form of motive power, more direct routes, and a general improvement in every direction. His first intention, when he had accomplished the great work of uniting the many adverse interests involved, was to introduce the cable, but before he had fully succeeded in his primary undertaking to such an extent as to warrant reconstruction, the most important event in the history of street-railroads took place.

Electricians had believed and asserted for years that the wonderful power to the adaptation of which to practical uses they had given much intelligent study, could be utilized directly in the drawing of heavy loads. Edison built the first electric road in America at Menlo Park, New Jersey, in 1880, and three years later the same great inventor, coöperating with Stephen B. Field, built a similar road for temporary use at the Chicago Exposition in 1883. Leo Daft at the same time was making similar experiments in Baltimore, Pittsburg, and other places; and Charles J. Vandepole was doing likewise in Toronto. None of these, however, had reached such a point that its practical value was demonstrated beyond a doubt at the time when Mr. Whitney engaged in his work of consolidation in Boston. But, in 1888, Frank J. Sprague, first among the younger electricians of America, obtained sufficient capital to make an actual test upon a street in the city of Richmond, Virginia. He brought together the best features of all the systems which had then been devised, applied to motive-power the fundamental principles which he had learned in building electric-light plants and establishing stationary motors; added new and simple, but effective, methods of motor-control and suspension, and in general worked out a well-defined system, the essential features of which have not been changed in the seven years which have elapsed since he installed the first practical electric railroad in the United States.

His work in Richmond naturally attracted the attention of men engaged in the street-railway business, and scores visited the famous old Virginia capital to behold its actual operation. Among these were Mr. Whitney and Messrs. Widener and Elkins of Philadelphia. They appreciated at a glance the possibilities of the new invention, and after making most thorough examinations personally, as well as through expert engineers and electricians, did not hesitate to adopt, expand, and improve it in every possible direction. Mr. Whitney at once abandoned the idea of laying a cable under the streets of Boston, and began forthwith to lay the foundations of the great West End system, which is now the largest in the world in point of carrying capacity and revenue. Mr. Widener and Colonel Elkins proceeded with no less vigor to consolidate and electrify the principal lines of Philadelphia, and within three years after the Richmond road was inaugurated, there were hundreds of miles of overhead trolley-lines in successful operation in the streets of nearly every large city in the Union.

Since that time the work of changing old horse-car lines into modern electric railways by the overhead system has progressed so rapidly that there are now in actual operation in New England 1392 miles; in the Eastern States, 3189 miles; in the Central States, 3578 miles; in the Southern States, 743 miles; and in the Western States, 1461 miles; making a total of more than 10,000 miles of overhead trolley-lines now in actual operation, against less than 2000 operated by horses.

It will thus be seen that the development of the overhead trolley system has been one of the most rapid ever known, in a change so radical and involving so many untried elements. This has been due no less to a spirit of competition among rival electrical companies than to the public demand for improved facilities for local transportation. The two or three large companies engaged in the business of furnishing electrical supplies so thoroughly appreciated the possibilities of the new method, that they invested millions of dollars, not merely in the building of extensive plants, but in the perfecting of their individual systems. The inevitable result has been the concentration of an abundance of ability and energy in solving the difficult problems involved in the adaptation of electrical power to this most practical of uses.

Under this stimulus improvement has followed improvement so rapidly that little apparently remains to be achieved. Cars are now run in hundreds of cities by devices so simple that skilled labor is no longer essential to their operation, and they are both lighted and heated by the same current which propels them. Moreover, all this is done far more economically than was ever possible through operation with horses or by cable. Chief among the important effects of electrical operation has been the building of roads of a very few miles in length, which, despite their limitations of both district and patronage, can be and are conducted at so small a percentage of gross receipts, as to produce a fair profit upon the investment.

It was formerly supposed—and the supposition, while horses and cables afforded the only means of motive power, was correct—that street-car service could be used to advantage only within the limits of a city or village. But since the introduction of electricity has widened the possibilities and increased the diversity of such traffic, it has been found distinctly profitable to connect municipalities and towns having common interests by the new system. A notable illustration of this fact is afforded by the great success of the trolley road connecting Minneapolis and St. Paul. Before this line was established the steam railroads operated scores of trains of cars between the two cities daily, for the sole purpose of accommodating the local traffic. As soon, however, as the trolley road was put into successful operation, the demands upon the steam railroad decreased rapidly, and have gradually been reduced to such a point that nearly, if not quite, all of the steam-railroad trains formerly operated for this purpose have been taken off. A more recent but hardly less striking illustration of the same tendency is afforded by the new trolley lines connecting

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Newark, Elizabeth, and Jersey City. Indeed, it is now an established fact, that on distances not exceeding ten miles, the steam-road cannot compete with the trolley because of the more frequent, more cleanly, cheaper, and more pleasant accommodations offered by the latter.

The most recent development of the trolley idea has been the creation of an entirely new traffic, namely, that of riding upon street cars for mere pleasure. Few people appreciate the extent of the demand for this branch of street-car service; but an instance is afforded by the fact that so-called "trolley parties" during the past summer added more than seventy thousand dollars to the receipts of Philadelphia companies alone. Street-car managers themselves have only begun to appreciate the magnitude of business which may be created by offering exceptional accommodations for pleasure-seekers, and the development of the idea has, consequently, only begun. That it will become a decided factor in the operation of trolley lines, especially in suburban districts, is now beyond question.

There have been, and always will be, objections to the overhead trolley. Some are founded upon reason, but more upon fancy, and it is a fact that in the great majority of cases, where the introduction of the system was most bitterly opposed, its removal now could by no possibility obtain the assent of the public. Only in the largest cities, where overhead wires of any description are objectionable because of the density of population and the seriousness of placing any obstacle in the way of extinguishment of fires, is there any good reason for opposing its introduction and use. These objections, and the natural conservatism of the community, have prevented the adoption of the new method in New York city. The direct result of this condition of affairs has been the inauguration, during the past few months, of an experimental railroad, operated by electricity, conveyed through wires strung in a conduit beneath the surface of the ground. For this experiment, which now bids fair to achieve success, the far-sighted directors of the Metropolitan Traction Company are entitled to full credit. They saw the necessity of overcoming the objections to the overhead system, and at the same time of superseding both horses and cables.

With this object in view they sent to Budapest, where an underground system had been in operation for several years, Mr. F. S. Pearson, one of the most capable and resourceful electrical engineers in the country. Mr. Pearson made a careful examination of the system there in use, studied the conditions, climatic and otherwise, which would make necessary certain changes, and finally worked out a plan which he submitted to the directors of the Traction Company, with an assertion of his belief that, if tried properly, without an attempt to save money in making the experiment, it would prove successful. The road was constructed upon the lines thus suggested, and has been in operation several months under my direction. During this time no accident of any kind has taken place, and no money has been required or expended for maintenance or changes. Although far more expensive in construction than the overhead trolley, it is also far more satisfactory in operation when once built. It only remains to be seen whether this system, the success of which in fair weather has already been demonstrated, will be found capable of defying the severe storms of the winter and spring months in northern American cities. If so, it will undoubtedly become the favorite system in large cities, as it comprises all the advantages, with none of the disadvantages, of the overhead trolley over cables and horses. Storage-battery systems have been tried at various times in various places, but so far have met with so little success that, although affording apparently the ideal system, they have not yet reached the point of efficiency which warrants serious consideration.

It is not of the future, however, that I am supposed or would presume to write, and regarding the past, all has been said in detail that can be said within limits which would not trespass upon the patience of the reader. In summarizing, I can only add that there have been four great events in the history of the street-railways of America during the past seventy years. The first was the invention of the primitive street-car by John Stephenson. The second was the use of the cable by Andrew S. Hallidie. The third was the harnessing of electricity to the street-car service by Frank J. Sprague. The fourth, and most important of all in actual result, has been the outgrowth of Henry M. Whitney's idea of consolidation, which has resulted in a benefit to the American people so vast as to be incalculable, and in the investment of hundreds of millions of dollars in an industry which could never have been created or imagined in any age other than that in which we live. As an interesting and valuable summary of the magnitude of the street-railway business of the country, I present the following tables, obtained from the census reports of 1890 and from other equally reliable sources of a much later date:

COMPARISON OF STREET AND STEAM-RAILWAYS IN 1890:

Street-Railways.		Steam-Railways.		Per Cent. of Total Steam-Railways.
Length of line (miles)	5,783.47	Length of line (miles)	157,758.83	3.67
Passenger cars	32,505.00	Passenger cars	25,665.00	126.55
Employees	70,764.00	Employees	704,743.00	10.04
Passengers carried	2,023,010,202.00	Passengers carried	472,171,343.00	428.45

DIVISION OF THE MOTIVE POWERS OF STREET-RAILWAYS IN 1890:

Items.	All Motive Powers.	Distribution.			
		Animal.	Electric.	Cable.	Steam.
Length of line (miles)	5,783.47	4,061.47	914.25	283.22	524.06
Length of all tracks (miles)	8,123.02	5,661.44	1,261.44	488.31	711.30
Passenger cars	32,505	22,408	2,895	5,089	2,113
Employees	70,764	44,314	6,619	11,673	8,158
Passengers carried	2,023,010,202	1,227,756,815	134,905,994	373,492,708	286,854,685
Total cost	$389,357,288.87	$195,121,682.50	$35,830,949.63	$76,346,618.23	$82,058,038.51

NUMBER OF PASSENGERS CARRIED BY STREET-RAILWAYS IN SIXTEEN OF THE PRINCIPAL CITIES OF THE COUNTRY IN 1890:

Cities.	Population.	Passengers Carried.	Average Number of Rides per Inhabitant.
Baltimore, Md.	434,439	40,659,982	94
Boston (including Lynn and Cambridge), Mass.	574,232	129,038,563	225
Brooklyn, N. Y.	806,343	147,500,399	183
Buffalo, N. Y.	255,664	16,685,983	183
Chicago, Ills	1,099,850	180,326,470	164
Cincinnati, Ohio	296,908	37,905,370	128
Denver, Col.	106,713	21,281,584	202
Kansas City, Mo.	132,716	38,000,978	286
Louisville, Ky.	161,129	21,535,735	132
New Orleans, La.	242,039	30,510,662	126
New York, N. Y.	1,515,301	449,647,853	297
Philadelphia, Pa	1,046,964	165,117,627	158
Pittsburgh, Pa.	343,904	46,099,227	134
St. Louis, Mo.	451,770	67,800,252	150
San Francisco, Cal.	298,997	80,619,005	270
Washington, D. C.	230,392	31,032,187	135

COST OF CONSTRUCTION PER MILE OF LINE OF STREET-RAILWAYS IN 1890:

Items.	Animal.	Electric.	Cable.	Steam.	Mixed and Inseparable.
Total cost of construction and real estate	$99,812,886.27	$14,074,049.13	$33,374,627.39	$35,777,187.08	$65,583,242.72
Miles of line to which this cost pertains	2,388.48	463.70	166.48	350.31	734.12
Cost of construction and real estate per mile.	$41,789.29	$30,351.63	$200,472.29	$102,130.08	$89,335.86
Total cost of equipment	$22,344,285.14	$3,873,544.21	$3,827,436.62	$4,348,511.10	$12,022,289.54
Miles of line to which this cost pertains	2,473.56	464.93	167.13	361.83	855.43
Cost of equipment per mile	$9,033.25	$8,331.46	$22,900.96	$12,018.11	$14,054.09
Total cost per mile	$50,822.50	$38,683.09	$223,373.25	$114,148.19	$103,389.95

The above table gives a comparative summary of the cost of each five classes of roads making completed reports. It will be noticed in this table that cost of road is given in two principal items, viz., "Total cost of construction and real estate," and " total cost of equipment."

THE CAPITAL STOCK, FUNDED DEBT, AND ACCRUED INTEREST OF THE STREET-RAILWAYS OF THE UNITED STATES IN 1890:

Items.	Capital Stock Issued and Outstanding.	Dividends Declared.	Rate of Dividends Declared (Per Cent.).	Funded Debt Issued and Outstanding.	Interest Accrued.	Rate of Interest Paid (Per Cent.).
All motive powers	$163,506,444.50	$11,600,334.54	7.09	$103,494,259.99	$5,870,710.72	5.67
Animal	$62,415,614.50	$4,390,519.54	7.03	$34,361,904.99	$1,977,664.92	5.81
Electric..............	4,034,900.00	225,697.00	5.59	3,230,300.00	187,505.00	5.80
Cable................	6,437,900.00	653,587.00	10.15	4,076,000.00	218,160.00	5.35
Steam	25,917,180.00	1,561,512.00	6.03	19,326,200.00	1,181,512.00	6.11
Mixed and inseparable.	64,700,950.00	4,769,019.00	7.37	42,499,855.00	2,285,868.80	5.38

The above table covers only those roads reporting the payment of either dividends or interest, as the case may be.

Now, turning from the facts and figures, as given by the census reports of 1890, the following data, compiled from other equally reliable sources, are of more recent date, covering the years 1892, 1893, and 1894. But before entering upon the details of the same, it may be well to make some additional general comparisons between the street-railways and the steam-railroads of the United States. The former represent about seven and one-half per cent. of the mileage of the latter, and in passenger receipts, about forty-five per cent. The total capitalization, bonds, and stocks, of the steam-railroads in the United States, is about $11,000,000,000, and of the street-railways, about $1,300,000,000, the latter being about eleven per cent. of the former, while the profits of the steam-railroads were $332,-000,000, and of the street-railways, about $43,000,-000, thus making the latter about thirteen and one-half per cent. of the former.

Of the 976 operating street-railway companies reported in "American Street-Railway Investments," 109 have been first selected as presenting the most complete reports for the past three years. They represent about twenty-two per cent. of the total mileage of the country—their capital stock amounting to $200,497,681, their funded debt to $193,-844,145, and their gross capital liabilities to $394,-341,826. Their capitalization is about thirty per cent. of the total capitalization of American street-railways. The report of these roads is as follows:

	1892.	1893.	1894.
Gross receipts	$56,119,612	$63,165,976	$57,232,545
Operating expenses	36,787,919	40,010,812	35,863,607
Earnings from operation.	$19,331,693	$23,155,164	$21,368,938
Fixed charges	8,834,282	10,373,510	11,118,217
Net income......	$10,497,411	$12,781,654	$10,250,721

	1892.	1893.	1894.
Per cent. operating expenses to gross receipts	65.6	63.3	62.7
Per cent. fixed charges to gross receipts	15.7	16.4	19.4
Per cent. net income to gross receipts.	18.7	20.2	17.9
Per cent. net income to capital stock..	5.2	6.4	5.1

The combined reports of 146 street-railroad companies, representing capital stock, $240,477,324; funded debt, $231,091,645; capital liabilities, $471,-568,969—or thirty-six per cent. of the total liabilities of the country—make the annexed showing for the years 1893 and 1894:

	1893.	1894.
Gross receipts................	$71,847,580	$65,791,187
Operating expenses	45,697,130	41,205,904
Earnings from operation.......	26,150,450	24,585,283
Fixed charges	12,281,424	13,329,765
Net income	$13,869,026	$11,255,518

	1893.	1894.
Per cent. operating expenses to gross receipts..	63.6	62.6
Per cent. fixed charges to gross receipts	17.1	20.2
Per cent. net income to gross receipts	19.4	17.2
Per cent. net income to capital stock..........	5.8	4.7

The combined operating report of 232 American street-railway companies—representing capital stock, $316,762,149, funded debt, $278,995,755, and capital liabilities, $595,757,904, or about forty-six per cent. of the total capital liabilities of the American properties—make the showing as below for the financial year ending June 30, 1894:

	1894.
Gross receipts	$84,664,338
Operating expenses........................	53,175,278
Earnings from operation	$31,489,060
Fixed charges..............................	19,387,729
Net income	$12,101,331
Per cent. operating expenses to gross receipts........	62.8
Per cent. fixed charges to gross receipts	22.9
Per cent. net income to gross receipts	14.3
Per cent. net income to capital stock	3.8

The mileage, cars, capital stock, funded debt, and capital liabilities of the street-railways in the

United States — some 976 in number — made at the beginning of the present year, make the following showing:

Geographical Division.	Number of Roads.	Miles of Track. Horse.	Electric.	Cable.	Miscel.	Total.	No. of Cars. Total.	Per Mile Track.
New England States (1)	104	168	1,392			1,560	5,519	3.54
Eastern States (2)......	305	567	3,189	157	189	4,102	16,001	3.90
Central States (3)......	278	555	3,578	252	134	4,519	16,936	3.74
Southern States (4)	111	214	743	6	213	1,176	1,930	1.64
Western States (5).....	178	410	1,461	217	143	2,231	4,359	1.95
United States..........	976	1,914	10,363	632	679	13,588	44,745	3.29

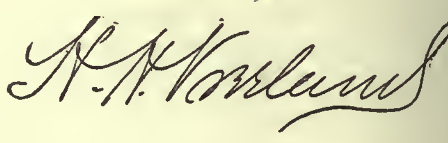
Geographical Division.	Capital Stock. Total.	Per Mile Track.	Funded Debt. Total.	Per Mile Track.	Capital Liabilities. Total.	Per Mile Track.
New England States (1)	$ 53,778,300	$34,500	$ 43,546,000	$27,900	$ 97,324,300	$62,400
Eastern States (2)......	348,194,073	84,900	249,318,505	60,800	597,512,578	145,700
Central States (3)......	222,641,025	49,300	173,567,500	38,400	396,208,525	87,700
Southern States (4)	33,155,725	28,200	23,578,900	20,100	56,734,625	48,200
Western States (5).....	90,245,083	40,300	62,114,600	27,700	152,359,683	68,000
United States..........	$748,014,206	$55,000	$552,125,505	$40,600	$1,300,139,711	$95,600

(1) Includes Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut; (2) New York, New Jersey, Pennsylvania, Delaware, District of Columbia, Maryland, Virginia, and West Virginia; (3) Michigan, Ohio, Indiana, Kentucky, Wisconsin, Illinois, Minnesota, Iowa, Missouri; (4) North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Tennessee, Louisiana, and Kansas; (5) South Dakota, Nebraska, Kansas, Texas, Colorado, Montana, Idaho, Utah, Washington, Oregon, and California.

Aside from the accommodation afforded the residents of the territory through which the roads run, it is a source of profit to the railroad companies.

As to the recent innovation — involving the placing of postal-cars upon street-railways — the St. Louis and Suburban Railway Company of St. Louis was the first of the kind in this country to make the movement in this direction, by running from the business part of the city to the choicest residence and suburban portions of the town of Florisant, distant sixteen miles from the center of the city. This began several years ago, and was followed by Brooklyn, over the Atlantic Avenue line to Coney Island, in August, 1894; by Boston, in April or May, 1895; by Philadelphia, to Chestnut Hill and Passayunk, June 1, 1895, and to Manayunk, October 1, 1895; and by New York, over the Third Avenue line, October 1, 1895. For these mail-cars, the railway companies furnish conductors and motormen, while the Post-Office Department supplies the mail-clerks.

The cars are built especially for the purpose, equipped with their own motors, and furnished with the necessary desks, cases, racks for mail-bags, etc. This mail service has now been in operation, as already noticed of St. Louis, for about three years, and new features are being constantly added to it. The question as to whether or not such mail service is called for, depends almost entirely upon local conditions, — the length of the road, the territory through which it runs, the proximity of depots and post-offices to the line of the road, and many other considerations. An advantage, independent of any financial return, and one which is regarded by many as the one reason for street-railways embarking in this service, lies in the prestige of the government's name. This point was never so thoroughly illustrated as in the late troubles in Chicago in the transmission of the United States mail, which has precedence or right of way above all else. As the Second Assistant Postmaster-General governs all transportation of the mails, the street-car postal service is within his province, and has now become part and parcel of the postal railway system of the country. The fuller development of this system is only a question of time, and its progress will be viewed with more or less interest until it becomes a permanent and widespread factor in the distribution of the mails in the larger cities to their suburbs.



CHAPTER XXIII

THE HOTELS OF AMERICA

"There is nothing that has yet been contrived by man by which so much happiness is produced as by a good tavern or inn."—DR. JOHNSON.

"Shall I not take mine ease at mine inn?"—SHAKESPEARE.

"Whoe'er has traveled life's dull round,
Where'er his stages may have been,
May sigh to think he still has found
The warmest welcome at an inn."—SHENSTONE.

IN old colonial times many of the inns in the towns and scattered along the few routes of travel bore such names as "King's," "Queen's," "Red Lion," and the like; but the revolt of the colonies produced a change, and these names gave place to those in harmony with the spirit of the time. The portrait of Washington replaced that of George III. on the swinging signs, as these once quiet taverns became the meeting-places of patriots. Clustered about many of them are historic memories of special scenes and events, and of the men of the Revolution and of the formative period immediately following. Washington was a guest of the City Tavern, Philadelphia (1775); the Bunch of Grapes Tavern, Boston, where he enjoyed "an elegant dinner provided at the public expense, while joy and gratitude sat on every countenance and smiled in every eye" (March 28, 1776); the True American Inn, Trenton (1777); Arnold's Tavern, Morristown; Sufferin's Tavern, Smith's Clove, New York; the Buck Tavern, near Philadelphia (after the battle of Brandywine); Smith's Tavern, Smith's Clove (1779); the tavern at East Chester, New York, where he was ill (1780); the Fountain Inn, Baltimore (1781); Day's Tavern, Harlem (with Governor Clinton, 1783); Fraunces Tavern, New York, where in the assembly-room he bade farewell to the faithful men who, with him, had achieved the liberties of the States; Mann's Hotel, Annapolis, from which he proceeded to the Congress and resigned his commission; and the City Hotel, Alexandria, where he was entertained by the Alexandria Lodge, of which he was a member. The tavern where Washington stayed during an illness at East Chester was built early in the seventeenth century, and now stands within the New York City limits. The room occupied by him remains as he left it. Lafayette was entertained there later. For a season the house was in a sense the seat of government, when President John Adams sojourned at East Chester during the yellow-fever epidemic at the then capital, Philadelphia. There was also the Catamount Tavern, Bennington, Vt.; George Burns' Coffee-House, New York, the lounging-place of British officers, and at the same time privately frequented by the Sons of Liberty during the British occupation; the Tun Tavern, Philadelphia, in which the first masonic lodge in America was organized; the Rose Tree Inn, at Media, Pa.; the City Tavern and the Bird in Hand, Richmond; and many others. From the memories that haunt these ancient hostelries our literature has drawn much of its inspiration. The red Wayside Inn at Sudbury inspired the thought that it was

"Built in the old colonial day,
When men lived in a grander way,
With ampler hospitality."

In 1795 our inns were kept on the "American plan," which embodied a fixed price for a day and for each fraction of a day. One dollar a day was then considered a good round price. As a rule the taverns were small; one containing twenty rooms was regarded as a commodious house. The rooms were comfortable and the furniture plain and strong; carpets were rarely found. The meals were served at fixed hours, and at the summons of gong or bell, to which all guests were expected to respond promptly. The cooking was done by the "landlady" and her assistants. The table was abundantly supplied with palatable and substantial dishes, among which meats predominated. Game was comparatively more abundant than now; and as the Western regions, especially, were opened to settlement, some taverns kept their hunters. Vegetables and fruit were plentiful in New York, but in most localities the variety was limited, many coming into use since that date—tomatoes, for example, about 1840, and celery still later. Fresh sea-fish could not be carried far inland without deterioration, and transportation to a distance of the salted sea products was expensive. In the towns ice came into early use,—in wide contrast with the custom in foreign countries,—and ices appeared on the tables in 1793. In some districts it was difficult for a time to get good milk, owing to the repulsive flavor given it by the wild garlic and other grasses. Decanters of liquors were upon many hotel tables, from which the guest could serve himself freely. The favorite wine of the period was Madeira, the others used being mainly port and sherry. There were no bills of fare, the food being placed on the table, and any information desired concerning it being given by some person at hand. In the Southern States the landlord frequently called out the names of the dishes in a loud voice, and each guest—whom the landlord usually knew personally—would then express his wish. In the main these taverns were generously conducted for the "entertainment of man and beast"; and a bar, a ball-room, and a stable were necessary adjuncts. The first Congress met in New York, then the capital of the Republic, in 1789, and the members were mostly accommodated at private boarding-houses, which were relatively more important than now. Talleyrand, as well as other distinguished travelers, made use of these houses. They were located at the Battery, lower Broadway, Cedar Street, and Maiden Lane. Their number increased with the times, and 330 licenses were granted the year of the first Congress. People from other places complained of the high prices of the New York taverns and boarding-houses, as "board of the Congressmen was paid out of the common treasury, to which every citizen of the United States contributed his share." This wail was met by the statement that "board ranges from three to seven dollars a week"; and one of the houses was cited as furnishing "from seven to nine dishes a day, with four sorts of liquor."

In 1795 the taverns of consequence were in New York, Philadelphia, Boston, and Baltimore. Those in New York were Fraunces (first opened in 1762 as the Queen Catherine), which was the largest during the Revolution, containing about thirty rooms; the City Hotel, erected in 1793, on the site of George Burns' Coffee-House (upon which the Boreel Building now stands), where the fashionable City Assembly met, and which was frequented by the so-called "Three Hundred"—not "Four Hundred"—of that day; Bunker's; Washington Tavern; and the Tontine Coffee-House in Wall Street. It was at the last-named house that the historic dinner was given to John Jay, May 30, 1795, in honor of his return from concluding the first commercial treaty between the United States and Great Britain; and here the "Century of Commerce" may almost be said to have been initiated.

In 1809 the two-hundredth anniversary of the discovery of Manhattan Island by Henry Hudson was celebrated at the City Hotel, in a manner which attracted universal attention, there being "a banquet in keeping with the historical spirit of the occasion, all modern delicacies having been rigidly excluded." In December, 1812, at the same hotel, 500 gentlemen attended the banquet in honor of the naval heroes, Hull, Decatur, and Jones. De Witt Clinton presided, with Decatur on his right and Hull on his left. The banquet-hall "had the effect of a great marine palace," and "other surprises of the most novel and stirring character enraptured the assemblage." The following month Decatur's gallant crew were dined at the same place, amid the same decorations. It was here, also, that Lafayette was sumptuously entertained in 1824.

In the first quarter of the present century the leading men of the larger towns seem to have realized that the hotel, as a rule, was the index of the place of its location. A good hotel meant a prosperous town, and a public-spirited town would have a good hotel. When the general government became permanently established at Washington, the regular journeyings to and fro of public officials, members of Congress and their families, and foreign ministers, resulted in the appearance of good hotels for their entertainment in the principal towns and along the various routes of travel. These were graced by the familiar presence of the eminent Northern and Eastern statesmen, from the time of Hancock, Adams, and Otis to that of Webster and others, on the route from Boston; and of Jackson, Clay, Benton, and Cass along the old Government Road over the mountains from the Ohio River. It was at a hotel in St. Louis—the Missouri—that the first governor of the then new State of Missouri was inaugurated in 1821, and that the legislature convened and elected Benton Senator. The increasing desire for more commodious and comfortable hotels—for the pretentious ones were now all called hotels—continued to manifest itself. The National Hotel was opened in Washington in 1827, and at once became, and continued for a whole generation, the home of eminent public men, and is rich in memories of events of vast national interest. The principal taverns in Boston were Doolittle's City Tavern, the Eastern Stage House, and the Lamb Tavern. The Tremont House was opened there in 1829 by Dwight Boyden, and was the grandest hotel in the land. It was even claimed at the time to be the largest and most elegant hotel in the world, and certainly there was nothing equal to it in England.

It was about 1830 that Delmonico introduced in New York the high-class restaurant. Previous to that there had been great monotony in the dishes served at the better restaurants, and the flavoring was limited. Delmonico used new flavors; gave new "fancy" dishes; brought into more general use claret, champagne, and the light wines of Germany and France; and served bread and coffee superior to anything before known in America. In 1833 the United States Hotel, New York,—now standing in Fulton Street,—was opened. In 1834 the Louisville Hotel, and in 1835 the Galt House at Louisville, were opened, and their names are perpetuated in fine houses. In 1835 the United States Hotel was opened in Boston, and has since been greatly enlarged. At about this period the old Washington Hotel, Portland, Me., which opened before 1823, took the name of the United States, and has also been enlarged from time to time. The Rockingham at Portsmouth, N. H., once the palatial home of Governor Langdon, was opened in 1834, and came into high repute. It has recently been rebuilt. Up to 1836 there were few hotels in the world that could accommodate 200 people.

In 1836 New York opened its rival to the Tremont, the Astor House, built, like the former, of massive granite. This became at once the resort of the wealthy and of men in public life. For a time, under Coleman & Stetson, it was the one place in which to meet distinguished people, and it is still prosperous. Barnum's Hotel at Baltimore opened about this date, and eclipsed the hitherto important houses there—the Washington, Eutaw, and the rest; although the United States Hotel still held the patronage and friendship of Webster and others.

The most important hotel event of 1836 was the opening of the St. Charles Hotel, New Orleans, in the center of the "American town," fronting upon three streets, with its stately portico in the style of a Corinthian temple, the vast rotunda surmounted by dome and cupola,—next to the Capitol at Washington the most imposing structure in America,—finely appointed for that day, and accommodating more than 700 persons. Rich planters of vast estates then dominated the South, and with their families and retinues of valets and maids came from their country houses in winter to the Southern cities. New Orleans was the metropolis, and the St. Charles became the most famous hotel in the country—thronged throughout the season by tourists from abroad, Northerners in search of health or a milder clime, and by the intellect, wealth, and beauty of the ancient glory of the Southland. This fine hotel was destroyed by fire in 1851, rebuilt in 1852 with all the former exterior grandeur except the dome, and with more interior splendor, and continued a career of increased popularity and charm until the outbreak of the Civil War. It was again burned in 1894, and a new St. Charles is now about to open. In 1839 the Charleston Hotel was opened at Charleston, and burned on the same day. It was rebuilt and reopened in 1840. It was the frequent resort of Calhoun and his great Southern compeers, and continues to be the leading hotel of the city. In 1841 the Planters' House, St. Louis, was opened, being the "largest hotel west of the mountains," and equal to any east in furnishing and appointments. It had 215 rooms, a classic ball-room, a floor-space "8911 square feet more than the celebrated Tremont House in Boston"; the china and cutlery were made in England, and the name of the house "fired on the china." Dickens stopped there in 1842, and even spoke favorably of it in his "American Notes." A magnificent new Planters' House now occupies the old site. The house was opened by Stickney & Knight, who came from Boston. It is well, perhaps, to say here that New England was the nursery of a very large majority of the prominent hotel men of this country. The Massasoit House, Springfield, Mass., one of the celebrated New England houses, opened in 1843. The name reminds one not only of the Indian chief, but suggests the fact that much might be written of the special dishes of certain hotels, prominent among which would appear the old Massasoit "waffle." The New York Hotel was opened about this period, and soon became, and continued for many years, the favorite summer resort of the people of wealth and distinction from the Southern States. The Delavan House at Albany was opened in 1845.

The year 1847 will ever be remembered in hotel annals as the date of the opening of the Revere House, Boston, by Paran Stevens. It immediately took the first rank and commanded the best patronage of the country. The gathering there at the time of the funeral of President John Quincy Adams in 1848 was the most notable assemblage, up to that date, ever seen in the country outside of Washington. Mr. Stevens here introduced his advanced ideas of a system of management so liberal, so thorough in its details, and so comfortable, pleasing, and even luxurious, that the Revere became the pattern for American hotels; and his subsequent achievements in connection with several of the great hotels of the country, upon the same broad and careful lines, justly caused him to be regarded as the most eminent man of his vocation. The principal hotels in Philadelphia in 1830 and later were the Mansion House, United States, Washington, City, and others. In 1850 the Girard House was opened, and continued to be the principal house for ten years. In the same year was opened the Burnett House at Cincinnati, with its 250 bedrooms, large drawing-rooms, and spacious corridors and public conveniences. The Eagle Hotel, Richmond, of high repute, where Lafayette was entertained in 1824, was burned in 1840, and about 1850 the Exchange and Ballard's were opened. The same year the Clarendon was opened in New York on the European plan, and the Irving House was in successful operation. The first Tremont House, Chicago, soon appeared on the lists, and was for some time the leading hotel there; and at the same time Colonel McMicken, of musical voice, continued to call out his bill of fare in the large dining-room of the Washington Hotel at Vicksburg. In 1852 the Battle House, Mobile, was opened by Messrs. Darling & Chamberlain, Paran Stevens being interested with them. It was here that Mr. Darling successfully introduced for the first time on a large scale in the American hotel the system of serving breakfasts cooked to order. The house was admirable in its management, the social life was akin to that of the St. Charles in its palmy days, and it was here that the gracious courtesy of Madame Le Vert and her fair coterie was exercised. The popular St. Louis Hotel, New Orleans, was then in successful operation, under the genial Colonel Mudge. About that time (1852) the St. Nicholas and the Metropolitan were opened in New York, both very large houses, upon a more expensive scale, in some respects of furniture and decoration, than any that had preceded them, introducing "bridal chambers" and other novelties, and being sought by the best patronage. In 1854 the Brevoort and Everett were opened, on the European plan, and, like the Clarendon, were of a high order; and in 1855 the famous Parker House, also on the European plan, was opened in Boston.

In 1859 the Fifth Avenue Hotel, Madison Square, New York, was opened by Messrs. Stevens, Darling, and Hitchcock (Hitchcock, Darling & Company). The building covers eighteen city lots, and every advanced idea in construction was availed of—heavy subdivision walls of brick every twenty-five feet from foundation to roof, with two inches of cement on every floor, flush from wall to wall, making it practically fire-proof. As to the exterior, an eminent author on architecture, writing of Roman palaces, remarks: "The best type of palatial structure is the Farnese Palace. The edifice is a classic, a standard, the very perfection of house building, and in style it looks familiar to us. It is not unlike the Fifth Avenue Hotel." The same classic spirit pervades the interior of the hotel in its architecture, decoration, and furnishing. Among things deserving special mention, it was here that the first passenger-elevator in the world was erected ("Tuft's vertical railway"), and shortly succeeded in the same place by a later one by the same inventor. A noted writer says of the Fifth Avenue: "It is unequaled in the number and spaciousness of its corridors, halls, and public rooms, and the commodious character of its guest-rooms. Beginning with the Prince of Wales in 1860, a never-ending procession of the great men of this and other countries has marched through its corridors. No other single hotel in the world has ever entertained so many distinguished people as have been received at the Fifth Avenue—Presidents of the United States, United States Senators, Congressmen, governors, judges, generals, admirals, emperors, princes, foreign ambassadors, untitled men and women of renown; the list would fill a volume. The London 'Times,' in speaking of the gathering at Grant's funeral in 1885, said that it was the most noted assembly of distinguished Americans ever brought together; and the same description would apply to many another occasion there. Throughout its entire career it has been identified with the most notable and brilliant local and national events of the generation." In 1860 the Continental Hotel, Philadelphia, similar in many respects to the Fifth Avenue, was opened under the auspices of Mr. Stevens, and has had an eminent career. The outbreak of the Civil War (1861) found Willard's Hotel, Washington, the very focus of thrilling scenes and events that in intensity have had scarcely a parallel

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in American annals. The Lindell Hotel, St. Louis, was opened in 1863, and the Southern Hotel in the same city in 1865. They have since been destroyed by fire, and rebuilt and reopened on a larger scale than before. The opening of the Albemarle, Hoffman, St. James, and Grand, all in New York, came within this half-decade. The Arlington, Washington, was opened in 1869, has been recently greatly enlarged, and is the present hotel center of the national capital. The Gilsey House, New York, was opened in 1871, and at once took the first rank among houses on the European plan. In 1873 the Windsor Hotel, New York, commenced its successful business career, and at about that date the Buckingham also opened. In 1874 the Brunswick was opened in Boston. At this time the large and attractive hotels of Chicago, the Palmer House and the Grand Pacific, were deserving their enormous patronage.

The year 1875 is noted for the opening of the "largest and most magnificent structure ever dedicated to the needs of the traveling public," the Palace Hotel, San Francisco. The immensity of the building as a whole; the grand court, a vast amphitheater as it were, occupying 12,000 square feet of surface, with its charming accessories, sheltered by a roof of nearly 150 feet elevation; the immense palatial apartments for various functions, in such admirable arrangement and effect; and the roominess, comfort, and convenience of the private apartments, all conspire to make this hotel justly preëminent.

In the last two decades of the century there has been an uprising, as it were,—those that lacked the earth seeking the sky,—of splendid hotels, as well as an enlarging and beautifying of those already built, all over the land—from the Vendôme and Young's at Boston; the Narragansett at Providence; the Grand Union, Park Avenue, and Murray Hill at New York; the Lafayette and Stratford at Philadelphia; the Rennert at Baltimore; the De Soto at Savannah; the Kimball at Atlanta; the Iroquois at Buffalo; the Hollenden at Cleveland; the Grand at Cincinnati; the Cadillac and Russell at Detroit; those almost without number, including the grand Auditorium, at Chicago; the Plankinton at Milwaukee; the Ryan at St. Paul; the West at Minneapolis; the Coates House at Kansas City; across the plains to the Brown Palace Hotel at Denver; "over the range" to the great houses of the Pacific; away north to the Portland at Portland, Ore., with its accommodations for a thousand guests; and beyond to the Tacoma at Tacoma, Wash. In this brief article outlining the growth of the hotel business it is impossible to name all of the houses worthy of mention. It should be remembered that there are less pretentious houses that are special types of excellence, each in its way, in nearly all the large cities; for example, the Sinclair, Continental, and Ashland in New York. There are large houses poorly managed; and also small houses scattered throughout the country whose names are synonymous with real comfort. Within the last few years the Plaza, Imperial, Savoy, Holland, Waldorf, Netherland, and Majestic, all splendid hotels, have opened in succession in New York. The Waldorf, when its proposed extension is completed, will outrank all in size, if not in magnificence. Of these last creations an enthusiastic writer says: "Tessellated pavements, marble columns, groined, fluted, and quartered ceilings, veneerings of precious stones, statuary and paintings, Pompeian conceits in color and subject, tapestries superb enough for an Oriental queen, and a glitter of gold and silver and crystal, are all baptized in a flood of delicate colors, as a thousand jets of flame glow softly through colored glass, and flash their splendors through overhanging pendants and candelabra." As we are closing this paper the Jefferson at Richmond, considered by those who have seen it to be the loveliest of all, is opening its ample portals to "fair Virginia" and the world.

The watering-place hotels are a very distinctive, important, attractive, and rapidly increasing part of the business, and are of grades to suit all tastes and purses. In 1795 there were ordinary country taverns at Saratoga, Ballston, and at some of the Virginia springs. The first tavern at the White Mountains was built by Crawford in 1803, and "sheltered the scattering tourists." The Catskill Mountain House was built in 1822. At that date there was no tavern at Sharon, and only very primitive ones at Niagara and Rockaway; but by 1840 these were improved and houses were opened at Trenton Falls and the Delaware Water Gap. Twenty years later (1860) there were large hotels at Newport, Nahant, the White Mountains, Saratoga, Lake George, Niagara, Cape May, Old Point Comfort, and at the Virginia springs; but it was not yet customary for great numbers of our active population to "go away" in summer for relaxation, nor to indulge the taste for natural scenery. Long Island was almost a *terra incognita*, the beauties of the Adirondacks were undiscovered, the coast of Maine unexplored, and the Rocky Mountains seemed an eternal barrier between the Atlantic and the Pacific. But now in summer, with conditions of greater wealth and leisure, the whole world appears to be traveling. Great hotels stand out as sentinels at the Isles of Shoals and Block Island; and others have arisen as by magic—from the great houses on the northeastern coast, and on Long Island, where scores of thousands go daily, and along the Jersey shore, where their number is legion, away down to the Princess Anne at Virginia Beach. At Jekyll Island the scene is renewed, culminating in Florida in that remarkably beautiful example of Spanish architecture, the Ponce de Leon, in the Royal Ponciana, and in the grand Tampa Bay. So numerous and resplendent are our seaside resorts that yachtsmen cruising along our eastern shores in summer are ever in view of the sheen of their hundred lights. But even these palaces are excelled on the Pacific by the perfection and liberality of the appointments of the Del Monte at Monterey, "in the center of a beautiful garden—the finest, the most gorgeous, the richest, the most varied in all the world;" and by the splendid Hotel del Coronado at Coronado Beach, covering nearly eight acres. In the interior of the country, at the springs,—Poland, Saratoga, Sharon, Richfield, all through Virginia, Waukesha, and Hot Springs, Ark.,—there are vast establishments which are thronged in the "season" with health and pleasure seekers. The many inland lakes and the rivers are bordered with summer hotels, of which the Champlain is most "beautiful for situation." Sunny skies are at Lakewood, and over Aiken and the Bon Air in the midland South; and the White Mountains, the Adirondacks, the Catskills, the unique resorts of the Shawangunk range, the great Appalachian chain away down into North Carolina, are alive with hotels that illumine the night with lights that cluster into beacon-fires. In the Rocky Mountains—the great continental range, so vast in its scenes of grandeur, of beauty, and of charm—there is many a fine house at spring and on mountain-side.

In many parts of the country, when railroads were first built, and long afterward, the hotels at the stations, in their imitation of city houses, were vastly inferior to the old taverns along the public highways. In later years some of the great railway lines across the sparsely settled continent have rendered the traveling public a real service in opening and managing hotels of merit. In some marked instances houses of great magnitude and cost have been erected far in advance of population, to aid in the opening of vast tracts of land and the building up of railway systems.

Much might be said, did space permit, of historic rooms in American hotels: the colonial dining-room of Governor Langdon at the Rockingham; "P" at the St. Charles; Daniel Webster's room at the Astor; the famous "D. R." at the Fifth Avenue, and others of similar interest. One could dwell with interest, also, upon long terms of management, like that of the Cataract at Niagara, which has been in the same family for three generations, and Downer's Tavern in Vermont, which he has kept for fifty-three years.

The American plan—a fixed price per day, including room, meals, and service—generally prevails at the watering-places, and to a considerable extent in the cities and towns; but the European plan, which is of comparatively recent introduction,—a special price for each room and for each item on the bill of fare and for service,—has come to be very largely patronized in the cities. In some instances both plans are combined. The practice of tipping has greatly increased with the introduction of the European plan, and also liveries and coats of arms have in some cases been introduced. There are hotels for all conditions and nationalities of men, and at all prices, from that of a plain room off from the great thoroughfares, and of meals where they serve "ten thousand a day at an average of thirty cents" (in the manner of Pattinson and Sweeny in 1832), up to princely apartments where every dish means dollars and every tap of the bell a *pour-boire*. The different departments of trade and commerce and their representative commercial travelers are catered to, as well as tourists and men in public life, as are also the various clubs and associations of gentlemen and of ladies. The charges of the best hotels now are about twice those of the corresponding class in 1850. It may be said in passing that the modern apartment-house or flat has lessened somewhat the need for private houses, but has not met the requirements of a "travelers' home." In the general prosperity, as large fortunes have been created and the number of persons of wealth and leisure has multiplied and travel extended, the requirements and wishes of many patrons of hotels have increased in a most marked degree; and at times nothing seems too lavish, sumptuous, and palatial for the novelty of the hour. Yet the great majority of patrons seek those "home comforts" which gratify refined taste and leave no tinge of care.

During the century great changes and improvements have been made in hotel construction, appointments, and management. We now have running water with set basins, water-closets and baths with exposed plumbing, open grates and steam-heat, improved ventilation, more numerous stairways, fire-escapes, fire-proofing, elevators for passengers and baggage, electric bells, and telephones; and the laundry and other machinery which was the wonder of the Astor in 1836 was primitive compared with that of to-day. There are now single hotel structures that are valued at three or four million dollars and rented for one fifth of a million. The complete furnishing represents an outlay of several hundred thousand dollars, in which variation in style, reproduction of old patterns, special designs in china, glass, etc., carpets and hangings, pictures, bric-à-brac and gilding, with elaborate fixtures and decorations, all conspire to rival a palace in a golden age. The industrial arts and appliances have fairly reveled in hotels; utensils and machinery have multiplied; oil and candles have been succeeded by gas, and that by electric light, with (in some cases) its special plant; water is sometimes distilled on the premises, and the ice-machine is at times the companion of the many wonderful preservative and economical results of cold storage. Among the now necessary conveniences and adjuncts are reading, writing, and music rooms, coat, package, baggage, and boot rooms, barber-shop, billiard-room, church directories, railway and steamship announcements, telegraph, telephone, and various ticket offices, book and news stands, stenography and type-writing, and carriage and messenger service.

The general purveying for a great hotel is most varied and important. For the table alone the markets of the entire world contribute their many and choicest foods, nectars, and spices, which are placed in stores representing scores of thousands of dollars in value. The cuisine, of infinite variety, has perhaps attained the highest possibility in gastronomic art; and the almost hourly service, at times enlivened by music, approaches perfection. The fastidious guest, with ever-developing tastes, requires all that the world can provide, and the most constant and immediate attention. The host, in turn, by his alluring and tempting novelties, creates a demand for newer luxuries; and daily a feast is spread of viands so delectable that a Lucullus might envy.

The hotel business has grown to enormous proportions, its growth stimulated recently by millionaires of other occupations who have erected palatial houses regardless of cost. It is impossible to give correct statistics and financial results, and any attempt to do so would be unwise and misleading. Under favorable conditions houses prosper; but at present, in most of the large cities, the supply of first-class houses exceeds the demand.

There is no business more complex and exacting in details, or that requires greater ability in management. The proprietor has "all sorts and conditions of men" to deal with; he must know human nature in its varied phases; and he must solve race and class problems with delicate tact. He must have a fair knowledge and conception of trade, and of everything that meets and supplements the wants and desires of mankind. In all this he is a helpful factor in the commerce and industries of the world. He is aided in caring for hundreds of guests by the several important heads of departments, from the clerk who receives the guest, through all the intricate working of the establishment, to the head porter who gives the final sign of departure; and by (in some cases) several hundred servants, including skilled artisans engaged in manufacture and repair. Too much can never be said of the aid, influence, and encouragement of woman, from time immemorial, in bringing to pass splendid successes; and there are rare intances in the hotel business of her sole management, such as furnished by Mrs. Alvord's most excellent houses in Colorado. The local and State hotel associations (originating in New York) and the Hotel Men's Mutual Benefit Association are of great advantage to the business in many ways; the newspapers and magazines published in the interest of hotels are able and influential; and the publications entitled "Hotel Red Book" and "Where to Stop" are of much value. On the other hand, the business is greatly hampered by legal restraints, is subject to the whims of legislation, and is a sufferer from pilfering thieves.

The life of the host is one of constant watchfulness. His responsibilities for and in behalf of his guests are as continuous for the full twenty-four hours of each and every day as the swinging of his ever-open doors. He is responsible always for the safety, oftentimes for the respectability and conduct, and constantly for the comfort of his household. To his guest he has the opportunity of being a friend and a guide. He makes him feel "at home," is his banker, tells him of the shops, galleries, churches, libraries, places of interest and amusement, and informs him of forthcoming events and routes of travel. He is ever ready in felicitation and always at hand in the hour of trial. He calls in the counsel, goes on the bond, witnesses the will, summons the physician and the clergyman, and aids in the last sad rites. It is not strange, therefore, that the realized hope of Archbishop Leighton was that he might die at an inn.

The taverns of 1795 were the "fountains of news." The hotels of to-day are closely related to the public welfare; statesmen and men of affairs meet in them to consider the public weal and formulate policies of state; and in the hour of national peril or elation it is to the center of public sentiment, the hotel, that the citizen goes for the latest information and the truest measure of the public mind. And in the presence of great events the host is a not unimportant factor, and with the historian of old he can say, "All of which I saw, and a part of which I was."

In the future it is hoped that proprietor and guest will take serious counsel together, and that faulty and mixed architecture and florid and meaningless decoration and furnishing may be avoided, and correct taste and practical methods followed. Health and cleanliness are of the first consideration. A hotel should occupy ample space and not be uncomfortable in elevation. The plumbing, ventilation, and sanitary arrangements should be perfect. A hotel contains a large and daily changing population from all places under the sun, and as far as possible all wall-stuffs and hangings, those pestilential resorts of disease-germs, should be avoided. *Safety*, *respectability*, and *comfort* are the three hotel graces; all else, in comparison, is "sounding brass and a tinkling cymbal." In this spirit the host will stand at the gateway of commerce and welcome all her votaries on their journey.

"The world 's an inn, and death the journey's end."
DRYDEN.

Hiram Hitchcock

CHAPTER XXIV

AMERICAN THEATERS

IN order to convey to the reader a fair understanding of the progress of the American theater 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 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 March 5, 1750, to July 8, 1751. The first play was "Richard III.," in which Kean played *Richard.* So far as is known, the company appeared in fifteen plays and nine 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 theater in Goodman's Fields where Garrick made his début, but of a theater 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 theater 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 the 5th of 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," November 9, 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 September 17, 1753, until March 18, 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 rôles 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 twenty-four performances and one night for the benefit of the poor. The season began April 15, 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's company who had previously appeared in the New York and Philadelphia theaters. He had already become a full-fledged tragedian, although he was only in his twentieth 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 granddaughter 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 theater for a full half-century—1759–1809. After his arrival in New York, Douglass had much difficulty in obtaining permission to open the theater that he had built on what was called Cruger's Wharf, and it was not until December 28, 1758, that he began his season with the tragedy of "Jane Shore." The season was a very brief one, closing February 7, 1759.

During the following spring and summer Mr. Douglass built a theater at Vernon and Smith streets, in Philadelphia, which he opened June 25, 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 theater was so great in the province that an act prohibiting plays was passed by the Assembly to go into effect January 1, 1760. After Philadelphia was closed against him, Mr. Douglass went to Annapolis, where he played an engagement extending from March 3 to May 12, 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 theater in New York, in what was then Chapel (now Beekman) Street, where he gave performances from November 19, 1761, to April 26, 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 did not venture upon the continent again until 1766, when he built the Southwark Theater 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 theater 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 April 24, 1767. This was the first tragedy written and played in America. The season lasted from November 21, 1766, to July 6, 1767, and was followed by a supplementary season of two months, September 24 to November 23, 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 theater in John Street, New York, which was the second of the permanent theaters in the colonies, the Southwark being the first. The first season at the John Street house lasted from December 7, 1767, to July 2, 1768. The company alternated between these two theaters down to the time of the Revolution; but Mr. Douglass found the patronage of the two cities inadequate as early as 1770–71. 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 theater at Annapolis, where the company played an engagement in the autumn of 1771. In 1773 Douglass also built a theater 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 December 22, 1773, to May 19, 1774. It was the manager's intention to reopen the New York theater 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 Theater 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 1766–69 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 1765–66, and Mr. Godwin, who was with the American Company at the Southwark in Philadelphia in 1766–67. 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's company. These cover forty 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 theater, 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 theater was opened January 15, 1782, and continued open without important interruptions until the 9th of July—forty-two nights. In all nineteen plays and fourteen farces were produced, and the total receipts for the season were £2841 17*s.* 5*d.*, an average of £69 5*s.* 10*d.* 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 theater extended from September 13, 1782, to February 7, 1783; but the house was closed from October 18 to November 15, 1782, when the company was at Annapolis. The receipts for ten nights at Baltimore were £896 6*s.* 7*d.*, an average of £89 12*s.* 6*d.*; and for seven nights at Annapolis, £688 2*s.* 7*d.*, an average of £98 6*s.* 1*d.* 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, February 7, 1783, he assumed the reins, keeping the theater open from February 11th to June 9th. From Baltimore Ryan carried his company to New York and opened the theater in John Street, June 19th, keeping it open until August 16, 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 players gave a performance for Mrs. Ryan's benefit. In the winter Ryan again opened the Baltimore theater, the season extending from December 7, 1783, to February 14, 1784.

The only noteworthy event of this season was the first production of the "School for Scandal" in America, February 3, 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 theaters 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 Theater August 24, 1785. None of his players had ever appeared under Douglass's 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 theater 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 Theater 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 Theater reopened under their management, November 21, 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 theater 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 theater 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 April 18, 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 theaters, 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, September 26, 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 Theater 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 Theater, September 7, 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 Theater, 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 Theater in Philadelphia, afterward known as the Chestnut Street Theater. The house was modeled after the theater at Bath, and was completed early in 1793; but owing to the yellow-fever epidemic it

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was not opened by the company of players engaged by Wignell until February 17, 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 Theater, who had become the wife of Robert Merry, the Della Cruscan poet; Thomas Althorpe Cooper, then a young man of twenty, but destined to be the manager of the New York theater 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 theater. 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 theater by Wignell's company a new theater in Boston, scarcely inferior to the Philadelphia house, was opened by an English company engaged and brought over by Charles Powell. This theater 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 theater 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 theater, known as the Haymarket, had been built through the exertions of Charles Powell, and opened by him for the first time December 26, 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, February 20, 1797; and "West Point Preserved," the first of the André pieces, by William Brown, on the 17th of April following. Dunlap's "André" was not produced in New York until March 30, 1798.

This epoch, 1792–98, 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 theater. 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 theater in Charleston, conducted by Mr. Jones, who had been previously at the Boston Theater. His principal actress was Mrs. Whitlock, who had just retired from the Philadelphia company. A Frenchman, Mr. Sollee, succeeded to the management of this theater, and organized a company in Boston to play in Charleston for the season of 1795–96. 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 theaters within five years—the Chestnut Street in Philadelphia, the Park in New York, and the Boston Theater 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 theater, and Dunlap, who had undertaken the sole management of the New York theater 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 Theater 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 theater 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 Theater 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 Theater 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 Theater 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 Theater; 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 theaters 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 theaters 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 Theater; 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 rôles 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 theaters for the next half-century, may be said to date from his appearance here in 1810–11.

Simultaneously with Cooke's performances in the theaters of Philadelphia, New York, and Boston were the star engagements of our own "young Roscius"—John Howard Payne. Cooke played three engagements in Philadelphia—in all thirty-nine nights. His highest receipts for any one night were $1475, 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 fullness 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 theaters 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 theaters 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 theaters of importance in Philadelphia during the same period were the Walnut Street and the Arch Street theaters, the former erected for a circus in 1808 and fitted up for theatrical uses in 1820, and the latter built in 1826. The theaters built in Boston in these fifty years were the Tremont, the American Amphitheater,—afterward the Warren and National,—Kimball's Museum, the Eagle, and the Howard Athenæum. Baltimore had nothing better than the old Holliday Street Theater during this epoch, and Washington was without a place of amusement worthy of the drama until 1835. The theater builder of the period in the South and Southwest was James H. Caldwell. He built the American Theater in New Orleans in 1823, and afterward erected the Camp Street and Charles Street theaters. Mr. Caldwell also built theaters in Cincinnati, St. Louis, Natchez, Huntsville, Nashville, and Petersburg. Another manager, John S. Potter, was concerned in building as many, or more, theaters in the South and Southwest; but, after all, the theatrical activity of a century resulted in an approximate number of theaters in actual use at its close not exceeding fifty.

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 fourteen weeks in New York with a loss of $2350; but, on the other hand, Caldwell, in 1818, cleared $10,000 in four months at Petersburg, Va. The receipts of the Park Theater, New York, for the season of 1832–33 reached nearly $150,000, Fanny Kemble and her father drawing $56,000 for sixty nights, an average of $933 per night. In 1833–34, when the receipts at the Park fell to $135,000 for the season, the Kembles averaged $732 per night; but in 1834–35, 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 theaters outbidding one another for the best stars. This was especially true of the managers of the three rival theaters in Philadelphia, who for nearly twenty 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 $6436. 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 $1000 for ten nights. This system finally culminated about 1846, when nearly all the theaters in the country were ruined. But it was divided patronage as well as the excessive percentages of the stars that made the theaters 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 theater 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 theaters 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 the writer of this article 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 theaters for a while employed stock companies, but mainly for the purpose of supporting traveling stars. This lasted until after the close of the war between the States, when the impetus given to business enterprises of all kinds was felt in renewed theatrical activity not only in the cities, but over all 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 theaters, was the consequence of this theatrical revival. Nearly every inland town and city from Maine to California built a theater, with the expectation that traveling companies would occupy it at intervals. The demand thus created could be supplied only by the combinations.

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 theater, have raised its financial standing to a point which, during the first century of its existence, seemed beyond its reach. The theater 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 theater 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 centers. 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 theaters 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 theater.

A remarkable aspect of the American theater, 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, still reaps the harvest of his well-earned popularity, and should he retire now he would realize in his fortune of $1,000,000 that the public he has served so long and so well is, to say the least of it, not ungrateful; while Lotta Crabtree, Fanny Davenport, Maggie Mitchell, Francis Wilson, and many others of diverse gifts are in the list of fortune's favorites. Among foreign actors, William C. Macready owed to America the realization of his dream of retirement from a profession he affected to loathe; Sara Bernhardt acquired here a fortune which enabled her to defy the authority of the house of Molière and to establish a theater of her own in beautiful Paris; Tomasso 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 theater 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 4500, and now probably exceeds 7000. 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 12,000; including stage hands and all the persons who derive their support from the theater, the number may be roughly estimated at 50,000. 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 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 400 regularly organized theatrical companies on tour through the United States during the season, and the number of theaters of all kinds is not fewer than 4000. The cities of New York and Brooklyn have at the present moment first-class theaters in greater number than either Paris or London.

The improvement which has taken place in the construction of theaters in America within the past twenty years is worthy of especial notice. The tragic disaster in Brooklyn on the night of December 5, 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 theaters 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 theaters in the world. Even the older theaters, 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 theaters than in any city in the world; while for beauty and convenience combined with safety it is impossible to find elsewhere such theaters as the Garden, Abbey's, the Empire, the American, and the Metropolitan Opera-House. As the older houses pass away they must be replaced by absolutely fire-proof structures if replaced at all, and before the end of the next two decades it is almost certain that there will not be a building devoted to amusement in the Greater New York which will not be a model of safety, convenience, and comfort.

Perhaps the most marked change that has taken place in the American theater during the century, however, is in the character and number of its patrons. Attendance upon the theater was looked upon even fifty 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, theaters 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 theaters 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 theater is no longer successfully derided. In 1878 there was established in the city of New York a theater the avowed purpose of which was to produce plays of a moral tendency, and to which religious persons might go. This effort succeeded. The theater was thronged for several years by a new class of theater 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 theater was this effort, so honorably put forth and so brilliantly carried out by the gentlemen who established the Madison Square Theater. 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 theater; 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.

A. M. Palmer

CHAPTER XXV

AMERICAN NEWSPAPERS

NEVER in the history of the world has there been a time when ideas were so necessary for progress and success as now. Right here I want to record the fact that the first journalist in America had an idea two hundred and five years ago which would be a very popular feature for any newspaper to-day. On the 25th of September, 1690, in Boston, he issued the first number of "Publick Occurrences, both Foreign and Domestick." In his salutatory he stated that there were many false rumors constantly circulated in the town of Boston which did a great deal of harm. He asked his readers to send him the names of people who started these stories, and he would print the list in his next and succeeding issues. Briefly, he proposed to publish regularly a list of the liars of the town. That is an idea which I think would certainly sell well to-day; but alas! the authorities of that day had no sooner read this announcement than they promptly suppressed his newspaper. The name of that original journalist was Richard Pierce. I now cheerfully embalm him in this history. I really believe that if he were now alive, in his prime, in any leading city, his contemporaries would find him an exceedingly lively and original journalist.

The first regular American newspaper was also born in Boston, the Boston "News-Letter," which was started by James Campbell, the postmaster, in 1704, eighty-two years after the first newspaper appeared in London. The first French journal was earlier than the first newspaper in England by seventeen years. Germany preceded all other countries, having made several ephemeral attempts at journalism in the last years of the sixteenth century.

Here are what I regard as the stages of American journalism, and its principal distinction at each stage:

1. A mere abstract of European newspapers.

2. Employed by the agitators of the Revolution for printing appeals to the people.

3. The puppet of the politicians in the first years of fierce party conflict under our new government, and usually edited by imported adventurers who had worn out their welcome everywhere else in the world; often men of flashing wit, but never men of sober purpose.

4. The vehicle of an editor's oracular and often eccentric opinions on politics. The press was now emancipated from the control of politicians; it was free, courageous, and influential, but was narrow in its field, and intolerant. It was not yet a newspaper, and it still excluded from its interest and support seven tenths of the people, including all the women and young people. To them the newspaper of 1815–35 was as forbidding as any political tract is to-day to women and children.

5. At last the News paper! It gives the news for the first time; it has vindicated and illustrated its name; it is more educational than ever, though less dogmatic; it is freer than ever, because it has become too vast a concern to be the mere instrument of any single personality or any single clique, however powerful; it has become a property instead of a plaything; it is devoted to the public interest and is more clearly the representative of the public, because it is too great to live on the favor of a few, as it once did; it is more independent and fairer in politics, because to attain the first rank it must have the respect of people of all parties. No mere organ of any party is a leader among the newspapers of any city to-day. The press is more scrupulous and conservative in all respects than ever before, because an immense capital is always at stake. It is more influential than ever, not only because it is more widely read and more varied in its interests, but also because its opinions carry the weight of business sagacity and success, as well as intellectual acumen.

Until the time of the Revolution the newspapers of the country were very small affairs. After we became an independent nation the politicians and political parties did much to develop the press on the lines I have indicated; but the News paper came with the advent of the New York "Sun" and "Herald," in the early thirties. Still the great development of the century has been since the early years of our Civil War. Since then the progress in journalism has kept pace with the marvelous advance which has been shown in other lines of life. Indeed, since that time journalism itself has come to be regarded as a profession, and is properly considered by many as the "first" rather than the "fourth estate."

Let us consider cold but interesting statistics. Perhaps the average reader can get a good idea of the progress of one hundred years by a statement of the increase in the number of newspapers during that period, and the volume of the business which is annually transacted. There was no census of newspapers in the earlier years of our government. Thomas says that in 1800 there were at least 150 publications, and in 1810 the number had increased to 360, more than 20 being dailies. The dailies of that time (1810) were, in New York, the "Gazette," "Evening Post," "American Citizen," "Public Advertiser," "Columbian," "Mercantile Advertiser"; in Pennsylvania, the "Daily Advertiser," "True American," "Gazette of the United States," Philadelphia "Gazette," "Aurora," "Political and Commercial Register," "Freeman's Journal," "Democratic Press," "Evening Star"; in Alexandria, the "Daily Advertiser"; in Baltimore, the "Federal Gazette," "Whig," "Federal Republican," "Evening Post," "American"; in Charleston, the "City Gazette," "Times," "Courier"; in New Orleans, the "Gazette" and the "Courier." There were then no dailies published in Boston, Albany, or Cincinnati, although one had been issued in Boston as early as 1796.

The statistics in 1810 were:

NUMBER OF NEWSPAPERS PUBLISHED IN 1810.

State or Territory.	Total.	Daily.	Semi-Weekly.	Tri-Weekly.	Weekly.
New Hampshire	12	....	......	.....	12
Massachusetts	32	....	9	......	23
Rhode Island	7	....	1	.....	6
Connecticut	12	....	......	......	12
Vermont	15	....	......	......	15
New York	67	6	9	......	52
New Jersey	8	....	......	......	8
Pennsylvania	73	8	3	1	61
Delaware	3	....	......	......	3
Maryland	21	5	1	5	10
District of Columbia	6	1	1	3	1
Virginia	23	...	6	1	16
North Carolina	10	....	......	......	10
South Carolina	10	3	2	......	5
Georgia	13	....	2	1	10
Kentucky	17	....	......	.....	17

NUMBER OF NEWSPAPERS PUBLISHED IN 1810.—*Continued.*

State or Territory.	Total.	Daily.	Semi-Weekly.	Tri-Weekly.	Weekly.
Tennessee	6	...	......	......	6
Ohio	14	..	......	......	14
Michigan Territory	1	....	......	......	1
Indiana Territory	1	....	......	......	1
Mississippi	4	....	......	......	4
Territory of Orleans	10	2	2	4	2
Territory of Louisiana	1	.. .	......	.....	1
Totals	366	25	36	15	290

The American "Newspaper Directory" for 1895 gives this table, showing the number and frequency of issue of newspapers and periodicals published in the United States:

NUMBER OF NEWSPAPERS PUBLISHED IN 1895.

State or Territory.	Daily.	Weekly.	Monthly.	Qu'terly.	Total.
Alabama	21	153	16	......	200
Alaska	....	3	1	......	4
Arizona	10	33	....	......	43
Arkansas	20	223	18	1	266
California	97	447	78	......	640
Colorado	35	209	25	1	276
Connecticut	43	113	44	6	213
Delaware	5	26	5	......	37
District of Columbia	5	36	19	4	67
Florida	15	114	12	......	146
Georgia	26	237	42	1	311
Idaho	3	50	1	......	57
Illinois	141	1,060	241	20	1,532
Indian Territory	2	35	1	......	39
Indiana	120	564	80	1	791
Iowa	68	810	65	5	979
Kansas	38	595	59	3	707
Kentucky	28	220	28	1	296
Louisiana	17	141	10	.....	173
Maine	17	108	47	4	184
Maryland	16	145	38	6	210
Massachusetts	79	343	184	24	657
Michigan	60	575	77	1	741
Minnesota	40	439	56	3	554
Mississippi	8	154	9	......	177
Missouri	89	697	119	9	937
Montana	12	71	3	1	91
Nebraska	33	532	34	......	614
Nevada	10	16	......	.....	29
New Hampshire	13	83	14	1	114
New Jersey	49	265	39	1	370
New Mexico	5	41	......	......	52
New York	178	1,127	530	47	1,993
North Carolina	18	156	17	1	200
North Dakota	10	119	7	......	139
Ohio	150	783	136	14	1,146
Oklahoma	12	90	7	......	111
Oregon	17	143	21	1	189
Pennsylvania	197	921	234	14	1,433
Rhode Island	14	39	11	1	70
South Carolina	10	90	6	......	119
South Dakota	19	227	14	......	264
Tennessee	15	213	33	3	275
Texas	56	548	32	1	659
Utah	8	39	7	......	65
Vermont	4	61	13	......	80
Virginia	34	181	44	4	272
Washington	18	181	22	1	225
West Virginia	12	141	12	.....	167
Wisconsin	54	467	37	2	578
Wyoming	5	32	......	.....	38
Total	1,956	14,096	2,548	182	19.530

The total includes 37 tri-weeklies, 301 semi-weeklies, 5 tri-monthlies, 79 bi-weeklies, 272 semi-monthlies, 5 semi-quarterlies, 49 bi-monthlies, and 182 quarterlies.

From reliable sources the following list of newspapers, which were started prior to or during the year 1800 and which are still in existence, was compiled:

MAINE.

Portland	Advertiser	1785

NEW HAMPSHIRE.

Keene	New Hampshire Sentinel	1799
	Cheshire Republican	1793
Portsmonth	New Hampshire Gazette	1756
	Journal	1793

VERMONT.

Rutland	Herald	1794
Windsor	Vermont Journal	1783

MASSACHUSETTS.

Greenfield	Gazette and Courier	1792
Haverhill	Gazette	1798
Newburyport	Herald (weekly)	1793
Northampton	Hampshire Gazette (weekly)	1786
Pittsfield	Berkshire County Eagle (weekly)	1789
	Sun	1800
Salem	Gazette and Mercury	1768
	Register	1800
Worcester	Spy	1770

RHODE ISLAND.

Newport	Mercury	1758

CONNECTICUT.

Bridgeport	Republican Farmer	1790
Hartford	Courant	1764
New Haven	Connecticut Herald and Journal	1766
Norwalk	Gazette	1800
Norwich	Courier	1796

NEW YORK.

Ballston Spa	Journal	1798
Cambridge	Washington County Post	1798
Catskill	Recorder	1792
Hudson	Gazette	1785
Newburg	Register	1796
Owego	Gazette	1800
Troy	Northern Budget	1797
Utica	Herald and Gazette	1793
New York City	Commercial Advertiser	1797
	Shipping and Commercial List and New York Prices-Current	1795

NEW JERSEY.

Newark	Sentinel of Freedom	1796
New Brunswick	Times	1792
Trenton	State Gazette	1792

PENNSYLVANIA.

Chambersburg	Franklin Repository	1790
Gettysburg	Star and Sentinel	1800
Greensbnrg	Westmoreland Democrat	1798
Lancaster	Intelligencer	1794
Norristown	Herald	1799
Philadelphia	North American	1784
Pittsburg	Commercial Gazette	1786
Reading	Adler (German)	1796
York	Gazette	1796

DELAWARE.

Wilmington	Delaware Gazette and State Journal	1784

MARYLAND.

Annapolis	Maryland Gazette	1745
Baltimore	America	1773

VIRGINIA.

Alexandria	Alexandria Gazette	1784

GEORGIA.

Augusta	Chronicle	1785

OHIO.

Cincinnati	Commercial Gazette	1793

The total number in 1810 was 290; in 1850, 2526; in 1860, 4051; in 1870, 5871; in 1880, 11,314; in 1890, 17,616; and in this year (1895), 19,530. The circulation of any one daily newspaper did not, in either 1795 or 1810, go beyond 900, and that of the ordinary weekly or semi-weekly did not reach more than 600. Supposing that there were 13 dailies in 1795, issuing 310 times a year, 18 semi-weeklies and 7 tri-weeklies, sending out as many copies as a weekly, and 150 weeklies, the circulation for the year would be 9,985,400, and the value of the paper used $62,410. The total number of copies issued of all kinds of newspapers in 1880 was 2,067,848,209, which might perhaps have been worth, as white paper, $12,500,000. North states it at $15,131,603.84. The amount received for these papers was probably not less than $50,000,000. While the census attempts to make some estimates, it rarely does so with entire accuracy. The total receipts in 1880 were stated at $39,136,306 for advertising and $49,872,768 for subscriptions, making a grand total of $89,009,074. Thus it will be seen that the advertising brought in 44 per cent. and the subscriptions 56 per cent. of the total receipts.

The amount received from advertising in 1890 was $71,243,361, and from subscriptions and sales $72,342,087, making a total of $143,585,448. The advertising forms 49.62 per cent. and the subscriptions and sales 50.38 per cent. of this amount. The gain in advertising between 1880 and 1890 was about 82 per cent., and if, in the five years since then, the ratio has been maintained, which I see no reason to doubt, the advertising for this year will amount to $100,000,000. The increase in the sales and subscriptions was about 43 per cent. in ten years, and if the same ratio has been maintained during the last five, the receipts this year from that source will be about $90,000,000. The steady gain of the advertising is noteworthy, as the per cent. this year is likely to be 52.63, and 47.37 from circulation.

Of the total quantity of paper consumed in printing newspapers and periodicals, according to the census of 1890, 59.08 per cent. was used on the

Charles H. Taylor.

dailies; 30.79 per cent. on the weeklies, semi-weeklies, and tri-weeklies; and 10.13 per cent. on the monthlies, quarterlies, and all others. The aggregate number of copies of papers printed during the census year of 1890 for all classes of newspapers and periodicals was 4,681,113,530, distributed as follows: dailies, 2,782,282,406, or 59.44 per cent.; weeklies, 1,492,460,587, or 31.88 per cent.; semi-weeklies, 57,637,353, or 1.23 per cent.; tri-weeklies, 7,634,350, or 0.16 per cent.; monthlies, 232,617,-133, or 4.97 per cent.; quarterlies, 32,479,100, or 0.70 per cent.; all others, 76,002,601, or 1.62 per cent. of the aggregate.

The patent insides, or papers printed partly in some considerable city and partly in the town of publication, played an important part in establishing the country weekly press, which has been the kindergarten of the American newspaper public. Now the stereotype-plate firms, which are making daily newspapers possible in every town of 7000 or 8000 inhabitants, instead of competing with the newspapers of the larger cities, are really helping them, because, while they satisfy the demand for local news, they stimulate a desire for general news, which only the big newspapers can satisfy.

When Max Maretzek was once asked if there was any money in Italian opera, he said he knew there was because he himself had sunk $300,000 in it. Still money is made in opera, as in journalism. Many millions have been made in American newspapers, and many have been sunk. In New York, for instance, in 1840 there were 18 daily newspapers, with an aggregate circulation of 60,000. Since that time 110 have been started. To-day there are 29 or 30 daily papers, each having a circulation fifteen or twenty times greater than was enjoyed in 1840. The late Erastus Brooks once told my friend, William B. Somerville, of the Western Union Telegraph Company, that during his lifetime he had seen 67 daily newspapers born and die in the city of New York alone.

In Boston in 1846 there were 14 daily newspapers. Now there are 10, and yet the average circulation of the latter must be fifteen or twenty times greater than that of their predecessors of 1846. During the last twenty years I have seen more than $2,000,000 sunk in old and new daily papers in Boston.

Perhaps I may here properly consider the value of a newspaper property. We do not seem to have any fixed standard in this country. In England a newspaper property is supposed to be worth the aggregate of its net income for five years. So much depends upon the personality and ability of the head of a newspaper that this is considered a fair valuation. In this country very poor properties have brought very high prices, and very good properties have frequently sold for low ones. The New York "Sun" was sold as early as 1849 for $250,000. During the management of Mr. Charles A. Dana ten times that sum has been refused for it. At both periods there were profits to warrant a good price. Mr. Joseph Pulitzer, on the contrary, in 1883 paid $350,000 for an "opportunity" when he bought the New York "World." The paper had lost from $50,000 to $100,000 a year for a great many years before he bought it. The price paid at the time was ridiculously high, as by the sale Jay Gould simply unloaded a liability. But it was the merest trifle when one considers the possibilities which Mr. Joseph Pulitzer has developed in this paper, and the fact that he has made it one of the greatest and most profitable newspaper properties in the world.

The improvement in the methods for the quick transmission of news has, of course, been one of the most important factors in the progress of journalism, and the great growth here has been since our Civil War. Before the days of the telegraph there were three quick methods:

1. Pony expresses, with frequent relays of fast horses.

2. Carrier-pigeons were used almost exclusively in getting European news to Boston and New York from the steamship at Halifax, after the Cunard Line began its trips, that being the nearest port to Europe.

3. Special engines were often employed in the early days of railroading.

In addition to these, steamboats were used, particularly between New England ports and New York, and Albany and New York.

Henry J. Raymond, when a reporter for the "Tribune," brought printers and type-cases with him when coming to Boston to report a notable speech by Webster, and returned by boat. In a vacant room frames were set up, the cases upon them, and then as fast as he could write a sheet it would be put in type; thus it was ready for instant publication on arrival in New York. The New York "Journal of Commerce" and the "Herald" introduced the scheme of owning a swift-sailing yacht with which to meet European vessels and get news of the Old World.

One of the conspicuous enterprises of the century was the overland express from New Orleans to Baltimore which was established by Mr. A. S. Abell, of the Baltimore "Sun." It comprised sixty blooded horses. During the Mexican War he not only led all other newspapers, but beat the government mails by thirty hours. The government received its war news from the "Sun" many hours ahead of its own despatches.

In 1846, when the country was in a great war excitement over the question of the Oregon boundary line between Great Britain and the United States, and the cry was "54 40 or fight," there was a combination of newspapers which sent a swift pilot-boat to England. Obtaining its news, then highly important, it hastened back. The cost was great, but not greater than the popular approval won by this early instance of newspaper enterprise. In the decade of the first general extension of the railway and the invention of the telegraph, which was between 1840 and 1850, American newspaper circulation increased more than twofold, New York printing and selling more papers than London. The newspapers were the first to seize upon the telegraph in 1844, 1845, and 1846, and they so crowded one another on the few wires then strung that by 1850 they were forced into press associations. These press associations would gather all the news along the lines of telegraph, some one at the end of the lines reading the newspapers from farther back in the country. From these the important news was clipped and sent with the rest. So it was with the cable, when finally established in the latter sixties. The Boston "News-Letter" in 1719 flattered itself because, whereas general European news had been a year late in its publication here, it had reduced the delay to five months. The Franco-Prussian War in 1870 was lavishly reported by cable by special war correspondents sent from the United States, and was the first important cable news. W. W. Story, of the Chicago "Times," while cable rates were yet high, caused 8000 words of the New Testament, at the time of its revision in England, to be cabled to him; and when the New Version reached New York on the steamer, he had it telegraphed to him in its entirety over twenty-one wires.

The extension of the telegraph lines, the increase in this business, and the lowering of the rates which has taken place within a few years, and the introduction of special wires, have made it possible for newspapers to get an almost unlimited news service. The New York Associated Press was formed in 1849, but it made very little use of the telegraph until 1861, partly because the public had not been accustomed to it, and partly because the rates were so high. Even as late as 1879 the night rate between San Francisco and Boston was ten cents a word, between Chicago and Boston five cents a word, and between Washington and Boston two cents a word. Now the rate between San Francisco and Boston is one and three quarter cents a word, between Chicago and Boston one half a cent a word, and between Washington and Boston one third a cent a word. The rates have actually been reduced sixty-six per cent. The average rate paid by press associations is about fourteen cents for 100 words, regardless of the number of papers to which the matter is delivered.

In 1879 the Western Union Telegraph Company handled 28,000,000 words of specials, at an average rate of one and one half cents a word. Last year the same line handled 212,000,000 words, at an average rate of one half a cent a word. Mr. Somerville estimates that last year between 1,500,000,000 and 1,600,000,000 words were handled over the Western Union lines for the newspapers, and by the leased wires of the press associations. This year it will probably be very much larger. The Postal Telegraph Company handled about 82,250,000 words for the press during the year ending July 31, 1895. This does not include leased wires.

In July, 1866, the cable rates were $100 for twenty words to newspapers and the public. The rate to newspapers now is ten cents a word for day or night service. The New York Associated Press, which was established in 1849,—much of its efficiency being due to Mr. James Gordon Bennett,—was followed by other associations. Various changes have been made from time to time, but the official list now embraces the United Press, the Associated Press, the New England Associated Press, the Maine Associated Press, the New York State Associated Press, the Southern Associated Press, the Trans-Mississippi Associated Press, and the Union Associated Press.

But promptness in gathering news would count for little indeed if not coupled with equal promptness in its distribution. Fortunately the facilities for rapid and wide-spread circulation of newspapers have grown with the growing facilities for getting a paper together. It is hardly more than thirty years ago since the Boston publishers, at least, depended upon boys or at most a wheelbarrow to carry their papers to the railway stations and outlying news-stands. But now a well-equipped and prosperous newspaper must have the use of dozens of delivery wagons. Moreover, where twenty-five years ago there was one train leaving any of our great centers of population, there now are a dozen trains to speed each edition of the newspaper hot from the press to the remotest hamlet of the contributary territory. But even yet there are not trains enough, and the more prosperous newspapers find it necessary to charter specials of their own on Sundays and on days following important elections. One special newspaper train in New England, for example, makes a run of 303 miles every Sunday morning during the summer months.

The improvement in presses has, of course, had much to do with the progress of newspapers. The old idea that any shabby, insignificant, dirty building would do for a newspaper has been exploded, fortunately for the employees and the newspaper makers. A newspaper building should serve two purposes: it should be a credit to the city in which it is located, and it should also be large enough, as a factory, to produce an unlimited number of papers with due regard to the health and comfort of the employees.

See how we have progressed in presses. The old flat press of the colonial period, worked by a screw, could print 50 papers an hour. The compound-lever press came next, with a capacity of 250 an hour. The revolving-cylinder press in 1814 brought the capacity up to 1000 an hour. The London "Times" first achieved this "velocity." But in 1827 the "Times" had a double-cylinder press that printed 2000 an hour. In 1835 all American newspaper presses were worked by hand, and popular papers actually could not meet the daily demand upon them. Hoe's lightning steam-press, patented in 1847, was the first fast press obtained in the United States. It was made at first with four, but finally with six, eight, and even ten cylinders, the capacity of the latter being 30,000 an hour, printed on a single side. In 1865 the Bullock perfecting press was made in Philadelphia. This press made it possible to print a paper from plates, both sides at once, at the rate of from 6000 to 10,000 an hour. In 1871 R. Hoe & Company completed a perfecting press which printed from 10,000 to 12,000 eight-page papers an hour. Then followed the double press, the quadruple press, and now the sextuple, with a working capacity of from 60,000 to 75,000 eight-page papers an hour, and with attachments by which from four to forty-eight pages may be printed. An octuple press is now building. It will have the capacity of eight single presses and will print from four to sixty-four pages. Within a few years color-presses have been made by R. Hoe & Company, and there is also the Scott press for rapid color-work. The Hoe press will print from 16,000 to 20,000 four-page papers an hour, producing several colors at once. In 1861 the New York "Tribune" began stereotyping. Up to that time a paper with a large circulation had to go to press earlier than its lesser rivals, and thus was at a great disadvantage in news.

Type-setting machines have at last come into general use among all the leading papers of the country. On these an expert operator can do the work of at least three men, as compared with hand-work. Some type-setting machines give a new cast of type each day, and all permit a large increase of product at a reduced cost. The machine most in use in the leading daily papers of the country is the Mergenthaler linotype, while the Thorne machine is used among a great many of the smaller newspapers and in book offices.

I have referred to the color-press, for now there are newspaper offices actually equipped for printing every hue of the rainbow. Yet excluding one transient illustrated daily in the late seventies, I am sure it cannot be fifteen years since any newspaper attempted regularly to illustrate its news even in simple black and white. Although the most ancient journals printed what are called "stock cuts" in their advertising columns, the process of cut making was not adapted to the swiftness required by the daily press until a time much more recent than we can realize when we look at the profusely and often admirably illustrated newspapers of to-day. Only twelve or thirteen years ago the woodcut was the only possible illustration, and since two and three days were required to make such a cut, its unavailability for newspaper uses is obvious. But with present methods, still in a comparatively undeveloped state, midnight happenings are often pictured in the regular morning editions of our papers.

No great progress was made in Sunday newspapers until the time of the Civil War. This naturally suggests a brief discussion concerning the size of newspapers. It is the size of the Sunday newspaper that is most extensively criticized, but this criticism is beginning to be applied to the large daily papers as well. The large newspaper is the only bargain of which people complain that they are getting too much for their money. It was only twenty years ago that the then leading Sunday newspaper of Boston increased its size from four to eight pages. On the day following many very intelligent and eminent citizens called at the office to express their indignation, and to insist that the paper was much too large, and, in fact, larger than the people would stand. The criticism has increased steadily with the growth of the papers. In my opinion this is as absurd as it is unjust. Equally idiotic is the carping against what are called the large blanket sheets. People sigh for the small compact newspaper of the olden times. If the publishers should give them a sample of that kind of newspaper for a week there would probably be indignation meetings in every city, and a falling off in circulation which would bankrupt most of the newspapers. The newspaper, and especially the Sunday issue, covers so much ground to-day that people who have not carefully analyzed the situation have no conception whatever of the necessity for the enlargement which is coming year by year with the natural growth of American journalism.

While I was preparing this article the great international yacht-race for the *America's* cup was in progress in New York. Every live newspaper in the country was giving it pages each day, with illustrations. The accounts were so accurate and faithful, and the illustrations so correct, that a person who could not attend the race (and this was only possible for a small fraction of the people) could follow it from day to day as well as an actual spectator of the contest. I had a curiosity to inquire how much space the American press gave to the race in which the yacht *America* first won this cup. The race occurred August 22, 1851. The first news printed in America was in telegrams from Halifax in the issues of September 4th, in the Boston and New York papers, thirteen days after the race. The New York "Sun" had 500 words about the race tacked on the end of three quarters of a column about the markets and the harvests and miscellaneous European news. On September 6th the "Sun" had 500 words copied from the London papers. The "Tribune" of September 4th had a list of the passengers on the steamer which arrived at Halifax, the summaries of the market, labor notes, etc., followed by 250 words about the contest, there being only eight lines devoted to the actual description of the race. On September 15th the "Tribune" gave a column about the race, clipped from the London "Times." On September 6th the New York "Herald" published three quarters of a column from the London "Times." The "Evening Post" of September 4th had 200 words about the race at the end of a European despatch of a column. On September 12th the "Post" gave about 500 words descriptive of the race from its correspondent at Cowes.

In Boston the descriptions were even more meager. On September 4th the "Journal" printed one and one half inches about the race. The "Herald" had half an inch on its second page, without a heading. The "Post" had two and three quarter inches on its second page, among other foreign news, with no mention of the race in the heading. The "Advertiser" had two despatches, one on the first page, at the bottom of the cotton market, half an inch in length, while on its second page it had three inches or more in a general despatch beginning, "The news from Europe is of little importance." The next day, when the English mail had arrived in the office, the "Advertiser" gave two thirds of a column, the "Journal" two inches, and the "Herald" three and one half inches. This gives one a good idea of the small compact paper of the old days, for which some people pretend to sigh. How would it answer to-day?

When Brooks assaulted Sumner, in 1854, I believe the longest despatch in any Boston paper on this startling and historic episode was less than half a column, that being printed at the bottom of the page.

Even as late as 1860, when Lincoln was nominated for the presidency at Chicago, one operator at the Wigwam sent out all the press matter that was offered to him in regard to it. In 1892, at the convention in Chicago which nominated Mr. Cleveland, the Western Union line had 100 operators at the convention hall, and in addition had a pony express to carry matter to the main office. It also sent from Chicago to newspapers throughout the country, during the days just previous to the convention, about 17,000,000 words of press matter. This was in addition to what the press associations sent over numerous leased wires, and the work of the Postal Telegraph Company. Did any one complain that the convention was over-reported? And what would have been done in newspaper offices with small newspapers when a proper share of this avalanche of news was received?

I cite these few examples; I might give hundreds. Do the people who criticize the size of newspapers realize what it means when they are told that the possible few hundred thousand dollars received in 1810 for advertising will amount this year to nearly $100,000,000? Where are you going to put all this advertising in small compact newspapers? If a Sunday newspaper has from eight to twenty pages of advertising to start with, how in the world are you going to have a small compact newspaper? These pages of advertising are fully as interesting to many thousands of readers as the news and miscellaneous columns are. The fact is that the newspapers have simply kept pace with the development of the country. Whatever the critics may think or say, the people have indorsed this form of progress by buying their newspapers in constantly increasing numbers. The events that are covered now are numberless. I have not the room to enumerate them. Furthermore, the newspaper has the best talent among the story writers of the world, and among professional men of all kinds, and gives an immense mass of most entertaining, interesting, and instructive reading in addition to the news.

On the enterprise in giving news I need not dwell. Shall we go back to the old days when a Boston reporter told his editor that Daniel Webster was going to make an important speech in a town near by, and asked if the paper had better send a man out to report it? The editor said he thought not, because somebody would send in something about it within a few days.

The realm of journalism is enlarging so constantly that even the most enterprising and active men in it can hardly comprehend its limits or possibilities. If any thinker in any part of the world has a new idea of importance, is not his greatest aim first to reach the people through the universal press? A newspaper on Sunday, or even daily, is not meant to be devoured as a whole by each reader, any more than the guest at a hotel is expected to eat every dish on the bill of fare. Men, women, and children find a list of contents, and select to read that which interests them the most. That their wants are met with intelligence and success is best shown by the fact that millions more newspapers are circulated in every year of our history.

After all, a jury decides most questions out of the court as well as in it. The American people form the jury which every newspaper and every business man has to meet. It may be claimed that papers print much matter which is useless and worthless. Any newspaper which does this very soon finds itself left behind in the race, and the people decide what they want and will have. A man who likes a common-sense shoe for comfort frequently wonders why the manufacturer should put a pointed toe shoe on the market. As soon as he sees millions of them worn in the streets the wonder ceases. Newspapers simply meet the demand of the age in size and in quality. I think that every person in this country can certainly make up his mind that newspapers will steadily grow larger instead of smaller. When the limit will be reached no man knows.

The controllers of newspapers are frequently criticized for what they print, and for the damage that they do in the community. Journalists have a much greater responsibility than other professional or business men. I fully believe that they appreciate it. They reach their ideal as nearly as they can. I believe firmly that the journalists of this country are just as loyal and patriotic citizens, just as true men, just as anxious to build up their communities, just as eager to uplift and broaden and improve the people, just as anxious to carry sunshine rather than sorrow and grief into the families which they visit, as are the same number of men in any other profession or any other line of business in these United States.

Chas. H. Taylor.

CHAPTER XXVI

THE AMERICAN TRADE AND TECHNICAL PRESS

ONE of the most surprising of recent developments of the press in America is the growth of trade and technical publications, which now far surpass in number and value those of any other country. Every line of trade, every science, every art, has its organs, in many cases wielding a large influence among the most enterprising and active classes of the community, and enjoying a degree of respect and prosperity commensurate with the importance of the interests which they represent.

This great development which has taken place, not within the century under review in this book, but more properly within the life of even the younger men of this generation, is one of the natural consequences that have followed the enormous extension that has taken place in almost every branch of production and industry, coupled with the division of labor, and the specialization which is characteristic of all the industrial arts and sciences.

The general newspaper keeps the public informed of the happenings in every country in the world, bringing men into one great community. So the technical press brings all professional and scientific men, as it were, together in one vast university, where the results of the thought, investigation, and experiment of all are made available for the common good. This is one principal reason why science and the industrial arts are advancing at a rate never before seen. The suggestion of a theory sets thousands of minds in distant countries and different environments instantly at work, and the theory is soon either established or overthrown. An invention or discovery which is destined to modify, perhaps revolutionize, a great industry, would probably have little interest to the general public, and the ordinary newspapers would be unwilling, even if they were competent, to treat it intelligently and fully. The technical press, however, brings it to the attention of those interested, and is glad to devote the necessary space to its discussion and illustration.

Every great trade has its organs which gather from the principal markets at home and abroad all that can throw light on its present and forecast its future condition, usually giving extensive tables of quotations which are inaccessible to the trade in any other way. They inform their readers of the bearing upon the trade of improvements in processes of manufacture that may cheapen production; they describe and illustrate the changes in style that play so large a part in many lines; they discuss public questions bearing on their trade with a knowledge of details and a grasp of the subject to be found nowhere else; they chronicle in many cases the gossip of the trade, and all strive to make each issue a compendium of everything of interest relating to the line with which they are concerned.

The editorial standard of the best technical and trade papers is very high. Their readers are experts in the topics of which they treat. They must, therefore, be edited by experts, and their contributions are often written by the ablest men in the business. Their readers will rebel against any inaccuracy of statement; and errors of judgment are not forgotten. A mistake in a quotation may entail loss on very many people, and will not be pardoned. The best trade papers employ a large corps of reporters who must be skilful and enterprising to ascertain the tendencies of the market before they have become apparent. They have, very generally, confidential relations with the leading minds of the trade. They must, above all, avoid being the dupes of interested persons. When a paper has established a reputation for a broad-minded, accurate knowledge of its trade, its influence is very great, and the leading dailies will quote it as the highest authority when discussing the subjects of which it treats and of which, in the nature of things, they cannot have so intimate a knowledge. Even when they do not quote it, they usually derive their information in large part from it. It will be studied in the committee rooms of Congress, and statesmen will form their opinions from its information, and fortify their arguments by quotations from its pages.

As a medium for advertising, the trade and technical press occupies a unique position. The advertiser can select the publication which goes to the class he desires to reach, whether in Maine or California, and he knows that each issue will be carefully consulted and read, the advertisements not being neglected, for its readers use it for business purposes, and are as eager to buy the best, the newest, and the cheapest, as he is to sell. As a result the leading journals of this class have always a large line of advertising, and it is, I believe, more generally profitable to the advertiser, if he use care and judgment, than that addressed to the general public in the ordinary newspapers.

The two fields, however, do not conflict. To reach the public it is necessary to use the publications they read; to reach a particular class, the special journal. But the advertiser must be sure the publications he spends his money in can really render him the service he pays for. The majority of the candidates for his business will, upon examination, prove to be but little worthy of it. If from the total were deducted those which are unsuccessful efforts to compete with the leading journals, and those which can only be properly characterized as traps, designed in fraud, to catch his advertising, the number would be very much reduced. If he has no sufficient knowledge himself of the field he desires to reach, his only safety lies in investigation and consultation with those who are in a position to inform him. "Claims" must go for nothing. I know of one weekly publication which enjoyed a large advertising business for years, and was very profitable, under a claim of 15,000 circulation, when they never had as many as 250 subscribers.

The growth of the American trade and technical press has been largely coincident with that of the trade and industry of the country. The early newspapers of America were devoted entirely to politics, war, and foreign news. The editors of that day did not know how to pick up the interesting news which was at their doors. Rarely was anything published in a commercial way, and only three or four times a year was the market price of country produce given. In the "New York Gazette" of March 4, 1739, there were quotations of flour, rum, wheat, corn, molasses, tea, and sugar, and it stated that cotton, wool, turpentine, and indigo were not in the market. Other newspapers gave brief reports occasionally in the same way. They rarely extended to twenty lines. This continued to be the rule up to the end of the Revolutionary War, and for some years after, although a larger tabulated market list, sometimes one or two columns in length, was given toward the end of this period by some daily journals. Among others which did this was the "New York Diary," published by Samuel Loudon, and the "United States Gazette," published in Philadelphia by Enos Bronson.

The desire to have this information in detail, and to have it every week, was the occasion of the founding of the "Shipping List" and of the "Price Current," at the beginning two distinct publications. These were afterward consolidated in the "Shipping and Commercial List and New York Price Current," the oldest commercial paper in America, and of which this volume celebrates the centenary. They were not absolutely the first in date, but were preceded by others of the same kind. Frederic Hudson, in his comprehensive book entitled "Journalism in America," states that the "Boston Prices-Current and Marine Intelligencer, Commercial and Mercantile," the publication of which was begun on the 5th of September, 1795, was the first regular and legitimate commercial paper issued in this country. It preceded the "New York Price Current," begun on December 21, 1795, a little over three months. It did not, however, continue as a commercial paper later than 1798, when it embraced politics, and a year or two afterward changed its name. Each of these journals was small, and required little time on the part of the printer, who was still the only editor. Several other price-lists of this kind were begun in early years and were maintained for a long time; two are still existing — one in Philadelphia and one in New York.

Meager and insufficient as they were, they supplied the needs of the public until the advent of the "Journal of Commerce," in 1827. This newspaper, although reasonably well conducted, was not successful until two new men — Hale and Hallock — took it. The latter was the editor, and Hale was the manager. It speedily became more utilitarian, paying great attention to all that could interest commercial men, and its markets were well reported. It was as good as could be expected until New York grew greater, until something of modern methods was known in journalism, and until improvements in machinery rendered possible the production of a newspaper easily and at a moderate cost. David M. Stone began reporting the money market about forty-five years ago. His previous experience on newspapers had been small, and he was chiefly known as a writer of poems and light sketches. When he began his reporting of Wall street, he did it at much greater length than his predecessors and rivals had ever attempted, and it was followed up with extreme thoroughness. Little had been given relating to the stock market as far back as 1830; the first newspaper which made a specialty of this line being the "New York Herald," at its beginning in 1833. The "Boston Post" shared with the "Journal of Commerce" and the "Herald" in the thoroughness of its ship news. The "Philadelphia North American" and the "Baltimore American" devoted much attention to these topics. Many general commercial weeklies have since been begun, covering every field.

Something more, however, was needed than this. However good a general journal may be, it can only cover the whole field incompletely. The last business directory of New York gives nearly three thousand occupations sufficiently large to be carried on in trade or manufactures in an office or shop apart from other business. It might be thought by a superficial observer that these callings could be classed together, and that they might be grouped somewhat as they are in the census, under manufacturing, commerce, etc. But the commerce in naval stores, for instance, is entirely different from that in dry-goods; and the manufacture of shoes bears no analogy to that of Bessemer steel. The maker or dealer desires chiefly to know what is going on in his own calling; what others are doing in it; what new things are coming out; what competition he is likely to meet; what the prices are for the goods he handles, and what the price of the raw material he needs may be, together with general news of the commercial world. This he requires to be given with fullness and particularity. No weekly or daily can be so planned that it can include this special information among other topics, for the journal would be too large for convenience, and the subscriber would care nothing about the remainder of its contents.

It was not until 1830 that any newspaper was begun bearing exclusively upon one commercial subject. It was the "American Railway Journal" of New York. A few others appeared and disappeared in the interval which succeeded before the first specialty commercial journal which still exists was founded in 1846. Conditions were not favorable, and it was only after long struggles that what is now the "Dry-Goods Economist" was at last on firm ground. The previous journals were weak and inefficient, and of no particular use either to him who sought for abstract information, or to him who desired to increase his sales or purchase his goods more cheaply. This periodical began in the largest trade — one which now in its subdivisions prints many journals; but it then had difficulty in making both ends meet, or in attracting the attention of either buyers or sellers. The next important journals were those in the hardware trade and in leather, now known as the "Shoe and Leather Reporter" and "The Iron Age." After some years of struggle their position was secure, and their value was perceived, not only by those in the same occupation, but by those in other callings, and similar journals soon began to multiply.

The philosophy of such a journal is that it masses together the information of the day in a way to render it pecuniarily profitable to the reader, if in the trade. It is of importance that the merchant or manufacturer should know the cost of his raw commodities, and the fluctuations in the value of all that enters into them. The price of coal affects the woolen manufacturer, for he must buy large quantities of it. A war in the East Indies between Holland and England affects the canned-goods manufacturer, for it sends up the price of tin; and a series of earthquakes in Sicily enhances the price of many chemicals, for it makes sulphur more difficult to obtain. Trade at the present day is carried on with more accurate knowledge of the sources of supply, the quantity which may be expected, the prices at which an article is selling, the cost of transportation, and the probable amount of competition which will be met, than it was half a century since. Every source of competition and supply must be watched by the commercial man of to-day, if he is to be more than a mere retailer, and the knowledge is most surely and amply obtained through a trade journal. How else can he know what is going on? Suppose the French government publishes a book on the diseases of grapes, all information being gathered by experts. Will the grower in America know of this unless his trade journal tells him of it? It is in French, and he cannot read it even if he hears of it; but his journal gives a summary of its facts and shows its conclusions. This may be worth many thousands of dollars to him; but he could have no knowledge of such facts without a newspaper.

Much of the advancement of American science is owing to the technical press. What the ancients knew upon any subject has to a great extent been lost to us because their writers had no means of supplementing or aiding each other. A discovery in history, art, or science was made, but was not

David Williams.

specifically recorded in some book. There was no method of giving bare announcements, of communicating interesting facts to those engaged in the same studies, or of preserving trifles. This continued to be the case to a less extent long after the discovery of printing, although there was, then, of course, an opportunity of publishing a pamphlet, and there were universities in which many branches were taught. Such was the only course open to Americans until the advent, in 1818, of Professor Silliman's periodical, the "American Journal of Science," in New Haven, and the "Journal of the Franklin Institute," in Philadelphia, in 1825.

Soon medical journals sprang up in Boston, New York, and Philadelphia, and are now to be found everywhere. A little later druggists' journals were begun. In law, a periodical was founded in New York eighty years ago, but legal journals were not common until nearly half a century later. The "Scientific American" was founded in 1847. Since 1840 some scientific or semi-scientific journals have been begun each year, and various professional journals, which have had no relation to science, have also been originated.

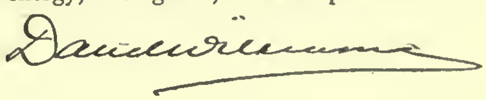
No means exists for finding out the exact position of the trade and technical press in 1860 or 1865, for no newspaper directory was then published. It may be estimated, however, that there were in 1860 about twenty trade papers and fifty other technical papers. In 1872 there were in the United States 124 trade papers and 132 other technical papers in forty-one different lines. Among these are not included religious, agricultural, educational, or sporting journals, although these are also class journals of a certain kind.

The rate of multiplication has not ceased since, the total number of technical journals now being over seven hundred, and of trade papers over a thousand. The wide field they cover will be seen by the following list of subjects:

Architecture, anthropology, astronomy, the army and navy, agents, art trade, advertising, banks, botany, brewing, building, building and loan associations, butchering, brickmaking, books, bookbinding, bookkeeping, blacksmithing, carpentry, carriages, carpets, cabinetmaking, clocks and watches, chemistry, collecting (objects of art or science), commerce and finance, china decorating, clothing, coal, catering, confectionery, crockery, cemetery management, cooperage, cordage, crops, corporation reports, credits, custom house news, drugs, dry-goods, dentistry, the deaf, dumb, and blind, electrotyping, engineering, exporting, express business, elevator and grain trade, entomology, economics, electricity, furniture, fruit, fire protection, fish, fancy goods and notions, furnishing goods, fashions, gas, groceries, glassware, geology, hardware, hops, hosiery, hotel keeping, hairdressing, history, hats and caps, iron and steel, insurance, ice trade, jewelry, law, ladies' wear, lumber, leather, lithography, laundrying, manufactures, mathematics, mechanics, mental philosophy, machinery, microscopy, mining, mineralogy, metals, milling, music, nature, nursing, numismatics, newspapers, optics, oölogy, ornithology, produce, printing, paper, plumbing, provisions, patents, postal matters, paints, power, photography, philately, philology, psychology, popular science, railroads, real estate, storekeeping, stationery, street-railways, soap making, sugar manufacturing, slate trade, spirits, science, saving-banks, shoes, shipping, social science, sanitation, statistics, stocks, tanning, trade-marks, tobacco, tailoring, textile manufacturing, upholstering, undertaking, weaving, woodenware, wine, wall paper, weather, and whaling.

Every important field has several publications. For example, there are thirty-seven now in groceries, although the first was not begun until 1869; and there are probably fifty in printing, although no printers' journal appeared before 1855.

It is too soon to tell what the future of the trade and technical press will be, but it is apparent to those who are most conversant with its history, and who have devoted the largest study to its details, that the development of the past will be continued in the future. Every group of thinkers, every line of trade, every one interested in certain kinds of knowledge, will require better means of communication, a more thorough analysis of facts, and more certain methods of chronicling the occurrences of the day. Many new lines will doubtless be represented in the press, while it is not unlikely that the increasing demands of both readers and advertisers will drive out of the field many of the weak and questionable publications which are now parading under the banner of the trade and technical press. The pace will be a hard one, and only those can keep it up whose business is based on a substantial foundation and managed with unflagging energy, intelligence, and enterprise.



CHAPTER XXVII

AMERICAN MINES

A CENTURY seems but a brief period in the history of an industry in this old world of ours, and though mining, next to agriculture, has been an occupation from the earliest times, when Tubal-cain was "an instructor of every artificer in brass and iron," nevertheless, when we consider mining as an "industry," in the modern acceptation of the term, a few hundred years reach far back toward its commencement, even in the older countries. But a single century ago an American mining industry had not been born, though gold was then produced in this country in an irregular and unsystematic manner, and bituminous coal, which had been known to exist in Illinois as early as 1670, and in Virginia, Kentucky, Ohio, and Pennsylvania certainly as early as 1770, or a century later, and anthracite, which had been discovered in Pennsylvania in 1768, were mined, though in very small quantities, for the use of blacksmiths, at various points throughout the country.

The American mining industry may be said to have commenced about three quarters of a century ago (1820), when Virginia was producing nearly 50,000 tons of bituminous coal a year, and all the rest of the country perhaps 15,000 tons more, and when the output of anthracite in Pennsylvania amounted to 1965 tons, of which 365 tons were shipped that year down the Lehigh River to Philadelphia, a shipment which is generally assumed to have been the commencement of the anthracite trade. From this modest and recent beginning the American mining industry has advanced with a marvelous rapidity, until in 1894, a year of unprecedentedly low prices, its products in their first marketable form had a value of $553,356,499, a sum which, though less by ten per cent. than the value of a smaller output the previous year, was still much greater than the value of the mineral production of any other country in the world.

This marvelous growth of the industry, and the fact that nearly every mineral and metal is now produced in this country at a cost as low, and in most cases lower than in any European country, while the wages of the workmen who produce them here are far higher than in any other country, must be recognized as demonstrations of skill, knowledge, and enterprise without equal in any other part or age of the world. It is natural, therefore, that the eyes of the whole industrial world should be turned toward the American mining industry for instruction in the arts that have produced these standing miracles.

TABLE OF PRODUCTS, BY DECADES.

Year.	Coal. Met. Tons.	Pig-Iron. Gross Tons.	Lead. Gross Tons.	Copper. Gross Tons.	Quicksilver. Flasks of 76½ Lbs.	Gold. Oz. Fine.	Silver. Oz. Fine.	Petroleum. Barrels of 42 Gals.
1820	67,000	....	......	......	......	....	....	....
1830	409,000	165,000	7,163	......	......	....	....	....
1840	2,000,000	347,000	15,000	......	......	40,000	25,000	....
1850	7,500,000	563,755	19,500	650	7,723	2,418,965	38,673	....
1860	13,000,000	821,222	14,000	7,200	10,000	2,225,447	116,019	500,000
1870	29,940,607	1,665,178	15,919	12,600	30,077	2,418,965	12,375,360	5,200,000
1880	66,813,453	3,835,190	87,344	27,000	59,926	1,741,500	30,320,000	26,286,123
1890	141,589,080	9,202,702	126,888	119,000	22,926	1,588,880	54,517,440	45,822,672
1894	154,229,383	6,657,388	143,332	161,510	30,440	1,923,619	49,846,875	48,527,336

Let us glance at the course of the industry as outlined in this table, and call attention to a few of the elements that have characterized its marvelous story.

Coal mining commenced in this country in Virginia, where, as has been said, the output as early as 1820 was about 50,000 gross tons a year. The rest of the country is estimated to have added to this 15,000 tons of bituminous coal, and the anthracite trade commenced with an output of 1965 tons. At that time we were sixth in the list of coal producers. Austria-Hungary, Belgium, France, Germany, and Great Britain exceeded the United States in output. Ten years later, in 1830, the total production of coal here exceeded 400,000 tons, and we had already passed Austria-Hungary, and then ranked fifth. In 1840 our output had nearly reached 2,000,000 tons, the demand for iron making and steam-engines having greatly stimulated the production. In 1850, with an output of about 7,500,000 tons, we had already passed Belgium, France, and Germany, and held, as we have since done, the second place. Great Britain was then producing about 54,000,000 tons, or more than seven times as much as the United States; but we have since gained so rapidly on her that it seems certain that by the close of the century, or in the year 1900, the United States will, with an annual production of about 200,000,000 tons, pass Great Britain, and hold from that time forward the first place as the producer of this "foundation of modern civilization."

In attaining this enormous output the mines have grown to great extent, though they have reached but moderate depths, no coal-mine in the United States to-day having a vertical depth of 2000 feet. Yet, with even this depth, some of our mines are the most "fiery" or gaseous in the world, and have called for a perfectionment of mine ventilation probably unequaled in any of the older countries. It is no uncommon thing to find a Pennsylvania anthracite mine circulating 250,000 cubic feet of air per minute through a single fan. This is done with a very low water-gauge, thanks to the large sectional areas of the airways which are possible in our great coal-beds.

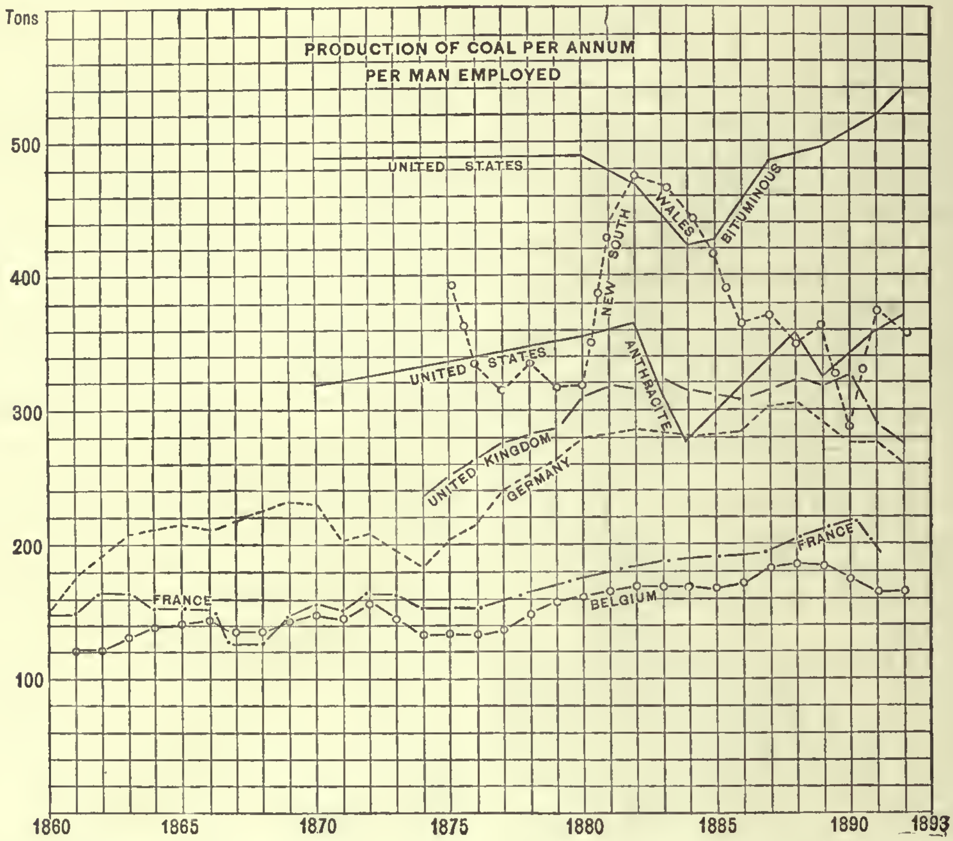
Though in no other coal country do the mines produce such enormous amounts of explosive gases, yet in none are serious explosions so rare, because the mines are so thoroughly ventilated by enormous fans and by skilful distribution of the air in the workings. Half a century ago there was scarcely any systematic ventilation, and there was no official inspection of mines until after the "Avondale disaster" in the Wyoming Valley, Pennsylvania, in 1868, when 110 men were suffocated in the mine by the burning of a shaft and shaft-house, the fire having been caused by a ventilating furnace in the mine. This "accident" enlisted attention, already directed by the mining journals, to the need of better ventilating appliances, and the writer of these lines then aided in drawing up for the Pennsylvania legislature the first law enacted in America requiring efficient ventilation of mines and the appointment of State inspectors of mines to see to its enforcement.

Fires in mines are sometimes caused by powder-blasts (the use of explosives being necessary in the hard anthracite), but they are quickly extinguished by the wonderful skill that constant practice has engendered. Water is led down the shafts and through the mine in pipes and hose, so that when such a fire occurs, water under the pressure of many hundred feet head is instantly thrown on it. In pumping machinery great improvements have been made, until now the old Cornish standard of 100,000,000 pounds of water raised one foot high by the expenditure of 112 pounds (one hundredweight) of coal has been far surpassed.

The system of mining in universal use in the anthracite mines, and in general use in the bituminous beds, is what is known as chamber and pillar work, "chambers," "rooms," or "stalls" being excavated in the coal, the intermediate portions of the bed being left as pillars to support the roof or rock over the coal. In a few—too few—places the "long-wall" system, under which the whole of the coal-bed is excavated and the roof allowed to fall, has been adopted. No radical improvements have been made in the systems of coal mining, which, especially in the anthracite fields, are extremely and disgracefully wasteful of coal. It is estimated that the coal and coal-dirt wasted in the culm banks in the anthracite fields since the mines were opened amount to thirty-five per cent. of the entire production of the mines, or to some 400,000,000 tons. At present this loss is smaller, but it may be counted at thirty per cent. of the coal shipped to market. Timber is still used for props, and in all the anthracite and in most of the soft-coal mines powder is used for breaking down the coal. In mechanical appliances vast progress has been made. The tools of the coal miner are better and lighter here than in any other country, and auger-drills in the anthracite, and coal cutters of various designs in the bituminous mines, are now in common use.

Underground haulage is done on roads laid with heavy steel rails, and with one or other of the following means: mules or horses, steam-locomotives, wire ropes, and, more recently, electric motors.

Hoisting is effected with abundant power and at comparatively high speeds, though, since none of our coal-mines yet attains a vertical depth of 2000 feet, very rapid hoisting cannot be practised. It is in the handling of the cars that the greatest economy is shown. Most of the coal is hoisted to the surface in the mine cars. In the anthracite mines where vertical shafts are used a single car (from 80 to 100 cubic feet capacity) is raised at a time on the cage. In some cases the cage with the car on it is dumped automatically, but in more cases the car is pushed off the cage and run some distance to the breaker, where it is dumped. The time occupied in changing the cars, taking an empty car off and putting a loaded one on at the bottom, and the reverse at the top, of the shaft,—that is, from the time the cage emerges from the shaft until it disappears,—is about seven seconds only, and this wonderful speed is kept up hour after hour through the day.



I may cite as an example of this almost incredible work the hoisting at the Nottingham shaft, in the Wyoming Valley, Pennsylvania, in one month of which the details are at hand. This shaft has a hoisting depth of 470 feet. During the month of October, 1891, this colliery was operated twenty-four days and one and one half hours (ten hours constituting a day), and it shipped 70,152 tons of coal, to which we must add, as already mentioned, about thirty per cent. for coal and coal-dirt sent to the waste or culm banks. This would give us a total of 91,150 tons hoisted from the shaft in the month, or 3798 tons a day, or nearly 380 tons an hour. Each car (eighty-six cubic feet), therefore, carried about 2.88 tons in addition to its own weight, which was 2250 pounds. In all 3.88 tons were moved at top and bottom of shaft within about seven seconds. Since there were two hoistways in the shaft, one car going up while the other went down, and the average hoist per day of ten hours was 1318 cars, or 132 cars an hour, a single trip was made in about fifty-four and one half seconds, including the changing of the car at the top and bottom, and the time required to hoist the 470 feet. The whole of the 70,152 gross tons shipped (or 91,153 tons hoisted) came through this one shaft. To show that this was not merely a spurt for a month

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it is sufficient to say that in June of the same year the average hoist through the month was 1305 cars a day, and shipments were 66,714 tons in twenty-three days and three and one half hours; in July, in twenty days and eight and one half hours, 57,-145 tons were shipped, 26,468 cars being hoisted; in August eighteen days and nine hours were worked, and 23,527 cars were hoisted and 51,031 tons of coal shipped. This record is believed to far exceed anything ever done in any other country in the world, though it has been almost equaled in other collieries in Pennsylvania.

It is by such extraordinary speed—rendered possible only by the adoption of ingenious mechanical and labor-saving devices—that the output per man in the American coal-mines exceeds that in any other part of the world, as shown in the diagram on the preceding page; and that, in spite of the payment of much higher day wages, the cost of coal is less than anywhere else in the world.

The anthracite coal is all broken in rolls and sized in various classes in screens for the trade—a custom which, while rendering its use much more convenient, adds to its cost and to the waste of the coal, as already stated.

The economy with which coal is mined in this country may be illustrated by a certain colliery which produces about 1800 tons of bituminous coal per day of ten hours. The miner is paid twenty-five cents per ton for mining and loading in the mine car, and the total cost delivered on the railroad cars is about forty-five cents per gross ton. A total cost of forty cents per ton is reached at some of our other collieries, and a selling-price of sixty cents per gross ton has enabled certain mines to pay very handsome dividends for a number of years past, though miners earn from $1.50 to $2.25 a day.

The actual average selling-price of all the coal produced in the States of Pennsylvania and West Virginia in 1894 was only seventy cents per ton, while in several other States it averaged seventy-five to eighty cents per ton; and the average selling-price of all the bituminous coal mined in the United States in 1894 was only eighty-eight cents per short ton, or say ninety-six cents per ton of 2240 pounds. In Great Britain the average price of coal at the mines in 1894 was $1.59 per ton, and in 1893 it was $1.63 per ton. The average wages paid to all men working in the coal-mines of Great Britain in 1894 were $5.50 per week, as compared with about $12 per week in Pennsylvania. It is quite evident, then, that the cost of mining coal, as well as other minerals, depends much more upon other things than on the rates of wages of the workmen. With wages fully twice as high in the United States, the selling-price of coal at the mines is just about one half as great as that at English mines.

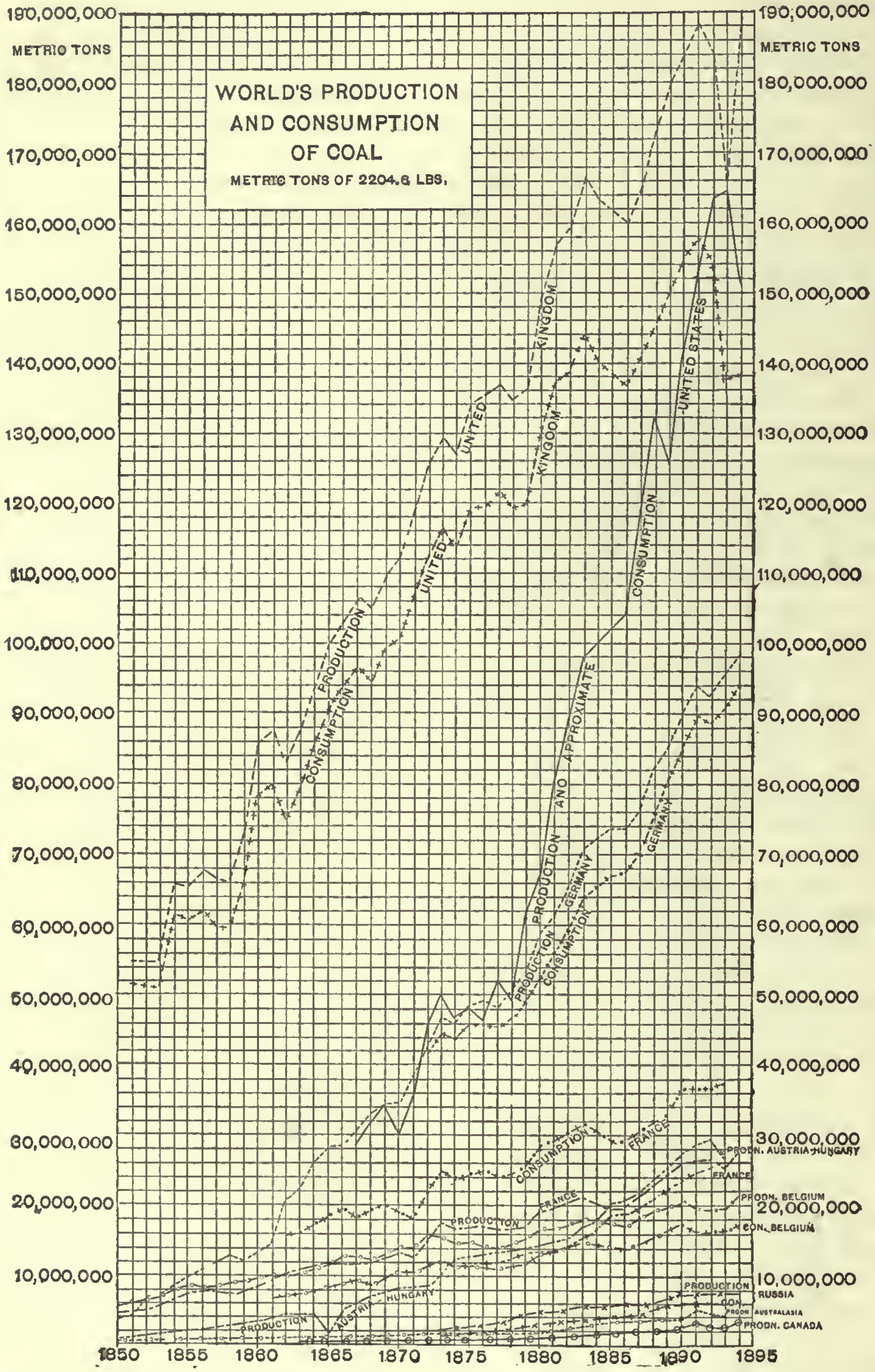
Anthracite is, of course, much more costly than bituminous coal to mine and to prepare for market. Nevertheless it is mined and prepared at a total cost of from $1.20 to $1.40 per gross ton, as against about $1.40 to $2 per ton at the same mines in 1830. Miners earn now from $1.75 to $2.25 per day, and laborers $1 to $1.75; while wages at the anthracite mines in 1830 were $1 per day for miners and eighty-two cents for laborers. It must also be remembered that in 1830 the mines were all working above water-level, requiring neither pumping, hoisting, nor much ventilation. The progress made in coal mining is thus shown in an actual large reduction in cost, while the difficulties and many of the elements of cost, including wages, have greatly increased.

The production of coal and the growth of the industry in the United States as compared with that in other countries are shown graphically in the diagram on the following page.

The mining of other minerals than coal has shown a progress both in economy and in extent of production which is, in some respects, still more wonderful than that shown in the coal industry.

The iron-ore industry probably commenced with the shipment of ore from Jamestown, Va., to England in 1608, and was continued with the production of iron in this country. The mining of iron ore in the early years was confined to a small and intermittent output from open-pit work on brown hematite or bog-ore deposits, requiring no mining skill. Iron was produced solely in bloomeries previous to 1724; and after that pig-iron was produced in blast-furnaces. The cost of mining ore in open pits, and with the low wages prevailing in those days, was much higher than it is to-day, when in the red-ore mines of Alabama thirty-five cents per ton is a common cost figure, and in the great Mesabi iron-ore mines of Minnesota, where the average cost of mining several million tons of ore that will run sixty to sixty-two per cent. in iron will this year probably not exceed fifty cents per ton; and there are mines where, after the stripping of the bed has been done, the actual cost of mining is at present less than ten cents per ton. The industry, which was formerly carried on laboriously by hand labor and wheelbarrows, with an output of a few tons a day, now employs steam-shovels and railroads in open pits, and the output per shovel per day (ten hours) is 1500 to

2000 tons, and there is a record of 3200 tons of ore having been loaded into the railroad-cars by a single steam-shovel in ten hours. The influence of the rate of wages on the cost of mining in such cases is infinitesimal.



In regular underground mining in the iron-mines of Michigan and Minnesota great improvements have been made. The system of mining now most in favor where the ore is not very hard is the working in chambers, which are kept full of ore as the excavation goes on. Thus no timber is required, and when the chamber is opened through to the mined ground above it, the ore is drawn out from it, the roof allowed to fall, and then the pillars are worked out from the top down by what is known as the "caving system." In other cases the whole of the ore is worked by the caving system in horizontal slices, commencing at the top, the roof being allowed to fall as the ore is mined out. By these methods and other improvements ore that only a few years ago cost over $2 per ton is now mined at a cost of seventy-five cents to $1 per ton. The average value at the mines of all the ore mined in the United States in 1894 (nearly 12,000,000 tons) was but $1.10 per ton. A large proportion of the 14,000,000 tons of ore which will be mined in this country in the current year (1895) will be quarried or mined in open pits as described above, as is all the limestone used for flux in the blast-furnaces.

The cost of quarrying stone has been so greatly reduced that contracts for rock-work on the great Chicago drainage canal, where the sides of the excavation are cut down in smooth vertical walls by channeling-machines, are made at only seventy-three cents per cubic yard, or say thirty-seven cents per ton.

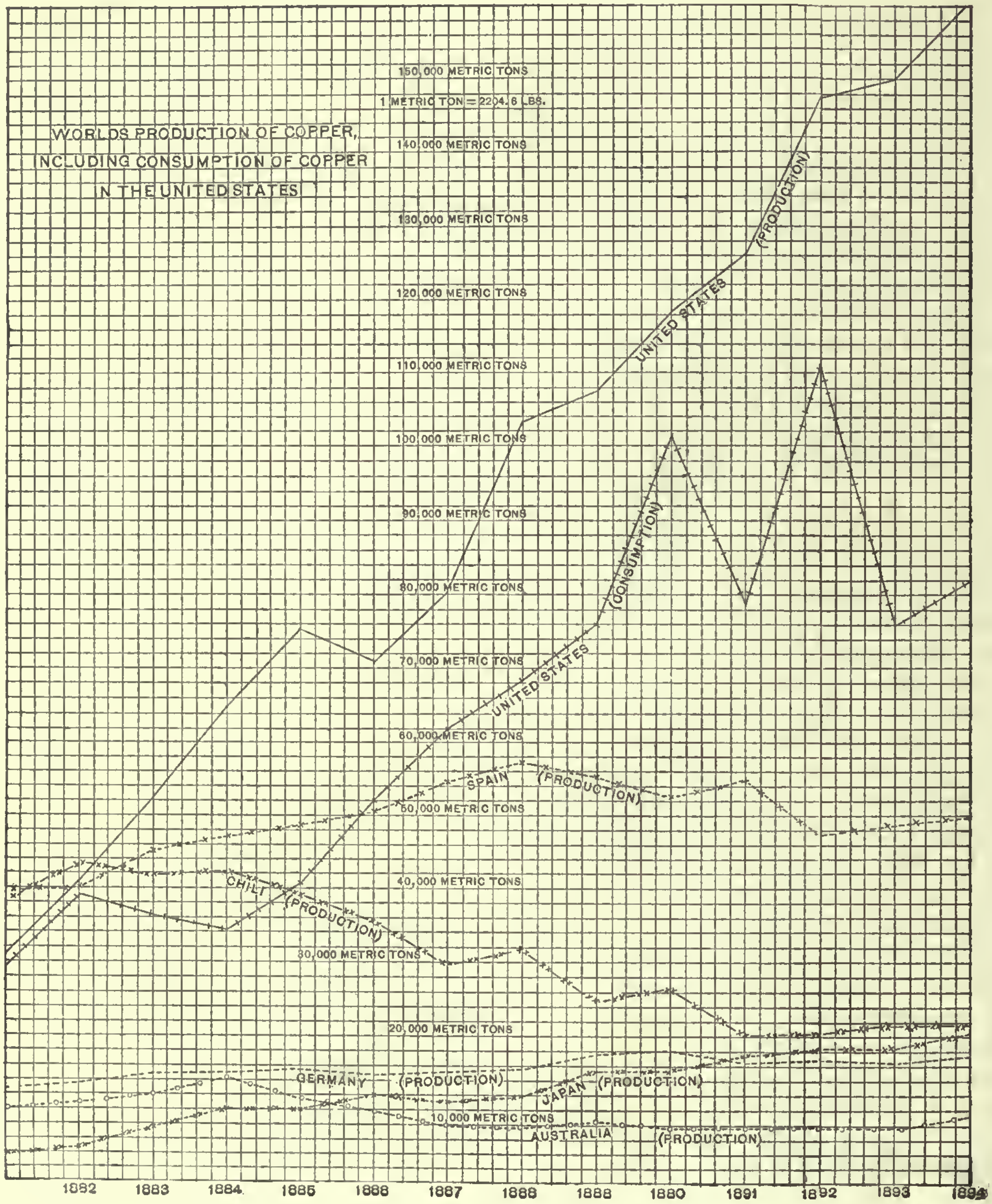
Lead-ore mining is carried on for the most part for the winning of silver as well as lead, and the cost of lead is therefore affected by the values of the other metals gained. Nevertheless in Missouri and Kansas, where ores are mined for lead alone, this has been mined, concentrated, smelted, and sold with profit even below three and one quarter cents per pound of lead, though the grade of the rock scarcely exceeded six per cent. Where the ore is somewhat richer it is estimated that the mines can compete in cost with Spanish mines, which are operated with labor costing about one third as much as here. The reductions in cost of both lead and zinc are, however, due rather to improvements in metallurgy than in mining. The price of pig-lead, which in 1820 was 6.36 cents per pound, was in 1894 but 3.29 cents per pound.

Perhaps in no other department of the mineral industry has progress been so rapid or so great as in copper mining and metallurgy. Though the existence of great deposits of native copper in Michigan was known to the early Jesuit missionaries, yet copper mining as an industry had its modest beginning about 1846, or just half a century ago, when Michigan produced 26 tons of the metal, and all the rest of the country produced only 124 tons. In 1850 the total output of the United States was only 650 tons, and in 1880 it was 27,000 tons. Since then there has been an enormous development of this industry, the output going up at a wonderful rate; in 1890 it had already reached the enormous figures of 119,609 gross tons, and in 1894, 161,510 tons, or almost equal to the aggregate production (163,349 tons) of all the other countries in the world, as shown in the diagram on the following page. This country has, indeed, now become the great source of supply for Europe, and the regulator of the copper markets of the world.

The reduction in the cost of copper, as in that of every other mineral product in the United States, has been due to increased skill, knowledge, and economy in administration, and has been almost everywhere accompanied by higher wages and a general betterment in the condition of the workmen. Lake copper, the standard brand, which in 1860 was worth 22.25 cents per pound, in 1870 was sold at 20.74 cents; in 1880 it was worth 20.12 cents per pound; while in 1890 it brought 15.75 cents per pound, and in 1894 only 9.55 cents per pound, all in New York. Yet with these prices the output constantly and rapidly increased, and the producers made handsome profits, even greater with the lower prices of recent years than with the high values of the earlier days. What these profits have been may be judged from a few examples. The Quincy Copper-Mine, in Michigan, has a capital of $200,000 paid in, and has paid in dividends no less than $7,690,000. It has for many years paid from $200,000 to $450,000 a year, or from 100 per cent. to 225 per cent. a year on the money invested. The Calumet and Hecla Mine, with a paid-in capital of $1,250,000, has already divided dividends to the amount of $43,850,000, and pays regularly about $2,000,000 a year, or 150 per cent., on the capital invested.

The copper-mines in Michigan are the best examples known of skilful and economical mining. They are much the deepest mines in the world; the new Calumet and Hecla shafts are now more than 4800 feet in vertical depth, while the Tamarack shafts are 4400 feet, and the new Tamarack shafts will be 5000 feet.

We may take the Atlantic Mine as affording perhaps the best illustration of what the art of mining has attained in this country. This mine, which in 1874 produced 69,728 tons of ore, produces now more than five times as much, or 315,626 tons of ore a year. The cost of stoping has been reduced from $17.33 per fathom in 1874 to $3.42 in 1894, and drifting per foot from $14.42 to $4.23. The introduction of rock-drills and high explosives was not at once a great economy; but as experience was gained, and as the contract miners made higher wages by their use, the economy became more and more apparent, and affected not alone the cost of breaking ground per foot or per fathom, but, through the rapidity with which ground was opened and could be broken, the extent of openings required for



a given output was reduced, and the work in every department was pushed with a degree of energy heretofore unknown.

It would be absolutely impossible to attain the great output of to-day by the old methods of work, no matter how many men were employed. The general conduct of the work in and about the mines has undergone a progress scarcely less important than that shown in drifting and stoping. More work per man per day is accomplished through the greater facilities provided for doing it, and through the high-pressure energy infused in every department by the example of one department where men strive to earn extra high wages by the use of improved appliances. The great reduction in the cost of work has been accompanied by an increase in the remuneration of the workmen from an average of $46 per month in 1881 to $51 per month in 1891.

Comparing the costs in 1874 and 1894, we find:

	1874.	1894.
Tons stamped	69,728	315,626
Average yield of ore	98%	70%
Cost of mining and all surface expenses, taxes, etc	$2.32	$0.75
Transportation three miles to mill	.18	.03
Concentrating	.99	.23
Freight to market, smelting, selling, etc.	.35	.18
Total cost mining expenses	$3.82	$1.19

When the work of mining a hard rock in a mine nearly 2000 feet deep, the transporting of the rock to a mill three miles distant, the crushing and concentrating of the ore, the smelting of the concentrates and refining the copper, the transportation 1500 miles to market, and all the expenses of administration both at the mine and at the companies' offices in New York, are done at a cost of $1.19 per ton of ore milled; and when an ore which carries only fourteen pounds of copper to the ton can be mined at a profit with copper selling at 9.55 cents per pound, we have certainly reached the marvelous. No other mine in the whole world can equal this.

In gold and silver production the story has been the same. The American miner invented the wonderful "hydraulicking" process by which the work of mining the gold-bearing gravels is performed by jets of water under very high pressure, the water being carried across valleys thousands of feet deep in iron pipes, and carried around precipices in timber flumes pinned to the face of the vertical cliff in a manner which for boldness and originality has never been equaled elsewhere. Thus it is that gravels containing gold to the value of only five cents per cubic yard are worked at a profit. It is to American engineers and metallurgists that the greatest improvements in gold and silver milling are due, a fact so universally recognized that our engineers are now found in charge of the most important mining and metallurgical enterprises in every part of the world, and their services are so highly valued that they are paid in South Africa and in Australasia from $15,000 to $50,000 a year salary. The United States is the largest producer of both gold and silver among the nations; in silver, in fact, it produces about thirty per cent. of the whole world's output.

The ore of the American quicksilver-mines is extremely low grade, having only about twenty pounds per ton, as compared with about 200 pounds per ton of ore in the Spanish Almaden Mine. Wages paid in California are from $1.50 to $3 per day, or four times as great as those paid in Spain. Nevertheless the American mines have been able to stand the competition, and have even paid dividends, though they seem now almost exhausted.

It is characteristic of the two countries that while the average number of tons handled for each worker in the Spanish mine was only 6.23 tons per year, at the California mines just ten times as much, or sixty-three tons, was handled in the same time per workmen employed. It costs no more to extract and reduce rich ore than poor, and were the American ores equal in richness to the Spanish, the production of the American mines would be ten times as great, and the cost would be $2.64, or, including flasks, $3.64 per flask, as against $7.10 in the Spanish Almaden, notwithstanding the difference in wages.

We may extend the review of work done, of great increases in output and diminutions in cost, until we exhaust the entire list of mineral products, and we will find substantially the same story; but this is unnecessary. In 1840 our mineral industry was summed up in four items: coal, 2,000,000 tons; pig-iron, 347,000 tons; lead, 15,000 tons; all other minerals valued at $238,980 and employing 728 men.

The table (given on page 186) of the mineral and metal production in the United States in 1893 and 1894, or fifty-four years later, adding up to a value of $553,356,499, tells the story of the present. What language can more eloquently describe the progress of this industry?

For this table, as well as for the diagrams comparing the world's production of coal and copper, and for much of the other data used in this paper, I am indebted to the volumes of "The Mineral Industry: Its Statistics, Technology, and Trade in the United States and Other Countries."

The achievements of the American mining industry are indeed marvelous, and have never been approached by those in any other country. It was argued, and not so very long ago, that though nature had munificently endowed this favored land with the richest of her mineral gifts, yet the high prices of wages (which average from two to five times as much as in European countries), enhancing the cost of production, and the enormous distances which our coal, iron, copper, lead, zinc, and other minerals and metals would have to be transported to tide-water ports, would forever prevent the United States from competing in the markets of the world with the old European countries, or, as it is sometimes expressed, from competing with the "pauper labor" of Europe or of China and Japan. Glorious achievements have triumphantly answered

No.	Products.	Customary Measures.	1893. Quantity. Customary Measures.	1893. Quantity. Metric Tons.	1893. Value at Place of Production.	1894. Quantity. Customary Measures.	1894. Quantity. Metric Tons.	1894. Value at Place of Production.
	Non-Metallic.							
	Abrasives:							
1	Corundum and emery	Short tons	1,747	1,585	$140,589	1,220	1,106	$109,500
2	Garnet	"	1,520	1,379	55,800	1,000	907	35,000
3	Grindstones	"	45,340	41,133	345,920	37,400	33,922	335,800
4	Millstones	"	155	141	2,359	297	269	4,447
5	Tripoli and infus. earth	"	1,351	1,226	25,625	1,802	1,634	36,687
6	Whetstones	"	1,903	1,726	89,550	1,735	1,574	84,450
7	Alum	"	96,000	87,093	2,880,000	72,000	65,304	2,160,000
8	Antimony ore	"	850	771	41,000	165	150	9,075
	Asbestos and Talc:							
9	Asbestos	"	120	109	6,000	250	227	3,750
10	Fibrous talc	"	36,500	33,113	337,625	39,600	35,917	396,000
11	Talc and soapstone	"	20,100	18,235	366,825	21,044	19,087	401,892
12	Asphalt	"	3,490	3,166	68,682	4,198	4,080	75,654
13	Bituminous rock	"	31,404	28,489	114,752	34,199	31,018	148,120
14	Barytes	Long tons	26,632	27,067	133,160	23,758	24,141	95,032
15	Bauxite	"	11,041	11,222	55,205	10,732	10,908	42,928
16	Borax	Pounds	9,199,000	4,173	689,925	13,140,589	5,962	919,841
17	Bromine	"	348,399	158	87,100	379,444	172	98,655
18	Cement, natural hydraulic	Bbls., 300 lbs.	7,445,950	1,013,238	5,010,958	7,895,259	1,074,179	4,397,407
19	Cement, Portland	"	673,989	91,715	1,052,173	738,196	100,352	1,080,644
20	Clay, refractory	Short tons	3,214,989	2,916,501	4,822,483	3,375,738	3,061,794	4,050,885
21	Clay, kaolin	"	30,183	27,382	205,667	24,552	22,246	185,169
22	Coal, anthracite	"	[1] 47,355,387	42,960,116	74,605,885	[1] 52,010,433	47,183,345	80,879,404
23	Coal, bituminous	"	[1] 128,826,364	116,869,397	123,899,415	[1] 117,950,348	106,953,311	103,842,467
24	Coke	"	8,939,961	8,110,245	14,706,544	8,495,295	7,706,846	12,654,558
25	Cobalt, oxide	Pounds	3,894	2	5,452	6,550	3	8,843
26	Copperas	Short tons	17,862	16,204	134,520	14,897	13,511	104,100
27	Copper sulphate	Pounds	54,000,000	24,492	1,822,500	[2] 60,000,000	27,215	2,016,000
28	Chrome ore	Long tons	1,629	1,646	16,000	2,653	2,697	35,125
29	Feldspar	"	17,000	17,274	85,000	23,280	23,655	116,400
30	Fluorspar	Short tons	9,700	8,800	63,070	9,000	8,165	64,000
31	Graphite	Pounds	882,912	400	39,731	770,846	349	34,689
32	Graphite, amorphous	Short tons	1,691	1,534	8,996	165	150	1,252
33	Gypsum	"	330,231	299,582	927,615	287,517	260,834	849,925
34	Lime	Bbls., 200 lbs.	[2] 60,000,000	5,443,164	30,000,000	[2] 56,750,000	5,148,326	28,375,000
35	Magnesite	Short tons	1,143	1,037	8,000	1,370	1,243	4,864
36	Manganese ore	Long tons	9,150	9,297	60,000	11,735	11,924	74,899
37	Mica, ground	Pounds	679,000	308	29,522	829,500	377	35,957
38	Mica, sheet	"	6,500	3	5,478	9,900	4	11,103
39	Monazite	"	130,000	59	7,600	750,000	340	45,000
40	Natural gas	....	....	....	14,000,000	....	....	11,000,000
41	Paints, mineral	Short tons	44,709	40,559	726,160	38,801	35,200	662,262
42	Paints, vermilion	"	37	34	40,000	41	37	45,600
43	Paints, white lead	"	88,500	80,286	9,469,500	87,242	78,155	8,445,174
44	Paints, zinc oxide	"	25,000	22,679	1,875,000	22,814	20,697	1,711,275
45	Petroleum (crude)	Bbls., 42 gals.	50,349,228	7,043,857	32,223,505	48,527,336	6,788,974	40,762,962
46	Phosphate rock	Long tons	981,340	997,140	3,434,690	952,155	967,485	2,856,455
47	Marls	"	200,000	203,814	540,000	225,000	228,622	607,500
48	Precious stones	....	....	....	200,000	....	....	250,000
49	Pyrites	Long tons	95,000	96,529	285,000	107,462	109,192	466,466
50	Salt, evaporated	Bbls. 280 lbs.	9,703,419	1,232,392	4,945,583	9,161,053	1,163,508	4,608,275
51	Salt, rock	"	1,935,642	245,838	678,064	2,341,922	297,438	788,681
52	Silica, sand and quartz	Long tons	300,000	304,814	330,824	315,531	320,610	347,951
53	Slate, roofing	Squares	803,887	237,014	2,956,895	693,944	204,656	2,551,259
54	Slate, other manufactures	Square feet	4,138,920	....	475,681	5,099,791	....	499,578
55	Soda, natural	Short tons	2,500	2,268	12,500	....	....	....
56	Soda, natural sulphate	"	90	82	450	....	....	....
57	Stone, limestone (flux)	Long tons	3,750,000	3,810,375	2,250,000	3,544,393	3,601,458	2,126,636
58	Stone, marble	Cubic feet	5,639,681	429,399	2,087,758	5,681,766	433,093	2,177,280
59	Stone, onyx	"	2,175	166	28,750	1,450	110	29,000
60	Other building stones	....	....	....	[2] 38,000,000	....	....	[2] 30,000,000
	Total, non-metals	....	....	....	$377,517,086	....	....	$353,760,877
	Metals.							
61	Aluminum	Pounds	312,000	142	202,800	817,600	371	490,560
62	Antimony	Short tons	350	318	63,000	220	205	39,200
63	Copper	Pounds	327,255,788	148,441	35,179,997	353,504,314	160,392	33,540,489
64	Gold	Troy ounces	1,739,323	[3] 54,093	35,955,000	1,923,619	[3] 59,824	39,764,708
65	Iron, pig	Long tons	7,043,384	7,157,782	93,888,309	6,657,388	6,764,572	71,966,364
66	Lead, value at New York	Short tons	166,678	152,080	12,434,178	160,867	145,906	10,585,048
67	Nickel, fine	Pounds	25,893	[3] 11,745	12,429	....	....	....
68	Quicksilver	Flasks, 76½ lbs.	30,164	1,046	1,108,527	30,440	1,056	1,095,840
69	Silver, commercial value	Troy ounces	60,500,000	[3] 1,881,731	47,311,000	49,846,875	[3] 1,550,387	31,403,531
70	Zinc spelter	Short tons	76,255	69,178	6,214,782	74,004	67,135	5,209,882
	Total metals	....	....	....	$232,370,022	....	....	$194,095,622
	Est. products unspecified	....	....	....	6,000,000	....	....	5,500,000
	Grand total	....	....	....	$615,847,108	....	....	$553,356,499

[1] Bituminous coal includes brown coal and lignite. The anthracite production is the total for Pennsylvania, Arkansas, and Colorado.
[2] Estimated. [3] Kilograms.

these timid economists. True, our wages have remained far higher than in any other country, and have actually advanced, except in our far Western mining camps; and even there the net earnings have increased by reason of the cheapening of the cost of living. True, also, the miles to tide-water are many; but distance disappears when railroad freights are much less than a cent per ton mile. To-day we are producing coal, iron, copper, gold, silver, and many other metals and minerals cheaper than anywhere else, and have already demonstrated our ability to compete successfully in the markets of the world with any other producer. Moreover, strange as it may appear, it is with the product of our highest-priced labor, that is, with fine machinery and high-class goods, that we defy competition in prices and are most successfully competing with Europe.

To whatever department of the mineral industry we turn we learn the same lesson: that the unit cost of most mineral products is lower in the United States than elsewhere, and that the labor cost of producing nearly everything is less here than in any other country, while our rates of daily wages are the highest paid in the whole world. The explanation of this apparent paradox is neither difficult nor doubtful. The self-reliance engendered by our free institutions, the intelligence, industry, and enterprise which are stimulated by the possibility of earning not only a competence, but wealth and luxury, and the wants which larger means and better conditions create, all tend to make our labor more efficient than that of the older countries, where traditional conditions limit wants and cause life to the workman to be without inspiration and almost without hope. Moreover, the scarcity of workmen and the high rates of wages have necessitated economy in the use of labor, and have led to the invention of wonderfully ingenious and practical labor-saving devices, and have encouraged the adoption of every improvement discovered or introduced elsewhere. The outcome has been that these contrivances and improvements have increased the efficiency of labor here beyond the increase in wages, and have thus actually lessened the labor cost of producing nearly everything, and especially in the higher classes of products, in which the proportion of cost of labor is greatest, to a point below that in producing the same articles in countries where the fetters of custom retard the introduction of improvements, and where lack of incentive lessens the efficiency of the workman.

Magnificent natural resources, intelligence and industry in the workmen, knowledge of what all the rest of the world is doing, and enterprise to adopt whatever is advantageous, are the solid foundations on which this marvelous development of the American mineral industry is based. Technical and trade periodicals, technical schools, and technical societies have been the efficient aids in this progress and prosperity.

Time was when the supremacy of a nation was determined by the sturdy wielding of the sword; to-day the nation that makes cheapest and best the material from which sword-blades are fashioned is strong. It is preëminence in the ennobling arts of peace that now renders nations invincible and their people prosperous and contented.

R. P. Rothwell

CHAPTER XXVIII

AMERICAN QUARRYING

IF it is true, as is claimed by many, that the prosperity and growth of a country can be traced in the character and stability of its buildings, then it must be that the United States in the original plan of creation was given advantages far superior to those of other countries. The natural resources of this land, fast being developed by American ingenuity and skill, have at no time been more apparent than during the past twenty years, as is shown in the quantity and quality of stone buildings which have been erected. As wood in building has given way to brick, and brick in its turn has given way to stone, so have American quarries, out of barren pasture-ledges supposed to be worthless, been worked and developed until last year they yielded a product of more than $37,375,000, distributed among the different kinds of stone as follows: Granite, $10,029,156; marble, $3,199,585; slate, $2,790,324; sandstone, $3,945,847; limestone, $16,512,904; bluestone, $900,000. I know that figures and statistics are as a rule dry and uninteresting, and yet there is nothing that will show the growth and present volume of the quarrying business more quickly or eloquently than the few here given. In 1889 the capital invested in this industry, represented by 4257 quarries, was $89,688,133, which probably is not far from the amount at the present time. Employment was given to upward of 83,000 men, to whom was paid nearly $31,000,000 in wages. There were produced 235,264,351 cubic feet of stone for building, monumental, and mechanical purposes; about 75,000,000 cubic feet (principally limestone) for street and bridge work; nearly 1,000,000 squares of roofing slate, and 18,474,668 barrels of lime.

The census statistics just completed by Dr. Day show that in actual output of stone for every purpose Pennsylvania takes the lead, with shipments last year of over $5,245,507; with the Buckeye State second, its output being a little over $3,500,000. If, however, we exclude the amount used for lime, flux, and road-building, Vermont would be at the head of the list in actual production of stone for building and monumental purposes, with shipments in 1894 of $3,053,602. Although stone suitable for at least rough building purposes is largely distributed (the census returns being made up from the productions of forty-four different States), and will, I believe, in time be extensively worked everywhere, yet at the present day the different marketable products are limited to a few places, so much so as to give the localities where found a world-wide reputation. The great bulk of the granite output comes from the eastern coast of the United States; slate from Pennsylvania and Vermont; sandstone from Ohio, and marble from Vermont, Tennessee, Georgia, New York, and Massachusetts, the product from the three latter States being used largely for exterior building, while that from Tennessee is employed principally for interior decoration.

One hundred years ago stone-quarrying in this country was practically unknown. There were isolated places where the native rock was used sparingly in buildings, or rough slate or marble slabs had been hewn out to mark a grave, but quarrying as such cannot be said to have begun until many years later, and then only in a very meagre and small way. The total output, even fifty years ago, would have been no more than wealthy men to-day put into a private residence for themselves. Nothing shows the comparatively recent growth of this industry better than the gain made from 1880 to 1889, the production in 1880 being a little over $18,500,000, while for 1889 it was nearly $53,000,000.

It is impossible in the course of this article to trace with any degree of detail the history of the quarrying interests up to the present time. In some of the oldest cemeteries in New England you will occasionally find a slate slab bearing an inscription that

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shows it was erected previous to 1795, one even bearing an inscription as far back as the seventeenth century. But any such slabs came from Wales as ballast. As early as 1785 a marble-quarry, although it could hardly be called such at the present day, was opened at Dorset, Vt., from which were taken stones for fire-jambs, chimney-backs, and lintels. Their beauty was such that people came from a long distance for these pieces, and something of a trade was done in them. About the year 1800, at Marbledale, Conn., Philo Tomlinson was at work quarrying and sawing marble into slabs, and two years later Newell & Clark erected a stone saw-mill at Stockbridge, Mass. The next year Johnson & Stephens took a contract for 33,000 cubic feet of marble for the front of the New York City Hall, and for several years thereafter the quarrying of marble for buildings was more or less actively carried on in this neighborhood. In a general way, however, with the exception just noted, it may be safely said that but little was done previous to 1830. From then on, marble, granite, slate, and limestone — but more especially granite, owing to its proximity to the seacoast — came into gradual use, but lack of proper railroad facilities within reasonable access to the stone were a bar to their active development until many years later.

Sandstone was first put upon the market about sixty years ago, in the form of a grindstone, by Mr. John Baldwin, the founder of Baldwin University. These stones were turned out by ox-power, and hauled by him into Cleveland, O., by ox-teams; and from that modest beginning the industry has grown to such proportions that one firm alone in Ohio last year furnished sidewalk slabs (that being merely one department of their business) sufficient to lay a walk from New York City to Albany.

The first slate quarry in Vermont was opened in 1845, by Colonel Allen and Caleb Ranney, at Scotch Hill, in Fair Haven, and its prosperity may be judged from the fact that land which they leased for sixty dollars an acre was ten years later sold to Boston parties for $50,000. This same quarry is, I am told, in operation to-day, and purple slate quarried from it can be found in the treads and landings in almost any public building or business block in any city. In 1847, the production of roofing slate began, and developed rapidly. The first year but 200 squares were produced; eight years later the output in the same locality had increased to 45,000 squares.

The granite industry had its beginning in New England, at Quincy, Mass. This was about 1820, although King's Chapel, in Boston, the first building of any architectural pretensions from Quincy granite, was erected in 1752. It was from these ledges that in 1827 the stone was blasted out for Bunker Hill monument, and it is recorded that the first railroad in America owes its origin to these quarries and the monument, a road having been built under a Massachusetts charter to transport the stone from the quarries at Quincy to the Neponset River, the iron rails resting upon granite sleepers. The road was, to be sure, but two miles in length, but it is said to mark the beginning of railroading in the United States. The growth of granite for building purposes, owing to its proximity to the sea-coast and consequent low freight rates, was gradual and steady, so that, in the year 1880, the output of granite for all uses amounted to a trifle over $5,000,000. In the next nine years, however, its development was phenomenal, the output nearly trebling, and in that year it furnished 62,000,000 paving blocks alone.

The process of quarrying any of these stones, except marble, is a comparatively simple and inexpensive operation, and as a natural result the number of quarries from which stone is taken is extremely large. Occasionally, in the case of granite, top rock has to be removed, owing to imperfections in it, but, as a rule, fairly marketable stone is found even at the surface. I am speaking now of all but marble. That is so different that I will mention it separately later on. The stone is all removed by blasting, with the exception of sandstone, where the beds are thin, and some of the limestone quarries, particularly adapted to building purposes, where channeling machines are extensively used for cutting up the stone into strips. The fundamental idea in this style of quarrying is to remove the largest and best-shaped blocks possible, with the minimum of expense, and the skill of the quarry foreman is shown in so arranging his blast-holes as to take the best possible advantage of any natural cut or fissure in the rocks. Large blocks freed from the other rock by blasting are then split up into the sizes required, by wedges driven into small holes, drilled a little way into the rock, in the direction in which it is desired to make the break. Ordinarily, in quarrying of this kind, the blast-holes are filled with but a small amount of powder, the purpose being merely to loosen the rock without shattering it. Sometimes, however, the formation of the stone is such that very large blasts are fired, Dr. Day, in his report on mineral resources, instancing one case where 32,700 pounds were used in a single charge. Improvements in methods in these quarries have not kept pace with development in other lines. Steam or compressed air gadding drills take the place of a wedge and sledge-hammer, and the steam-derrick and crane have in most places supplanted the old horse-sweep for lifting the blocks from the quarries, but otherwise the process of getting the stone from the ledge has been changed but little.

While any of the stone comprising the quarrying industry in some form can be used for building work, for monumental purposes one is restricted to either granite or marble. Although limestone is widely distributed, marble, which is really a limestone in such a crystalline condition as to be susceptible of a high polish, is found only over a limited area, and then in such shape that its production is a matter of much greater expense than attends the quarrying of any other stone.

Nathaniel Chipman, the ablest of Vermont's early jurists, in a letter written July 25, 1792, from Rutland, Vt., says: "There are also in this part of the country numerous quarries of marble, some of them of superior quality. Machines may easily be erected for sawing it into slabs by water, and in that state it might become an important article of commerce." Yet it was not until 1836 that even a small beginning was made to take advantage in any degree of what Judge Chipman foresaw forty-four years before was destined to give world-wide reputation to the State. Six years later, William F. Barnes, the real pioneer in the working of Rutland marble, began labor upon the quarry of West Rutland, which, in connection with others on the same belt, has given this marble its reputation.

Quarrying in those days was all done by hand-labor, and scores of men with their long steel drills struck away at the rock from morning until night, cutting deeper and deeper with each stroke until finally the point was reached from which the rock could be raised from its bed, and hoisted from the quarry. For some time attempts had been made to do away with this hand labor, and have the channeling done by steam. In 1863 the first channeling-machine, invented by George J. Wardwell, of Rutland, Vt., was tried upon the Sutherland Falls Quarry. This single-gang machine, nicknamed the "Posey," and used upon this same quarry, I believe, for about twenty years, was the beginning of the use of machinery, in a short time destined entirely to supplant hand labor in marble quarrying. The introduction of American marble for monumental purposes was a hard and up-hill fight, owing to the strong prejudice in favor of the Italian product. The Census of 1870 credits Vermont with marble sales that year of less than 131,000, while the importations amounted to $479,337. That the tide finally had to turn was shown in 1889, in which year there was shipped from Vermont stone worth $2,169,500, while the total importations for the same year, mainly from Italy, were but $701,518. Of all the marble produced in 1889, for whatever purpose, Vermont furnished more than sixty-two per cent., and of the marble used for monumental purposes alone it is probably safe to say that at least ninety per cent. was quarried among the Green Mountain hills. Although the deposit extends through a considerable portion of the State, it is only in a comparatively small part of it, Rutland county, that the most valuable quarries are found. It is a curious fact that towards the north of this county the stone is much finer grained than in the south, evidently having been subjected to greater pressure, and in consequence it is very seldom that sound marble is obtained. So finely grained and beautiful is this stone that numerous attempts have been made to quarry it, the result being financial disaster in every case. Towards the south the reverse is true, the marble proving more sound, but gradually becoming so coarsely crystallized that it is suitable only for building purposes. The deposit known as Rutland marble is all contained within an area of less than half a mile. The hills embracing this deposit were so barren and poverty-stricken in appearance that the story goes that the entire tract was traded for an old horse to the man who first opened the quarries there. Be that as it may, the spot from which are now taken annually from 15,000 to 20,000 blocks, requiring, to reduce to merchantable shape, the employment of a small army of men, was at that time considered practically valueless.

In the Rutland deposit some fifteen different layers have been uncovered to date, varying in thickness from two to ten feet, and varying also in color, texture, and value; nor is it unusual to see the same layer produce several different varieties and colors of stock. At the surface the marble lies at an angle of about forty-five degrees, but after reaching a depth of from 150 to 200 feet it suddenly turns and is found lying almost flat, so that one can readily see that at that depth, to get the same marble that was found at the surface, it is necessary to tunnel far into the hills. The tremendous stone roof which is thus formed is supported at regular intervals by enormous piers left for that purpose as the quarry penetrates deeper and deeper. Marble worth the sawing is very rarely found until a depth of from twenty to thirty feet has been reached, and it does not then follow that the quarry may have any real merit; heads, cracks, tight cuts, and a predominance of inferior stock may all develop, and thus make it necessary to dump the blocks even after being quarried. Throughout the marble region it is not an infrequent sight to see abandoned quarry openings into which thousands of dollars have been poured by people carried away with the stone craze.

If an outcropping of marble is found that looks favorable for a future quarry, it is first bored, as a rule, with a machine specially constructed for this purpose, to ascertain if the deposit has any depth, and is of suitable quality and color. The soundness, however, of a deposit can be proved only by opening, and the opening of a marble quarry is laborious and expensive. From $40,000 to $75,000 has been spent upon several of the West Rutland openings before stock that would even pay to saw has been taken out. A quarry is first stripped of its top-rock by means of small blasts, great care being taken that the charge does not penetrate into the marble. Channeling machines, operated by steam or compressed air, are then put on to cut the layers into strips of the requisite size. The quarry being cut up into strips, a cut is made at each end, and a set of key-blocks, as they are termed, are cut and removed. This gives a chance to get at the bottom of the layers that have been cut. Steam-drills are then used to bore holes into the bed of the layer at intervals of eight to twelve inches, and into these holes steel wedges are driven. In this way the entire floor is freed from its bed, and it is not unusual to see a strip of rock, fifty feet or more in length, raised in this manner. By the same process the strip is cut into blocks of the size desired.

No powder is used in quarrying marble, although it is sometimes very sparingly used in removing scales and scalps when the layer has not raised evenly on its bed. Where the marble lies at an angle tunneling is resorted to, instead of removing the immense amount of top-rock that would otherwise be necessary. Powder is used for this purpose. To avoid shattering the marble in any way, a channel is cut into the side of the rock, and just above the good marble to be taken out a large number of small blast-holes are put in. The cut which has been made prevents the powder from shattering the marble below, and a sufficient space is thus made upon which to place a machine to cut the underlying layers. It is not usual to tunnel during the winter months, because, although quarrying is carried on throughout the entire year, it cannot be done so cheaply or satisfactorily as in summer.

Let us glance for a moment at the methods in vogue in Italy. Almost surrounding the city of Carrara, and within a few miles of it, is a high mountain range, bare of trees or vegetation, containing the marble quarries of Italy. These quarries, some 400 in number, are scattered through the mountains, beginning near the base and extending up the sides from 3000 to 3500 feet. So inaccessible are many of them, that the descent into some is by means of ropes, and in others the men do all the work while suspended in mid-air. The entire quarrying process is most primitive, no machinery of any kind being employed. Hand-drills are used to cut a hole in the face of the ledge. This is filled with powder, the charge exploded, and the quarrying is done. Unless unusual care is taken, huge blocks are frequently detached, and go tumbling down the mountain side. It often happens that the blast only detaches pieces that are too small to be of any use, and even in the huge boulders the powder that has been used is very apt to penetrate and check the stone, so that it is worthless, although the damage it has done may not be discovered until years after, when the marble has for a long time been exposed to the action of the weather. The boulders that have been tumbled out in this way are next put into shape by men with a hammer and chisel picking them over and knocking off the rough pieces. Blocks of unusual size are divided by sawing. An iron saw operated by two men, much after the manner we saw logs, except that there are no teeth in the saw, is used. Sand and water are applied, and gradually the implement wears through the block. The blocks are next transported on huge wagons, drawn by half a dozen yoke of poor, ill-kept oxen, to the railroad or the harbor, a few miles behind. The life of these laborers is, indeed, a hard one. Many start for work at sunrise, and leave only when darkness makes it necessary, and for their work receive from twenty-five to forty-five cents a day, a pittance so small, that it is a wonder how they live. Such, in brief, is the Italian quarrying industry. Compare it with the same kind of work carried on in Vermont, and how quickly is noted the difference between the results of American ingenuity and push, and of Italian adherence to antiquated methods.

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CHAPTER XXIX

POWDER AND EXPLOSIVES

IN order to gain a just appreciation of the progress of the manufacture of explosives in the United States during the last 100 years, it will be necessary to consider in a cursory manner the condition of the manufacture in the old world prior to 1795.

This review must of course refer to "black powder" only, as it is called, as this was the only explosive then manufactured. Very few others were known, most of the chemical explosives being discovered during the present century. Gunpowder, as is well known, is composed of three ingredients—saltpeter, sulphur, and charcoal. In the preparation of these, their purification, their incorporation, and the subsequent finishing of the product, consists the manufacture of powder. From remote times it has been the custom to granulate gunpowder in some way. The original method of manufacture was very simple, and consisted of pulverizing the ingredients in a mortar and forming grains of it by working the damp material through a sieve. The grains thus formed were hardened by final drying. At first the pestle of the mortar was worked by hand, then by means of a rope passing over a pulley, and afterward by mechanical means, as in the stamping-mill. This mill was a series of mortars excavated in a block of wood, a battery of pestles being raised and let fall in them by means of pins in a revolving shaft. The use of stamping-mills dates from the latter part of the seventeenth century. In 1794, the separate pulverization of the materials was adopted because of the frequent explosions of the stamping-mills. These explosions were said to destroy one sixth of the whole number of stamping-mills in France annually. The process of pulverizing in drums was first made use of in France, both for the separate comminuting of the ingredients, and for the intimate mixing of them. For the latter purpose was used a cylinder made of rawhide stretched upon a frame of wood, and containing zinc balls. This form of apparatus was imported into the United States, and is still in use to a limited extent. About the middle of the eighteenth century incorporating-mills were first used in France. Some time before this they had been introduced into Sweden. The wheel-mill is now the standard incorporating-machine, and is used in almost all powder-works of importance.

At the end of the last century the art of gunpowder-making had been brought to a high degree of perfection in France, having received the direct personal care of men of the best abilities in this line. Some of the processes used at that time have not been improved upon since. There were two factories at Essone under the personal care of Antoine Laurent Lavoisier, the great chemist and the discoverer of oxygen. An English writer says of him: "He improved the manufacture of gunpowder so as to add one third to its explosive force, thereby reversing the previous superiority of English over French ordnance."

Associated with Lavoisier was a young man who must be mentioned as the pioneer in improved gunpowder-making in the United States. Eleuthère Irenée du Pont, son of Pierre Samuel du Pont de Nemours, a statesman of reputation, came to this country in 1801. Having occasion to use some powder of native manufacture, he was struck by its very poor quality. Immediately his thoughts turned to the business he knew so well, and he conceived the idea of starting a manufactory here. Returning to France, he secured the capital required, and came again to this country, bringing his machinery with him. As soon as the necessary preparations could be made he started his works. His name still lives in connection with the establishment he founded. His coming marked the advent of improved methods. Before the importation of the French machinery, the

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art of gunpowder-making had been in a rudimentary state. A few small mills in which the old methods of manufacture prevailed were all that then existed in the United States. The names of the mills have passed away, but the location of one is remembered because it was upon the Brandywine Creek at a point not far from the site of the largest powder-manufactory at present in the country. This small factory was entirely destroyed by a freshet in the stream about the year 1800. From what has been said it may be understood how poor the quality of the powder was which was supplied by the domestic mills before the beginning of this century. The importation of the French methods gave the proper start, at once improving the powder made. With the right start made, it may be safely said that the progress since on this side of the Atlantic has been upon lines independent from those in Europe.

During the war of 1812 our forces were supplied with gunpowder of domestic manufacture. In the period which had elapsed from the beginning of the century the mills had been increased to such an extent as to render this possible. At the beginning of hostilities the United States found it a difficult matter to obtain saltpeter, as it was principally imported, and our coast was blockaded as far as possible by the British. Recourse was had to the old process of "nitre beds." These were masses of organic matter, animal and vegetable remains, mixed with calcareous earth to render the mass porous and to afford a base with which the acid formed could combine. The beds were placed in shaded situations. Nitric acid, being formed by the decomposition, united with the lime and magnesia present in the earth. The beds were afterward lixiviated with water, and the solution treated with water from wood ashes, the potassium carbonate of which precipitated the earthy salts as carbonates, forming in their stead potassium nitrate or saltpeter. This was afterward crystallized from the water of solution. Only a few years ago the plant of one of these nitre manufactories, constructed during the second war with Great Britain, was in a fair state of preservation in the Mammoth Cave in Kentucky, the dry atmosphere of the place having kept the wood of the vats and pipes from decay.

In the period from 1802 to 1840 two large gunpowder-factories were established in the United States, as well as a few smaller ones. During that time the building of canals and mines caused a considerable demand for powder for use in blasting. This became so marked that to meet it the manufacturers placed blasting-powder upon the market, which was simply a powder of ingredients less pure and less carefully incorporated. It was not, however, until 1856 that blasting-powder, as now commonly known, was made. For some years the idea of using sodium nitrate had obtained, but its deliquescent property hindered its introduction. In 1856, however, its preparation was begun on a large scale by the principal manufacturers, a result due to American enterprise alone. It was found that the difficulties which were supposed to be insurmountable were capable of being overcome, and the great blasting-powder industry of the present was the result. Indeed, the introduction of the sodium nitrate into the manufacture of powder may be considered a turning-point in its history. Not only did it revolutionize the industry, but its use so reduced the cost of the production of nitric acid that its influence was felt on the high explosive manufacture which came in a few years later. It gave to the United States the great benefit of a cheap nitrate which it could not otherwise have had.

Gunpowder made from the Chilian nitrate, as the sodium nitrate was at first called, has become one of the articles of prime necessity to our modern civilization. By its means have been developed the great mining operations of the United States, and as yet nothing is known which is capable of taking its place. Its introduction stimulated the extension of the older manufactories and the building of new. When the Civil War began, the gunpowder-factories of the North were in a condition to furnish all the powder that was required by the forces in the field and the vessels afloat. It was the older establishments, however, that were instrumental in supplying the needs of the government, as their experience and financial standing gave them preëminent ability. It must be said, however, that the requirements of the government at the time of the outbreak of the war were simple enough to admit of their being complied with without much difficulty. Had the necessities of modern guns formed the standard attempted, the task would have been different. The supplying of the government with the powder needed during the war called for the exercise of patriotism as much as did the duties of the camp and field. Great lack of skilled labor existed with which to operate the mills. The danger from emissaries of the enemy and lawless persons was always present, and constant vigilance was required to prevent their entrance to the works. It has never been ascertained whether the enemy did cause any damage to the powder-factories of the North during the war; but it is a fact that there were many disastrous explosions, which make the record of the four years of the war the most unfortunate in this particular ever known. Just before the battle of Gettysburg there was a plan on the part of the enemy to destroy the nearest powder-works. This plot was disclosed after the war by the officer who had been instructed to carry it out. The owners of the works, expecting an attack, had everything in readiness to destroy the finished powder, as well as that in fabrication, together with their mills, rather than let them fall into the hands of the enemy.

The Civil War acted as a stimulus to most of the industries of the United States, but there was a different reason for its effect upon the manufacture of powder than for the impetus given elsewhere. While, of course, this industry partook of the general increased activity, it was on account of the improvement in the ballistic conditions of guns that the time of the war was a turning-point for gunpowder. In 1860, General Rodman began his celebrated experiments, upon which it may almost be said were founded the modern theories of heavy ordnance; for he did what had never been done before, he measured the pressure in the bore of a gun at the moment of discharge. Immediately upon this followed the preparation of powder of a larger granulation than had heretofore been used. This change proved of much value; so that it was again due to American ability that new light was thrown upon the subject of explosives. This invention marks the close of the old and simple methods of manufacture and proof, and ushers in the more expensive, difficult, and exacting manufacture, and the more scientific proof. Prior to the time of this invention, the test that was universally applied to gunpowder was that of the "éprouvette" mortar. This was a mortar having about a six-inch bore, with a chamber at the bottom holding one ounce of powder. When the mortar was elevated to forty-five degrees the distance to which the round ball was thrown was the test of the efficiency of the powder. The required distance was 300 yards. It was a very imperfect test, as it showed the quickness of the powder only. No knowledge of the pressure or of the velocity imparted to a given weight of ball was sought or required. The ballistic pendulum was also used. This was a pendulum to which a rifle was securely fastened, being free to swing in the direction of the line of fire. The bullet was received in a metal case filled with sand, covered with a thin board. This case was hung upon another pendulum, also free to swing in the line of fire. The amount of swing of these two pendulums, registered by suitable devices, was the index of the value of the powder for use in the rifle. To General Rodman belongs the credit of inventing the pressure "plug." This was a piston, the head of which was capable of being acted upon by the gases of explosion in the bore of a gun. The end of the piston carried a knife, which had a curved cutting edge resting upon a block of soft copper. The gases at the moment of explosion acting upon the known area of the piston caused the knife to make a certain cut in the soft copper. The length of this cut is the indication of the pressure upon the end of the piston acted upon by the gases in the bore. The length of the cut made with a known weight applied to the knife is compared with this, and an accurate result is obtained. Sir Andrew Noble in England substituted a cylinder of soft copper for the knife, and measured the amount of its compression. This form is in use to-day, and is sometimes called the "crusher gauge."

The importance of this invention can scarcely be overestimated, for it was a step toward the success of modern gun practice, without which improved results would be impossible. The velocity of the ball was measured early, and the two combined made effective the adaptation of the powder to the gun. Benton's chronograph was used for a short time in this country. In it the velocity was measured by the crossing of the swing of two pendulums, which were let fall by electro-magnets, the one by the cutting of a wire in front of the muzzle of the gun, and the other at a measured distance from the muzzle. This form of chronograph was superseded by the Boulenge chronograph, in which a plummet is dropped by the cutting of the muzzle wire, and another by the same at the target, the second by means of a spring making a nick on the side of the first while it is falling, the distance of which mark from the mark made when both plummets are dropped together being the index of the velocity of the ball while traversing the distance from the muzzle to the target. These two instruments are of prime importance in the testing of powder for guns, but there are many other requirements as to density, susceptibility to moisture, and other matters. American ingenuity and enterprise has long been employed in the production of powder for large guns. Here our discoveries have antedated or run parallel with those in foreign countries. Hexagonal, sphero-hexagonal, cubical, and prismatic granulations of powder are all American inventions, the latter in all but its form. The United States has ample supplies to command in the manufacture of domestic powder in event of war.

Soon after the manufacture of nitro-glycerine began abroad it was imported into this country, but as this substance was then in the form of a liquid, several terrible explosions were the result of its transportation. After Nobel's discovery that it could be safely handled when held by an absorbent, works were established in the United States for its manufacture. On the Pacific coast particularly was its use encouraged, the hard quartz-mining being a most desirable field for its operation. Hercules and Atlas powders are the most important forms of American high explosives. Judson powder, an American invention also, is much used upon the Pacific coast. It combines some of the advantages of black blasting-powder with those of a mild form of high explosive. Modern engineering works are now almost wholly dependent upon the use of high explosives in some form. Black powder still has its uses, and will hold its own for years, but in hard rock there is need of more power than is possible with this kind alone. The detonation of the nitro-glycerine compounds shatters the hardest rock in a manner which makes its subsequent removal very economical. There are two engineering works which indicate very well the era of the introduction of high explosives in this country. In the year 1870, the Nesquehoning tunnel, near Wilkesbarre, was excavated in very hard rock by the use of black powder only. The engineers in charge were unwilling to introduce the then new and untried explosive. The work was, however, completed in good form and very quickly, owing largely to the extensive use of compressed air-drills. About the same time the Hoosac tunnel was completed, nitro-glycerine alone being used in the work. This explosive was principally manufactured upon the ground, and was much used in the liquid state. This work was a greater one than the tunnel first mentioned, but the two serve to mark the transition period in the practical use of explosives. One of the greatest of modern engineering works, the Chicago drainage canal, is now being carried on largely by high explosives. It is an example of the magnitude of the work that is attempted with explosives. Most of the American dynamite made by the older manufacturers is very safely handled. One large factory is shipping the material by rail all over the United States, and in thus transporting millions of pounds not one explosion has ever happened in transit. Frequently derailments and collisions have occurred, the dynamite cars, and even the boxes, being broken, and the cartridges scattered, but without evil results so far as this explosive was concerned.

Smokeless powder for small arms was in use in Europe for some time before its introduction here. Schultze powder was the first, but its use was restricted to sporting purposes only. E. C. powder was an English invention, and was imported to this country soon after its use began in England in 1882. Later a plant was built in the United States for its production. Like the Schultze, it was employed for sporting arms only. The idea of smokeless powder for larger guns was first advanced by Viele, in his Poudre B., and later by Nobel in ballistite, in 1886. Ballistite was a combination of nitro-glycerine with gun-cotton, and was the first use of the former attempted in gun practice. As late as 1889 cordite was patented by Sir Frederick Abel and Professor James Dewar for the use of the English government. It derives its name from the fact that it is made in cords or strings, in which state it is used. In smokeless powders the United States is not behind the European nations. An entirely original smokeless powder for sporting purposes has been invented here which is in many respects an improvement on the older powders, and is meeting with success and favorable notice. The adoption of the new .30 calibre rifle by the army and the .236 calibre by the navy has stimulated the efforts of domestic ingenuity, with the result that satisfactory powder can now be procured in large quantity for both branches of the service. In the production of smokeless powder for the large guns the Naval Torpedo Station has taken an important part, having just brought a long line of experiments to a successful conclusion. It has produced an excellent powder for the six-inch rifle. Good smokeless powder has also been offered by private manufacturers, but as yet the departments have moved slowly in the adoption of any of the new powders, being desirous of obtaining the best, and also to be sure of the stability of the product when subjected to the changes of climate necessary.

Gunpowder and explosives are manufactured in a number of the States, Pennsylvania producing the most, and being followed by Delaware, New Jersey, Connecticut, Ohio, California, Iowa, Tennessee, Massachusetts, and Maine. It is estimated that \$7,000,000 to \$8,000,000 worth is produced annually, the capital being about \$20,000,000 and the number of employees about 5,000.

Francis G. du Pont

CHAPTER XXX

AMERICAN LUMBER

TO describe the progress of the lumbering industry during the last hundred years is to write of a class of sturdy people who have carried the first germs of civilization into the deepest wilderness of our vast forests, and who have furnished one of the most essential materials for the building up of our civilization and development in all parts of the country. But it also means the recording of a destruction and deterioration of natural resources such as has perhaps nowhere else been witnessed in so short a span of time. It is a record of which those who have been engaged in making it may be proud, because it required pluck, persistence, and ingenuity on their part; but the nation and coming generations can only regret the wastefulness with which seemingly boundless resources have been exploited without regard to future needs, and to the detriment of desirable reproduction.

Wood is, has been, and probably will always be the most indispensable material for human civilization; and in no country, perhaps, has it played a more important factor in the progress of material development than in the United States. If, as the imperfect statistics at our command indicate, the per capita consumption of wood in all shapes at present falls hardly short of 350 cubic feet,—nearly nine times that of Germany and twenty-five times that of Great Britain,—the probability is that one hundred years ago it was even greater, when iron and stone had not yet replaced the native timber in building, and when coal had not yet been substituted to any extent in the fireplaces of the fathers. While, then, the consumption of wood has always been large, and the exploitation of forest resources one of the earliest occupations of the settlers in the new country, the great lumber industry as we know it to-day is a child of comparatively recent times—hardly over fifty years old; but in that short time it has not only developed in all its parts to gigantic proportions, from a commercial point of view, but has also become an art distinctively American; for no other nation can compete with us in the expertness of the axmen, loggers, drivers, and sawyers, in the excellence of machinery and appliances, or in the systematic methods used in this exploitation of our great natural forest resource.

A hundred years ago logging was carried on only along the coast and the Eastern river-courses. Beside all convenient waters small sawmills, the common accompaniment of all early settlements, were established, the mill parts costing no more than from $60 to $500 at the most. These mills sawed to order for home consumption or sent material to the mouth of the river, to be carried by vessel to home and foreign markets. They were often run in the manner of the country grist-mills,—in fact, usually formed a part of them, the log owner paying toll to the miller for the sawing, and perhaps using the lumber to pay for store goods. That this petty method of doing business lasted until the middle of this century is evidenced by the census of 1840, which reports 31,560 lumber-mills, with a total product valued at $12,943,507, or a little over $400 per mill. The exports of timber, also, although a comparatively important item to the struggling colonies and States, rarely exceeded $5,000,000 per annum during these first four decades of the century.

The getting out of timber, squared and hewn, was then a much more important business; and the construction of wooden ships, then the only kind afloat, furnished a good market for large and select timbers, which constituted, no doubt, the bulk of the exports of a century ago. Timbers worth $200 and more apiece were often cut. "We saw brought in with fourteen yokes of oxen a pine spar, eighty-three feet long, seven feet in diameter at butt, bringing $250," reports a writer from Belfast, Me. In this connection it is interesting to note that such long timbers as masts, spars, etc., were quoted by the inch on the diameter, measured twelve feet from the butt, bringing $1.50 and more per inch in the rough as late as 1850 in Philadelphia. There were then no lumber markets, no prominent lumbering regions, where the business was concentrated; and even in 1820, Williams, in his excellent history of Maine, while carefully enumerating her resources, fails to mention the lumber industries of that State. Although a considerable amount was exported from places like Belfast and others, this lumber was brought to town, like farm produce, by the rural population of the neighborhood. Thus 300 to 400 sleighs arrived loaded with lumber one Saturday in 1816; and in a single day in 1822 136,000 feet were brought into Belfast by the numerous teams of the farmers.

To give an idea of the development of milling in Maine the following example will serve. At Lewiston, Me., the first sawmill, forming part of a grist-mill, was erected in 1770, and destroyed and rebuilt in 1808 and 1814. Not until 1851 was a new mill started, at a cost of $7000; in 1865 one valued at $60,000 found business with gang and circular saws; while in 1867 the Lewiston Steam-Mill Company completed a $100,000 plant. Similarly we find in Pittsburg, Pa., although large amounts of lumber were handled at the place, no mention of the sawmill business in the enumeration of the trades for 1804, 1812, and even as late as 1837; in 1876 there were enumerated thirty-four sawmills, at the head of the list, showing their importance. Yet even then the decline in supplies of certain kinds of lumber in Pennsylvania and New York had already become noticeable, as appears from the report of the Chamber of Commerce of Cincinnati, which was supplied by river from these States. We read in the report for 1869: "Receipts per river light, since the pine of western New York and Pennsylvania is largely exhausted." Prices of raft-run lumber were quoted at this market in 1867 at $24 to $25, and 130,000,000 feet were received. Three years later the chief supply came from Michigan by canal and rail.

In 1838 the first large mills were erected at Williamsport, Pa.; but the boom which afterward supplied between forty and fifty mills was not finished until twelve years later, in 1850. In 1834, Harvey Williams, the well-known pioneer of Michigan, built the first steam sawmill in the Saginaw Valley, and in 1837 completed the Emerson mill, which was considered the "crack" mill of the West. Yet the great lumber industries which have made Saginaw, Mich., famous all over the world were then mentioned only as "prospects," and the great pineries of Michigan, Wisconsin, and Minnesota were still unexplored. Even in 1857, while pine lumbering was carried on as the principal business at Stevens Point, Portage County, Wis., and on the Black, Wisconsin, and Chippewa rivers, the great lumber streams of later years were hardly mentioned. In 1854 a sudden increase in exportations to nearly double the previous figures indicates a change of methods, brought about, no doubt, by improved means of transportation. The export of forest products from that time constantly increased until the present average of $28,000,000 to $30,000,000 worth was attained.

Until 1819 the lumber supplies which found their way into St. Louis, Mo.,—then a mere trading-post, now one of the greatest lumber markets in the world,—were cut in the neighborhood, with whip-saws, at rates of $3 to $3.50 per 100 feet; and in a retail price-list of those times boards are mentioned as "not in the market," pine boards coming from Pittsburg, Pa., in flatboats, and selling at $8 per 100 feet. An accident in the breaking of the boom on the St. Croix in 1843 led to the construction of a log raft, which found its way to St. Louis, and seems to have given an impetus to the growing log trade in that direction, which in 1853 was changed into lumber rafting, initiated by Schulenburg & Boeckler, the extensive mill owners of the St. Croix River. In 1858 a regular lumbering business began at Alpena, Mich., when Archibalt & Murray put in 1,000,000 feet of logs at $2 per 1000 feet, board measure. This material was of a quality which could not now be bought for less than $12 to $15. Later, in 1874, this place turned out 85,000,000 feet of lumber alone, not mentioning shingles and lath.

After the war the settlements of the West grew as if by magic, and with them the lumber industry of modern times developed by rapid strides. In 1868 the "golden age" of lumbering in Michigan had arrived; in 1871 lumber rafts filled the Wisconsin; in 1875 Eau Claire had thirty, Marathon thirty, Fond du Lac twenty sawmills, now all gone; and La Crosse was cutting millions of feet annually from the Black River and St. Croix. By 1882 the Saginaw Valley had reached the climax of its production, and the lumber industry of the great Northwest, with a cut of 8,000,000,000 feet of white pine alone, was in full blast, while even the Southern pineries were filled with the hum and buzz of the circular saws, Mobile and Florida ports alone sending over 300,000,000 feet, board measure, of lumber and hewn timber to foreign markets.

The enormous increase in railroad mileage, opening up new territory and making virgin supplies accessible to markets, had doubtless much to do with this expansion of the lumber trade. It was probably, also, favorable to the concentration of this trade at great centers, and the establishment of lumber markets with wholesale and retail yards, independent of the points of lumber production. Of these, Chicago, the greatest lumber market in the world, derived its supplies from the three great lumber States, Michigan, Wisconsin, and Minnesota, which for a quarter-century have furnished the bulk of the lumber that has built up our civilization in the West as well as in the East. The receipts at Chicago from decade to decade best exhibit, perhaps, the rapid growth of this wonderful industry. In 1847 only 32,000,000 feet of lumber found its way to the then just budding metropolis; in 1855 this had grown to nearly ten times that amount, or over 306,000,000 feet; in 1865 it had more than doubled, the receipts being 647,145,734 feet, to be nearly doubled again in 1875, with 1,153,715,432 feet; increasing to 1,744,892,000 feet in 1885, and reaching a maximum in 1892 with 2,203,874,000 feet; it then fell with the general business depression in 1894 to 1,562,527,000 feet, board measure.

Census figures are, as a rule, only approximations, keeping generally below the truth; and since the method of enumeration is changed with each census, the data do not permit of ready and reliable comparison. Yet the following compilation, taken from the census for 1890, will be useful in showing the rapid increase in lumber production during the last three decades, and will exhibit the marvelous growth of the lumber industry, especially during the last decade:

COMPARATIVE SUMMARY, LUMBER AND SAWMILLS, 1870, 1880, AND 1890.

Items.	1870.[1]	1880.	1890.
Number of establishments reporting	25,832	25,708	21,011
Capital	$114,794,586	$181,186,122	$496,399,968
Average number of employees (aggregate)	149,997	147,956	286,197
Total wages	$32,007,322	$31,845,974	$87,784,433
Cost of material used	$82,674,744	$146,155,385	$231,555,618
Value of prodncts	$168,127,462	$233,268,729	$403,667,575
Average value of products per mill	$6,508	$9,073	$19,212

[1] The amounts for 1870 reduced to gold basis.

That the increase in lumber production is mainly due to home consumption will appear from the following table of exports, which, although showing increases, exhibits no extraordinary growth of the export trade.

VALUE OF EXPORTS OF FOREST PRODUCTS,[1] 1860 TO 1895.

Year.	Value.	Total Exports of Domestic Products.	Year.	Value.	Total Exports of Domestic Products.	Year.	Value.	Total Exports of Domestic Products.
		Per Cent.			Per Cent.			Per Cent.
1860	$10,299,959	3.26	1881	$19,486,051	2.20	1889	$26,997,127	3.70
1870	14,897,963	3.27	1882	25,580,264	3.50	1890	29,473,084	3.49
1875	19,165,907	3.43	1883	28,636,199	3.56	1891	28,715,713	3.29
1876	18,076,668	3.04	1884	26,222,959	3.62	1892	27,957,423	2.75
1877	19,943,290	3.14	1885	22,014,839	3.03	1893	28,335,115	....
1878	17,750,396	2.55	1886	20,961,708	3.15	1894	26,164,114	....
1879	16,336,943	2.34	1887	21,126,273	3.01	1895	28,743,887	....
1880	17,321,268	2.11	1888	23,991,092	3.51			

[1] These figures include, besides lumber, timber, and logs, representing from fifty to sixty per cent., shingles, cooperage stock, firewood, barks, and naval stores.

It is interesting to note that, next to England, South America, Australia, and Africa are among our best customers.

While the census figures above given refer to the lumbering and sawmill business only, the other industries relying upon the same resource, the forest, swell the values derived thence to at least double the amounts, as the following table of estimates based partly on census figures will show.

AMOUNT AND VALUE OF FOREST PRODUCTS USED DURING THE CENSUS YEAR 1890.

Classes of Products.	Quantity.	Estimated Cubic Contents of Forest-grown Material.	Value.
I. Mill products:		Cubic Feet.	
Agricultural-implement stock............feet, B. M..	30,000,000	....	$582,000
Bobbin and spool stock ....do....	49,000,000	....	688,000
Carriage and wagon stock ....do....	66,000,000	....	1,306,000
Furniture stock ....do ...	94,000,000	....	1,435,000
All other sawed lumber ....do....	27,630,000,000	....	310,818,000
Total sawed lumber.........................do ...	27,869,000,000	4,000,000,000	314,829,000
Lath ....pieces..	2,365,000,000	....	3,709,924
Pickets and palings ....do....	110,000,000	....	750,000
Shingles.............................. ....do....	9,276,000,000	200,000,000	17,000,000
Staves.....................................do....	1,178,000,000	300,000,000	7,762,000
Headings ....sets ..	183,000,000	175,000,000	4,934,000
Total lumber and cognate prodncts, directly from logs.	....	4,675,000,000	$348,984,924
II. Railroad construction:			
Ties ... .pieces..	80,000,000	400,000,000	....
Round and hewn timber nsed for bridges and trestles..	....	80,000,000	....
Telegraph poles	....	5,000,000	....
Total...................................... ...	....	485,000,000	$40,000,000
III. Exported timber not included in subdivision I.:			
Hewn timber, 6,900,000 cubic feet	....	9,000,000	$1,230,000
Logs and round timber............................	....	2,500,000	2,000,000
Rived staves, stave and bolts	....	500,000	1,500,000
		12,000,000	$4,730,000
IV. Wood-pulp:			
300,000 tons ground-paper-pnlp	....	75,000,000	$3,550,000
80,000 tons soda-pulp	....		
60,000 tons sulphite-pulp fiber	....		
50,000 tons pulp for other purposes	....		
V. Miscellaneous mill products other than lumber manufactured directly from logs or bolt	....	80,000,000	20,765,000
Total materials requiring bolts or log size	....	5,327,000,000	$418,029,924
This last figure of "miscellaneous prodncts" is a very considerable underestimate, based npon census returns, and we are entirely safe in rounding off the total of sizable timber nsed and its value to.	....	5,500,000,000	$450,000,000
VI. Fuel in the shape of wood	....	18,000,000,000	450,000,000
In the shape of charcoal	....	250,000,000	7,000,000
VII. Wood used for dyeing extracts and charcoal for gunpowder	....	16,200,000	437,000
Total amonnt and value of wood consumption..........	....	23,766,000,000	$907,437,000
	Quantity.	Value.	Total Value.
VIII. Naval stores:			
Turpentine ....barrels..	346,544	$5,459,115	....
Rosin ....do....	1,429,154	2,413,757	$7,872,872
IX. Wood alcohol...........................gallons..	2,000,000	1,750,000	....
Acetic acid in acetate of lime	....	360,000	2,110,000
X. Tanning materials:			
Hemlock bark...............................cords..	1,056,000	6,925,000	....
Oak bark............ ....do....	322,150	2,783,500	....
Hemlock and bark for extract............... .do ...	64,200	307,500	....
Sumac leaves for tanning ....tons ..	3,300	198,000	....
Sumac leaves for extract......................sets...	3,750	112,000	.. ..
Various materials not accounted for	....	74,000	....
			10,400,000
XI. Maple sugar ....pounds..	32,952,927	3,300,000	....
Maple syrup ....gallons..	2,258,376	2,200,000	5,500,000
Total value of forest by-products	....	....	$25,882,872
Total value of all forest products	....	....	$933,319,872
Add 10 per cent. for omissions and underestimates	....	....	93,331,987
Total value of wood and forest products at original place of production, estimated to have been nsed during censns year 1890	....	....	$1,026,650,859

Comparing similar estimates for the census years since 1860, an increase in the consumption of forest products at the rate of thirty per cent. more or less can be asserted for every decade.

Imports of such a bulky material as wood are naturally drawn chiefly from neighboring communities, except in the case of specially valuable woods. With the exception, therefore, of fine cabinet and dye woods of tropic origin, and other kinds which we do not produce, we import lumber and timber from Canada only. Although considerable discussion has been raised over the tariff duties on Canadian lumber, the importations from that country represent hardly five per cent. of our lumber consumption, ranging in total value for the last fifteen years between $10,000,000 and $20,000,000 out of a total importation of forest products ranging from $15,000,000 to $30,000,000. Almost the entire cut of the province of Ontario, tariff or no tariff, goes to the United States, while over eighty per cent. of the Quebec, New Brunswick, and Nova Scotia lumber goes to England.

At present, while sawmilling is, to be sure, carried on wherever trees can be found to cut, the staples of the market come from those regions where supplies are still most abundant and, at the same time, means of communication are well developed. White pine, the king of the American forest, furnishing the most useful lumber for building, as well as for a great many other purposes, is, of course, our greatest staple, forming more than one quarter of our entire lumber output. The long-leaf pine of the South,—the celebrated pitch-pine of the English markets, the yellow or Georgia pine of our markets,—unsurpassed for strength and combining most desirable qualities as timber, comes next in quantity of production. Two other Southern pines, the short-leaf and loblolly,—also known in the markets as North Carolina and Virginia pine, although growing in all the Southern States,—help to replace the waning supplies of white pine, spruce, fir, and hemlock; and while their use is chiefly local, they form a considerable amount in our lumber consumption. Cypress and cedar also help in a limited way in filling the requirements for coniferous timber, of which not less than 30,000,000,000 feet, board measure, are needed annually. The magnificent timbers of the Pacific coast,—the redwood, the Douglas spruce, the sugar-pine, the Port Orford cedar, etc.,—of the most excellent quality, and obtainable in sizes and clear material found nowhere else, have hardly yet reached the Eastern markets, the distance preventing profitable shipment. Most of this material goes by water to foreign markets. Of hard woods, our oaks (some ten or twelve marketable species), ash in several species, and hard maple are superior to those of other regions of the world; the tulip-poplar and the hickories have no equals of their kind; sycamore, walnut and cherry, birch and elms, furnish rich ornamental woods; and altogether the supply of wood materials in the United States excels every other region of the world in the combination of diversity of kinds, quality, utility, and abundance.

Maine, once the white-pine State, has long ceased to cut any appreciable amounts of that greatest staple of the American market, but supplies the bulk of the spruce, with New Hampshire and the Adirondacks in New York to help, and Boston, Albany, and New York City for markets. The white pine of Michigan is nearly all cut, and the supplies in Wisconsin and Minnesota are beginning to show signs of exhaustion; so that the enormous output of a round 10,000,000,000 feet per year will soon be reduced, and that materially. Hemlock supplies, despised twenty years ago except for the tan-bark, are still abundant in northern Pennsylvania and the neighboring counties of New York, but will not last long.

With the waning of the Northern coniferous timbers the Southern supplies are coming more and more to the front. The coast regions of the Atlantic, as well as the Gulf shore, furnish large quantities of long-leaf, short-leaf, and loblolly pine, some 7,000,000,000 feet, board measure, of these being cut annually, with eastern Texas probably still best supplied. Cypress, long despised, is now a well-established article, with main supplies in Louisiana and along most of the river-bottoms of the Southern States. Hard woods still abound in nearly all the central portions of the country east of the Mississippi, with St. Louis and Memphis as the principal markets, although some kinds, like the ash, the tulip-poplar, and the walnut, are more or less exhausted. An attempt to estimate the standing supplies for the lumber industry, based on rather slim and unsatisfactory data, would distribute the same as follows:

STANDING SUPPLY OF LUMBER IN THE UNITED STATES.

Southern States	700,000,000,000 feet, B. M.
Northern States	500,000,000,000 " "
Pacific coast	1,000,000,000,000 " "
Rocky Mountains, etc	100,000,000,000 " "
	2,300,000,000,000 feet, B. M.

Other estimates increase this amount doubtfully by twenty-five per cent.

The present cut, based on somewhat more reliable

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data furnished by census figures and other sources, may be estimated at a round 40,000,000,000 feet, board measure, including all material requiring bolt or log size, valued at about $450,000,000. This cut may be roughly estimated as distributed by regions and kinds in the following manner:

LUMBER CUT BY REGIONS AND KINDS.

Regions.	Feet, B. M.	Kinds.	Feet, B. M.
New England and North Atlantic States	6,000,000,000	White pine	12,000,000,000
Central States (mostly hard woods)	5,000,000,000	Spruce and fir	5,000,000,000
Lake regions (mostly pine)	13,000,000,000	Hemlock	4,000,000,000
Southern coast (mostly pine)	10,000,000,000	Long-leaf pine	4,000,000,000
Pacific coast	4,000,000,000	Short-leaf and loblolly	3,000,000,000
Miscellaneous	2,000,000,000	Cypress	500,000,000
		Redwood	500,000,000
	40,000,000,000	All other conifers	1,000,000,000
		Oak	3,000,000,000
		All other hard woods	7,000,000,000
			40,000,000,000

and the systematic methods of handling the business. If Germany has become the teacher of the world in the matter of forestry,—that is, in the rational reproduction and management of timber crops,—the lumbermen of the United States of America have become the most expert exploiters of the natural forest resources. Methods of cutting, hauling, handling, sawing, marketing, and all the appliances and tools employed have been developed to the highest degree, and all means have been adapted to the end which from the standpoint of private interest appears desirable, namely, largest immediate profits.

One of the remarkable facts in connection with the rapid development of the lumber industry is that with the necessary decrease of natural supplies the expected increase in price has not followed. This is due to several causes, the competition especially of the smaller mills, the increased facilities of transportation to market, and the lack of appreciation of the decrease of supplies being the most potent. That this latter condition is, however, not entirely lost sight of we find in comparing the price paid for stumpage of white pine, the leading staple during twenty-eight years, with that paid for the manufactured lumber.

These improvements, almost all put in practice since 1850 and later, are to be found in the logging appliances, the means of transportation of the logs to the mill, the sawmill, and the handling of the lumber. The ax of to-day, although much the same in shape as of old, is of better material and of superior workmanship; the handle of hickory, manufactured wholesale and sold cheaply, of a form which permits best execution, has, even in conservative Europe, supplanted the clumsy straight handle. Since the fifties cross-cut saws have more and more been used in felling, and in reducing the waste in the woods; the improvements in form, in the shape of

PRICES FOR LUMBER AND STUMPAGE OF WHITE PINE.

(COMPILED FROM REPORT OF SAGINAW BOARD OF TRADE.)

Year.	Lumber, per 1000 Feet, B. M.		Stumpage, per 1000 Feet, B. M.		Year.	Lumber, per 1000 Feet, B. M.		Stumpage, per 1000 Feet, B. M.	
1866	$11.50 to	$12.00	$1.00 to	$1.25	1877	$9.25 to	$9.75	$2.25 to	$2.75
1867	12.00	12.50	1.25	1.50	1878	9.50	10.00	2.25	2.75
1868	12.00	12.50	1.50	1.75	1879	10.50	11.00	2.50	2.75
1869	12.50	13.00	2.00	2.50	1880	11.50	12.00	2.75	3.00
1870	12.00	12.50	2.00	2.50	1881	12.50	13.00	3.00	4.00
1871	12.50	13.00	2.00	2.50	1882	14.00	14.50	3.50	4.50
1872	13.00	12.00	2.00	2.50	1883	13.50	14.00	4.00	5.00
1873	11.50	11.00	2.00	2.50	1884	12.50	13.00	4.00	5.00
1874	10.50	10.00	2.00	2.50	1885	12.50	13.00	4.50	6.50
1875	9.50	10.00	2.25	2.75	1886	12.50	13.00	4.50	6.50
1876	9.00	9.50	2.25	2.75	1887	12.50	13.00	4.50	6.50

That the stumpage value has increased sixfold, while the lumber value has hardly increased at all, points to a potent influence upon price, which can hardly be accounted for even by increased competition and transportation facilities. We have to seek it in the improvement of the tools, the machinery, the teeth, in the adjustable handle as well as the superior workmanship, have made American saws, and especially those of the firm of Disston & Sons, Philadelphia, Pa., world-famous. Steam drag-saws and tree fellers have been invented, but are not used to any extent; the application of the electric current in tree felling has not yet been more than experimental. One of the simplest yet most valuable aids to the logger, the ingenious peavy or cant-hook, perfected after 1870, excites the admiration of the European woodsman by its effective adjustment and almost elegant form.

The organization of the logging crew into swampers (road makers), choppers, sawyers, loaders, and teamsters is, at least in the pineries of the Northwest, as perfect as that of any business concern in New York. The timber estimators of large firms, and the scalers using scalers' rules, a specifically American invention of comparatively recent date, are experts in their way. Log sleds and log wagons with high wheels are essentially American inventions, but have not changed much in the last thirty or forty years. A mechanical steam-logger, which makes its own ice-road, traveling through the woods like a locomotive, skidding the logs, was put into practical operation a few years ago, but seems not to have been generally accepted. On the other hand, the "pull-boats" used in the swamps of the South, which, by wire ropes operated from the steam-engine on the boat, skid the cypress logs for a distance of two to three miles on either side of river or canal, have proved a perfect success, cheapening and simplifying the otherwise difficult logging operations in these swamps.

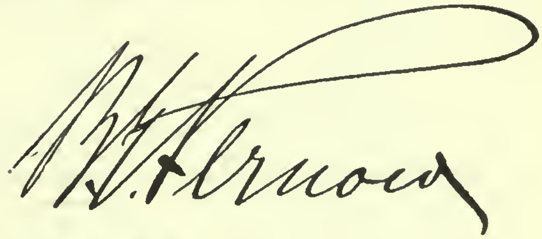
Railroads have not only brought distant lumber centers within easy reach of markets, but they have even penetrated the woods themselves, connecting the mill with the sources of supply, reducing, although not superseding, the river-drive. The temporary tramway, broad or narrow gauged, reaching out for fifteen, twenty, and more miles from the mill to the cuttings, is a common feature of lumbering operations, especially in the Southern woods; while water carriage is still largely practised in the North, and especially in the mountain country. Here driving of logs is done as in times gone by, both loose and in rafts; but the orderly arrangement of drives, booms, and boom companies, which act as carriers of the log crop of many firms from the woods to the mill, are in their present form an American practice developed within the last forty years.

The greatest improvements have been made in the mills themselves. The water-mill, with its single sash-saw, pulled downward by the water-wheel and back by means of a large elastic pole, with its cog-wheel feed, old-fashioned carriage and blocks, and its independent dogs made by the blacksmith, which was most common until well-nigh the middle of this century, hardly exists to-day. It was superseded at first by the circular or rotary saw, an invention of an entirely new principle, which may be claimed by Europe; for S. Miller received a patent in England for a saw of circular form—the description, however, being doubtful—in 1777, and C. A. Abert obtained patents in France in 1799 for a circular saw in sections, which in England was patented by Brunel in 1805. In the United States the year 1814 seems the first in which a consignment of such saws was received from England at Pawtucket, and the same year one was manufactured by B. Cummins at Bentonville, N. Y. But it is apparent from the many patents for single and gang reciprocating saws that until about 1830 the rotary saws did not find much favor. They were, however, perfected gradually, and improved in mounting, in plate and teeth (the first insertible teeth, an American patent, was issued to W. Kendall in 1826). The ease with which they could be set up anywhere, and the rapidity with which they did their work, favored their introduction, until in 1860 the great mass of lumber was cut by them. Gang-saws were operated in the old countries as early as the sixteenth century, and muley-saws were also of early origin, although many improvements were made in the United States; and with the growth of the lumber trade the gang-saws for the manufacture of better-grade material kept pace in their introduction with the rotaries.

The band-saw, the perfection of sawmill machinery, although invented as early as 1808 by an Englishman, W. Newberry, and patented in the United States by one Barker, seems to have been first put into practical operation for log sawing—it had hitherto been used only for scroll sawing—in 1872 by Hoffman Brothers, for cutting hard woods in the Maumee Valley in Ohio. Into the pineries of the North it found its way only in the eighties, the difficult adjustment, especially for rapid work, being against it; but now all the best-equipped mills of that region have discarded the rotary, and work with band-saws, single and sometimes double, supplemented by nicely adjusted gang-saws, the band-saw preparing the log for the latter rather than converting it into lumber. In hard woods, and in Southern and Western mills, to be sure, the rotary, single or with top and bottom saws, still prevails. Of the many improvements in the mill, covered, together with those in saws, by over 2500 patents, over 700 of which fall in the decade from 1870 to 1880, and over 800 in the last decade, I can only mention the direct steam-feed, supplanting the rope and friction appliances; the accurately adjusted setting-works, head-blocks, and dogs; the steam-nigger, a most remarkable log-turning device; endless chains for bringing the log into the mill; and mechanical carriers for lumber and for refuse. The improved edger, which converts the rough unedged board into commercial shape, and the trimmer, with its complicated system of levers and "lift" or drop saws, prevent in the better mills much waste and a loss of millions. With the improvements in the mill came improvements in its adjuncts, the introduction of shingle, lath, and slab saws reducing the waste and using up inferior material; planers, flooring, matching, and molding machines, in connection with the sawmills, refining the lumber at the original point of manufacture. In the manner of sawing rift, or quarter-sawing, is a notable departure, as it adds to the ornamental effect of certain kinds of lumber, as well as to the wearing qualities for certain uses. The simple piling of lumber to secure seasoning has been gradually superseded, especially in the South, by artificial drying in kilns and other devices, all introduced since 1867, natural-draft and blower kilns being most popular. This method of driving out the water from lumber artificially is perhaps the greatest advance in the lumber industry during the last fifteen years, in its saving of time, material, and capital. Systematic and uniform inspection or classification of lumber is still rather undeveloped in this country, though lately considerable attention has been paid to the subject in the meetings of the lumbermen's associations, and of the wholesale and retail yardmen.

That the lumber business has progressed to a high degree of development is perhaps best attested by the existence of at least thirty or forty associations of manufacturers and dealers, of wider or narrower scope, having more or less direct relation to the lumber business. Besides the lumber departments forming parts in general trade journals, there are fifteen or twenty publications specifically devoted to the lumber trade, at least five or six of which will compare favorably with the best trade journals of other branches in make-up and contents.

With the end of the century the lumber industry will have reached the climax of its development. The white pine, the great staple, will then have been reduced so as to be practically exhausted, and the lesson of the need of economy with our forest resources will then have been learned. The means of economy will be found in more careful preparation, and especially in more careful selection of material for different uses; many species now overlooked or despised will be utilized, and inferior material will satisfy the hitherto lavish taste; finally, the cutting in the woods will be done with more care, and they will be managed for reproduction. In other words, forestry, the art of producing wood crops, will have become established as the basis of the lumber industry of the twentieth century.



CHAPTER XXXI

PETROLEUM: ITS PRODUCTION AND PRODUCTS

EXPORTS OF PETROLEUM.

Scale: One Inch per 180,000,000 Gallons.

Year ending June 30th.	Gallons Exported.
1864	23,210,369
1865	25,496,849
1866	50,987,341
1867	70,255,581
1868	79,456,888
1869	100,636,684
1870	113,735,294
1871	149,892,691
1872	145,171,583
1873	187,815,187
1874	247,806,483
1875	221,955,308
1876	243,660,152
1877	309,198,914
1878	338,841,303
1879	378,310,010
1880	423,964,699
1881	397,660,262
1882	559,954,590
1883	505,931,622
1884	513,660,092
1885	574,628,180
1886	577,781,752
1887	592,803,267
1888	578,351,638
1889	616,195,459
1890	664,491,498
1891	710,124,077
1892	715,471,979
1893	804,337,168
1894	908,281,968

THE Historic Moment for petroleum was that at which Drake "struck oil" on Watson's Flats, near Titusville, Pa., August 28, 1858. In less than forty years, therefore, petroleum production and manufacture have grown to their present proportions. To-day the exports already rank fourth in the list for value, being surpassed by only cotton, breadstuffs, and provisions. For the year ending June 30, 1864, the total exports were 23,000,000 gallons; by 1869 they had grown to 100,000,000 gallons; by 1874 to 200,000,000 gallons; by 1877 to 300,000,000 gallons; by 1880 to 400,000,000 gallons; by 1882 to 500,000,000 gallons; by 1887 to 600,000,000 gallons; by 1891 to 700,000,000 gallons; by 1893 to 800,000,000 gallons; and last year to 900,000,000 gallons. To-day a larger percentage of the oil product of the country is sent abroad than of any other product except cotton.

The growth in exports of illuminating oil is still more marked. Those for the year ending June 30, 1866, were three times those of 1864; those of 1868 twice those of 1866 and six times those of 1864;

those of 1871 twice those of 1868 and twelve times those of 1864; those of 1877 twice those of 1871 and twenty-four times those of 1864; those of 1891 twice those of 1877 and forty-eight times those of 1864. In other words, beginning with 1866, the exports of illuminating oil were doubled in 1868, again in 1871, again in 1877, and again in 1891. Those of last year were more than sixty-two times those of thirty years ago. The average exports per week in 1894 were twenty-five per cent. more than the total for the entire year 1864. While considering this great growth in business, a glance at prices may be of interest. Export oil averaged in 1861 61½ cents per gallon; in 1871, 23⅝ cents per gallon; in 1881, 8 cents per gallon; in 1891, 6⅞ cents per gallon; in 1894, 5⅙ cents per gallon, or one twelfth the price in 1861. But this decrease, great as it is, does not represent the actual reduction in the price of oil, as the cost of barrels is included in these prices. A gallon of bulk oil cost, in 1861, not less than 58 cents; in 1894, not more than 2¾ cents, or less than one twentieth. The money that in 1861 was required to buy 1000 barrels of oil would have purchased, in 1894, over 20,000 barrels.

Enormous capital and energy have been required to establish an industry of such magnitude. Pipe-lines aggregating 25,000 miles in length—a girdle for the globe—and 9000 tank-cars—placed end to end, an unbroken train extending three fourths the distance between New York and Philadelphia—helped in moving the products to the home markets; while sixty-nine bulk steamers, not to mention bulk sailing vessels and the fleet of steamers and ships carrying oil in barrels and cases, transported them to the most distant quarters of the earth. Petroleum undoubtedly has a wider sale than any other American product. Wherever commerce has made its way it has found a welcome. "It is carried wherever a wheel can roll or a camel's foot be planted. The caravans on the Desert of Sahara go laden with astral oil, and elephants in India carry cases of standard white. Ships are constantly loading at our wharves for Japan, India, and the most distant isles of the sea."

The able special agent on petroleum for the Eleventh United States Census estimated the value of wells and land at over $155,000,000, and showed that the investment in plant employed in the production of crude petroleum brings this sum up to $229,000,000. This does not include the value of pipe-lines, nor of tank-cars, nor of the great fields of tankage for the storage of crude, nor of the costly refineries, nor of the terminals and docks at the seaboard for export shipments, nor of the fleet of bulk vessels carrying the product to foreign shores. The census report gives the value of refineries as over $77,000,000. We think it no exaggeration to estimate the total capital required for the production, manufacture, and transportation of petroleum and its products at $400,000,000.

The sinking of Drake's well was an event so momentous, starting the grand industry we are to describe, that the story is briefly repeated. The first petroleum company organized in the United States was the Pennsylvania Rock Oil Company, with a nominal capital of $500,000, incorporated in New York, December 30, 1854. The projectors were George H. Bissell and Jonathan D. Eveleth, members of a law firm in New York City. It chanced that Mr. Bissell's attention had been directed to petroleum by noticing a sample of it when on a visit to Hanover, N. H., his native place. This sample had been brought to Professor Crosby, of Dartmouth College, by Dr. T. B. Brewer, the son of one of the members of Brewer & Watson, lumber merchants at Titusville. Mr. Bissell's interest found substantial expression in the purchase of 105 acres of Watson's Flats, near Titusville, including an island at the junction of Oil and Pine creeks. On this island oil had been collected for eight or nine years by means of a series of pits arranged like separators, the water flowing away below, leaving the oil floating on the surface, to be dipped up with blankets. Some of the organizers of the company resided at New Haven, Conn. At their suggestion a quantity of the oil was sent to Professor Benjamin Silliman, Jr., who made an exhaustive analysis and an elaborate report. As it was most favorable, a Pennsylvania Rock Oil Company was formed in Connecticut, with headquarters at New Haven, and the property held by the New York corporation transferred to it. Mr. Bissell still retained, in 1857, his interest in the Connecticut company. He happened, in 1856, to see an advertisement of "Kier's Petroleum," a patent medicine owned by Samuel M. Kier, a druggist at Pittsburg. The advertisement showed the derrick of the brine-well from which the oil was secured with the brine. It suggested to Mr. Bissell that perhaps the crude, which was being obtained in such limited quantities by means of surface pits, might be found in paying quantities if artesian wells were sunk. The Seneca Oil Company in 1857 succeeded the Pennsylvania Rock Oil Company, of Connecticut, with a plan of drilling for the oil. Mr. E. L. Drake—soon known as "Colonel" Drake—was sent to Titusville the following year to carry out this project. He was forced to invent some new way of reaching the rock at which to begin drilling, as the hole he tried to dig filled with water and quicksand. It occurred to him to drive a pipe down to the rock—a plan afterward adopted not only in oil-well boring, but in all artesian drilling. Drake's tool struck the rock at thirty-six feet. Drilling then proceeded slowly, under the direction of "Uncle Billy" Smith and his two sons, until the bore had penetrated the rock thirty-three feet, when, on Saturday night, August 27th, the drill dropped into a crevice about six inches. The tools were pulled out and put aside for the work to be resumed on Monday. But Sunday afternoon Smith visited the well, to make sure that all was safe, and saw liquid within a few feet of the top of the pipe. He dipped up a little and found it to be oil. They had reached petroleum in the first sand, thirty-three feet through the rock, and sixty-nine and one half feet below the surface of the ground. When the pump was started on Monday, the well produced at the rate of twenty-five barrels per day, at that time an incredible quantity. They had hoped for gallons, and found barrels of the precious fluid.

It is impossible to state when petroleum was first discovered. In some form it seems to have been applied to the uses of mankind from the earliest periods known to history. The "slime" of the Old Testament, mentioned as the mortar used in constructing the Tower of Babel, 2200 years before Christ, was probably partially evaporated petroleum; and the "pitch" with which Noah coated the ark, 250 years earlier, was doubtless a similar product. The ruins of Nineveh and Babylon indicate that the asphaltic cement used for their walls and buildings was composed, in part at least, of semi-fluid bitumen. Perhaps the first mention of the use of petroleum for illuminating purposes is the "Sicilian oil," described by Pliny and Dioscorides Pedanius, the Greek botanist, as secured near Agrigentum, now called Girgenti, on the island of Sicily, to be remembered as the site of the temples of Concord and of Olympian Jupiter. This oil was burned in lamps as early as the beginning of the Christian era.

In America the Indians collected what was known as "Seneca oil" from petroleum springs; and the indications are that, long before them, the mound-builders, who worked the copper-mines of Lake Superior, the lead-mines of Kentucky, and the mica-mines of North Carolina, not only gathered the oil that flowed from natural springs and appeared on streams, but even dug numerous wells in Pennsylvania Ohio, and Canada, and dipped up the petroleum that flowed into them. Trees now growing in the earth thrown out in digging the wells, or in the wells themselves, show that this work was done from 500 to 1000 years ago.

The success of Drake's well ushered in a period of almost unparalleled excitement, surpassed only by the gold fever of California, ten years before. Western Pennsylvania, in 1859 and the next few years, was the scene of indescribable activity and speculation. Wells were sunk in great numbers along Oil Creek, French Creek, and the Alleghany River. Adventurers flocked thither from all parts of the country. What was soon known as the "oil region" was transformed from an almost unbroken forest into camps and towns. Many of the wells yielded nothing, others lasted but a short time, while some gave enormous quantities of oil. As the producing fields changed, the population shifted with the fields, and the towns that had sprung from the wilderness as by the touch of a magician's wand vanished almost as quickly as they had grown. Pithole City, for example, in 1865 next to Philadelphia the largest post-office in the State, has now entirely disappeared and the site of the city become a farm.

Elsewhere is given a table showing the quantities of oil produced each year. From this it will be seen that by the end of 1859 fully 200 wells were in successful operation, and the production of crude oil amounted to 2000 barrels. Phenomenal growth then followed. The next year the production was 500,000 barrels, and in 1861 it had increased to 2,113,609 barrels. In addition to this amount, it is estimated that at least 10,000,000 barrels ran to waste because of lack of barrels to hold it or a market to take care of it.

During the first two years after the success of Drake the search for oil was restricted to the territory around Titusville, wells being sunk up and down both sides of Oil Creek, and back on the hills that form its banks. The drills were then tried on the Alleghany River, and its shores were found to yield abundantly. It was not unnatural, though not very logical, for the petroleum seekers to feel that there must be some connection between the trend of Oil Creek and the Alleghany River and the underground deposits of oil. As it happened, the oil-bearing strata extended generally under these two streams; but a glance to-day at a map showing the location of all the oil-fields that have been discovered will demonstrate to the eye the fallacy of this belief, as the fields in some instances stretch across the Alleghany River at right angles. Up to this time all of the oil secured had been lifted from the wells by pumps. A new surprise was now in store for the producers. The first flowing well was struck in February, 1861, on the McElhenny farm, yielding 300 barrels per day. It flowed for fifteen months. This surprise had not spent itself when the Phillips well was struck, shooting forth ten times as much oil per day as the first well, and was followed soon by the Funk well, matching the Phillips in productiveness, giving 3000 barrels per day; the Noble well, with 3000 barrels per day; and the Sherman well, with 2000 barrels per day. The Noble well produced upward of $3,000,000 worth of oil, and the Sherman well flowed an average of 900 barrels per day for two years.

Such a stimulus as the finding of these "gushers," or petroleum fountains, following one another in quick succession, increased the production enormously; for not only did the large wells add to the quantity produced, but the success in striking them encouraged prospectors generally to renewed efforts for obtaining capital for further development. The production in 1861, a little more than 2,000,000 barrels, was increased fifty per cent. in 1862—to 3,000,000. As a natural consequence prices rapidly declined. Five cents per barrel was the price actually touched in November, 1861. A fresh surprise was still in store for the oil operators when it was found that productive territory need not necessarily underlie the valleys and river-bottoms, but that the high lands also covered the hidden treasure. In 1862 the drillers became crowded in following the banks of the Alleghany River, and pushed back into the adjacent country. They had already climbed the hills bordering Oil Creek and the Alleghany River, but now tested the high plateaus of Clarion, Butler, Armstrong, McKean, and Warren counties. In 1864 the Economy well and the surrounding region in Warren County, and the Pithole division in Venango County, became prominent.

Much of this extension of the oil region was carried out on lines developed by C. D. Angell and others, who formulated "belt theories" which they thought would enable them successfully to locate the subterranean deposits. Angell made a study of the relative location of the largest wells. In the Titusville group a narrow strip of country running in a direction a little east of north took in all the most productive ones. It is strange that the fact had not been noticed before. When the lower country was discovered, he quietly mapped out a similar field in Clarion and Butler counties, parallel to the Titusville one, and secretly secured leases of much of the territory. His success was patent, and others were led to see that he worked with method, which they soon copied. The plan was somewhat more scientific than that which had been followed in developing the territory along Oil Creek and the Alleghany River; and yet wildly tracing a line by the direction of a compass, and hoping to find productive territory after passing miles of untested country, almost suggests superstition. Even if the trend of the oil-bearing strata has been found, and there is reason to believe that the same strata extend under untried territory, still, when one remembers that the slightest variation from the true angle at the start soon becomes an error of miles if carried to a distance, the futility of the plan is seen. Besides, nature's lines are seldom straight. The oil-bearing sands are undoubtedly deposited in curves and in beds at intervals only. This is now recognized, and the oil-leads are traced by means of the drill, without any reference to the topographical conformation of the surface.

A northern district next claimed from the middle and southern a share of public attention when the Bradford field was found. The date generally given is that of December 6, 1874, when a well on the Buchanan farm, two and one half miles from the town of Bradford, was struck. In 1875 the production was fully 25,000 barrels; in 1876 it had increased to 380,000 barrels; in 1877 to 1,450,000 barrels; in 1878 to 6,500,000 barrels—as much in a day as was produced in a whole year in 1875. In the following year the production was again doubled, and brought up to 14,200,000 barrels. In 1880 it was 22,300,000 barrels; in 1881, over 23,000,000 barrels. The production of all the other Pennsylvania fields in that year was only 4,238,000 barrels, the Bradford production being six sevenths of the whole. In 1876 the Bullion and Warren oils appeared. The same year the Beaver district of Clarion County became prominent. In June, 1879, oil was found in the Richburg field in Allegany County, New York, closely allied—so far, at least, as location is concerned—with the Bradford territory. The first well was put down as a "wild-cat" or test well, and produced at the rate of four barrels per day, hardly foreshadowing the enormous output soon to follow; for in 1881 it had reached 600,000 barrels, and in 1882, 6,450,000 barrels. In 1880 the Clarion and Warren productions became a feature in the calculations of the producers. In May, 1882, the Cherry Grove oil made its appearance, of sudden growth and of almost as sudden decline. Found in May, it yielded in July over 24,000 barrels per day, but in October less than 9000, the average for 1883 being only 2000 barrels per day, which fell to 400 the following year. In September, 1884, the Thorn Creek oil was secured; the great Phillips well, the largest flowing well ever opened in America, starting at the rate of 10,000 barrels per day, which gradually declined to 500 barrels.

In 1885 and 1886 the production in Washington and Greene counties became prominent. During these two years the number of wells put down was greatly increased, the total for 1886 being 3478, the largest number for several years. The stocks of crude continued to be so large as to occasion general alarm among producers. The largest stock on record is that of August 31, 1884—a total of 39,084,561 barrels. The average stock of 1884 was 35,953,975 barrels; of 1885, 37,698,481 barrels; of 1886, 35,732,291 barrels. The early part of 1887 showed little decrease in production; and prices, with some minor fluctuations, steadily declined. In August, 1885, crude was quoted at $1.04 per barrel; in January, 1886, it had declined to 90 cents. It averaged for December, 1886, only 71 cents, having several times during the year fallen below 65 cents. The bottom price of 54⅜ cents was touched in July, 1887, the average for the month being only 59¼ cents. A plan was formulated at this time by the producers, looking to curtailing for a time the output of the oil-fields. An agreement was drawn up and signed by the members of the Petroleum Producers' Association. By it about one quarter of the production, or at least 17,500 barrels per day, and as much more as possible, was to be "shut in" for one year, beginning November 1, 1887. The movement was a success. The average daily production of the three months ending October 31st was about 64,000 barrels; that for the following three months only 41,000 barrels, a reduction of 23,000 barrels per day. The agreement was to stop cleaning out and torpedoing all wells for one year, and to shut in a certain part of the production of other wells. In 1888 the production was only 16,488,668 barrels; while it had been, in 1887, 22,356,193 barrels. The stock reported for October 31, 1887, of 30,662,583 barrels, was reduced to 18,995,814 barrels by December 31, 1888; and the average price of certificates advanced from about 67 cents in September, 1887, to 93 cents in September, 1888; the average for the year 1888 being 87 cents, as compared with 66⅝ cents for the year 1887. In 1889 production was again resumed, and 5435 wells were completed, as compared with only 1515 in 1888, and 1660 in 1887.

The phenomenal McDonald field appeared in 1891, but began to decline in the latter part of the year and continued to decline through 1892. In that year the production of the Sistersville field took its place to a considerable extent. Since then the production has steadily declined. In 1894 the production of what is known as Pennsylvania crude was 84,000 barrels per day, while the consumption was 100,000 barrels per day. The stocks were reduced to 6,336,777 barrels at the end of the year.

Fortunately for the American industry, the Ohio field appeared, to supplement the supply of the Pennsylvania field. At the World's Columbian Exposition the display of petroleum, particularly that offered by the Standard Oil Company, was impressive and magnificent. Its cost was commensurate with the magnitude of the industry it typified. The judges made many awards, but one was unique in the Mining Department, if not in the whole fair. It was "a special award for the manufacture from Ohio crude, known as 'Lima oil,' of the best illuminating oil ever made from any kind of crude oil." The breadth of this statement arrests attention, and, had we nothing else to signalize the Ohio petroleum-field, this alone would make it worthy of careful study. But a glance at the field's record shows that, for other reasons, it should not be overlooked. The total production of crude petroleum in the whole United States in 1894 was about 49,000,000 barrels. Of this, 20,000,000 barrels, or more than two fifths, came from the Ohio territory. For many years—in fact, up to 1885—the Pennsylvania field was regarded as the undisputed source of supply of petroleum for the world, and up to to-day its production has aggregated 500,000,000 barrels—a quantity so vast as to be almost incomprehensible. Yet the Ohio territory, operated during only the past eight years, has already furnished over 100,000,000 barrels, or one fifth the quantity secured from the more eastern field during its whole career of over thirty years.

The finding of what is known as the Ohio field—which is not limited to the State from which it takes its name, but, much like the Pennsylvania field, stretches out into adjoining States—was a surprise to both geologists and practical men. Expert drillers and scientific geologists feared that the limits of the American industry had been reached. So high an authority as the late Dr. Charles A. Ashburner, the eminent geologist, who made the oil-fields of Pennsylvania his life-study, wrote in 1885 that, in his opinion, the boundaries of the oil regions were well established, and that there was no reason-

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able expectation that any new and extensive field would be found. This was but another instance to support the maxim of the practical driller that "geology never filled a tank." Even while this opinion was being written, the drill was penetrating the rock at Lima to reach the oil reservoirs underlying so large a part of the State, and within a few months the great Ohio territory was an assured fact.

The production of Ohio crude in 1885 amounted to 650,000 barrels; in 1886 it had grown to 1,800,000 barrels. The following year it had grown to 10,000,000 barrels; the next year to 12,500,000 barrels; and in 1890 to 16,000,000 barrels, the average production each year up to 1893, when it was 18,500,000 barrels. Last year it was over 20,000,000 barrels. Until 1890 the Ohio crude had to be marketed as fuel, the sulphur compounds it contained rendering it impossible to refine it into illuminating oils; but during the last few years enormous strides have been made in the way of improvement in handling this refractory product, until not only satisfactory but even very superior oils are now manufactured from this crude product.

One of the first problems which the oil producer had to solve was that of transportation. The market for his product was the refineries that had been constructed in some of the large cities — particularly at the seaboard—for the production of illuminating oil out of coal. The oil-wells along Oil Creek and the Alleghany River were at first many miles from a railroad, in a lumber district where there were often no roads, or at best very poor ones. Those who have traveled in the oil region know that for several months of the year the roads are rendered almost impassable by the mud. Their condition in the days when they were merely trails up over the hills and through the valleys of the sparsely settled country can hardly be imagined. Oil City was the nearest shipping point, and Pittsburg the large distributing center. Crude oil was put into barrels, loaded on trucks, and hauled to Oil City. The loss was very great. The barrels, being old, leaked freely as they made their rough trip from the interior to the railroad. Barges were soon called into use and the barreled oil loaded on them; or the barges themselves were made tank-boats for holding the oil in bulk, and the load floated down Oil Creek to the Alleghany River at Oil City. But Oil Creek during most of the year was a shallow stream, and the novel plan of slack-water navigation, known as a pond freshet or "pond fresh," was resorted to. The water in the streams tributary to Oil Creek was held back by dams until sufficient quantities had accumulated; and then, at a fixed hour, each body of water was in turn released, filling the main stream for a short time with a flood. On this the barges of oil were carried down to their destination, warning having been given so that the boatmen along the stream might be ready to take advantage of the tide as it passed. The body of water was not large in extent, and considerable skill had to be used in starting at the right moment, and in navigating the boat during the trip. If the start was made too late, the waters would pass ahead and leave the craft stranded. If it was made too soon, the barge might be caught in the boiling waters and the power to guide it be lost. Losses were frequent. The barges collided with one another or struck projecting rocks in their rapid trip. Therefore, when boats were introduced for carrying the oil from Oil City down the Alleghany to Pittsburg, larger and stronger ones were constructed.

In the mean time, in 1862, the Atlantic and Great Western Railroad was carried into the oil region. In 1866 the Alleghany Valley Railroad was opened up from Oil City, at the mouth of Oil Creek, to Pittsburg, and a number of narrow-gauge lines constructed as feeders into the heart of the producing country. At first the barrels were loaded on flat cars; but the water mixed with the oil dissolved the glue used for coating the inside of the barrels, and the leakage in consequence was so large that wooden tank-cars were soon built, with two wooden tubs or vats, each holding 2000 gallons, placed on an ordinary platform-car. This was the forerunner of the tank-car of to-day. In 1872 cars consisting of a horizontal cylindrical tank of iron, mounted on a four-wheel platform or railroad truck, appeared. These were at first of no greater capacity than the wooden cars they displaced, but have been gradually increased in size as their plan of construction has been improved, until many of them are now of 8000 gallons' capacity each. There are between 8000 and 9000 tank-cars in use in the United States.

The magnitude of the petroleum industry made it necessary to find some mode of transportation even cheaper than a railroad. By force of circumstances barges and tank-cars for oil in bulk displaced the truck carrying oil in barrels. The pipe-line, in turn, displaced the car and boat. The introduction of this mode of transporting oil marks an era in the petroleum industry. The freight by rail amounted to five or six dollars per car from the region to New York. It was most economical, therefore, to refine the crude product near the wells, so that freight need be paid only on the kind desired, and the quantity to be moved reduced to a minimum. The country around Pittsburg and Oil City was filled with small works taking out of the crude the refined oil needed for export. When the idea of allowing the oil to flow from place to place through iron pipes was put into practical form, the cost of transportation was so much reduced that a few enormous refineries were built at the seaboard, near New York, Philadelphia, and Baltimore, and on the shores of Lake Erie, near Buffalo and Cleveland, to do the work which the almost countless small refineries in the oil region had heretofore done. This meant a revolution in methods of manufacture and in costs.

Samuel Van Syckle, of Titusville, was the first to put down a working line. It was only four miles long, extending from Pithole to Miller's farm, and carried but eighty barrels per day. It demonstrated, however, the thorough practicability of moving oil in this way. The difficulty up to this time had been in making the joints of the pipe tight. Van Syckle overcame this; and, although his line faced an ascent of nearly 500 feet, the oil was delivered at the further end practically without loss. This line, together with another laid in the same year by Henry Harley from Benninghoff Run to the Shafer farm, passed into the control of a corporation known as the Alleghany Transportation Company, by which it was operated. The owners and drivers of oil wagons saw that this mode of transportation must soon deprive them of occupation, and they did what they could to retard the progress of the work. They cut the lines, set fire to the tanks with which they were connected, and even threatened the proprietors and managers with personal violence. An armed patrol and the arrest of the ringleaders by detectives soon quelled this outbreak. The pipage of oil was a great general improvement, and personal interest had to yield. To-day the oil region is a network of pipes; and great trunk-lines, pulsing with the moving oil, supply the needs of New York, Philadelphia, Baltimore, Cleveland, Buffalo, Pittsburg, Chicago, and of many intermediate points.

The growth, however, was gradual. Lines were first laid only to the refineries in the oil region, and to the railroads taking the oil out of the region. With the lengthening of the pipes and the increase of pressure to force the liquid to greater distances, men became more and more impressed with the possibilities of the new mode of transportation, and enthusiastic ones began to believe there was no point short of the seaboard to which the oil might not be sent. In 1875 an organization called the Pennsylvania Transportation Company was granted a charter with power to construct a pipe-line to the seaboard. The only outcome of this venture was the building of various lines within the oil region. Short lines multiplied, and pipe after pipe from the producing fields to the refineries and railroad shipping points crossed and paralleled one another in every direction. Competing companies waged war upon one another, cutting rates to the point where business was done at an actual loss. When the producer had run his oil into the storage-tanks of one of these concerns he was not certain whether the certificate received (for they all issued certificates instead of paying cash for oil) had any value; yet he must either send the oil through the pipe nearest to him, or allow it to pass back into the earth from which it came. The concentration of these badly managed competitive companies into some centralized organization with systematic and economical methods was a necessary consequence of the situation.

The United Pipe-Lines Association, first known as the Fairview Pipe-Line, organized by Captain J. J. Vandergriff and George V. Forman, became the starting-point for such a movement. Into it were merged from time to time the other local lines —the Antwerp, Oil City, Clarion, Union, Conduit, Karns, Grant, Pennsylvania, Relief, the Clarion and McKean divisions of the American Transfer Company, the Prentiss lines, the Olean pipe, the Union Oil Company's line at Clarendon, and the McCalmont line, with others too numerous to mention. The first trunk-line was laid in 1874 from the lower oil country to Pittsburg. It consisted of thirty-nine miles of three-inch pipe, running from Carbon Center in Butler County to Fairview, a suburb of Pittsburg. The trunk-line to Cleveland next followed. Pipe-lines now extend from the Pennsylvania oil-fields to Cleveland, Buffalo, New York, Philadelphia, and Baltimore; and from the Ohio fields to Cleveland and Chicago. It is probably not an overstatement to say that the total length of these lines is 25,000 miles.

In a few instances petroleum has been obtained from the earth of color and odor so good that it could be burned for illuminating purposes in its natural state. Again, in a few instances—somewhat more numerous than those just mentioned, but still limited in number—oils have been found, heavy in gravity, and so free from both light ingredients and paraffine that they are excellent lubricants in the condition in which they come from the ground. But these instances are so few that it can be given as a rule that all the uses to which petroleum is put require a manufactured article.

Below is given a table of the production of petroleum in the United States from the time of its discovery through 1894. These figures are taken from the records of the United States Geological Survey. They show a total production of over 650,000,000 barrels, valued at not less than $500,000,000.

projects represented by these works had to be abandoned when the existence of Pennsylvania crude oil became known, and the plants were sold at a great sacrifice and rearranged for the distillation of petroleum. It was in such stills as those at the works named, constructed originally for handling coal, that refined oil was first manufactured in commercial quantities.

PRODUCTION OF CRUDE PETROLEUM IN THE UNITED STATES.

(Barrels of 42 gallons.)

Year.	Pennsylvania and New York.	West Virginia.	Ohio.	Indiana.	California.	Colorado.	Kentucky and Tennessee.	All other States.	Total United States.
1859	2,000	....	....	....	....	....	......	.....	2,000
1860	500,000	....	....	....	....	....	......	.....	500,000
1861	2,113,609	....	....	....	....	....	......	.....	2,113,609
1862	3,056,690	....	....	....	....	....	......	.....	3,056,690
1863	2,611,309	....	....	....	....	....	......	.....	2,611,309
1864	2,116,109	....	....	....	....	....	......	.....	2,116,109
1865	2,497,700	....	....	....	....	....	......	.....	2,497,700
1866	3,597,700	....	....	....	....	....	......	.....	3,597,700
1867	3,347,300	....	....	....	....	....	......	.....	3,347,300
1868	3,646,117	....	....	....	....	....	......	.....	3,646,117
1869	4,215,000	....	....	....	....	....	......	.....	4,215,000
1870	5,260,745	....	....	....	....	....	......	.....	5,260,745
1871	5,205,234	....	....	....	....	....	......	.....	5,205,234
1872	6,293,194	....	....	....	....	....	......	.....	6,293,194
1873	9,893,786	....	....	....	....	....	......	.....	9,893,786
1874	10,926,945	....	....	....	....	....	......	.....	10,926,945
1875	8,787,514	[1] 3,000,000	[1] 200,000	....	[1] 175,000	....	......	.....	12,162,514
1876	8,968,906	120,000	31,763	....	12,000	....	......	.....	9,132,669
1877	13,135,475	172,000	29,888	....	13,000	....	......	.....	13,350,363
1878	15,163,462	180,000	38,179	....	15,227	....	......	.....	15,396,868
1879	19,685,176	180,000	29,112	....	19,858	....	......	.....	19,914,146
1880	26,027,631	179,000	38,940	....	40,552	....	......	.....	26,286,123
1881	27,376,509	151,000	33,867	....	99,862	....	......	.....	27,661,238
1882	30,053,500	128,000	39,761	....	128,636	....	[1] 160,933	.....	30,510,830
1883	23,128,389	126,000	47,632	....	142,857	....	4,755	.....	23,449,633
1884	23,772,209	90,000	90,081	....	262,000	....	4,148	.....	24,218,438
1885	20,776,041	91,000	650,000	....	325,000	....	5,164	.....	21,847,205
1886	25,798,000	102,000	1,782,970	....	377,145	....	4,726	.....	28,064,841
1887	22,356,193	145,000	5,018,015	....	678,572	76,295	4,791	.....	28,278,866
1888	16,488,668	119,448	10,010,868	....	690,333	297,612	5,096	.....	27,612,025
1889	21,487,435	544,113	12,471,466	33,375	303,220	316,476	5,400	2,028	35,163,513
1890	28,458,208	492,578	16,124,656	63,496	307,360	368,842	6,000	1,532	45,822,672
1891	33,009,236	2,406,218	17,740,301	136,634	323,600	665,482	9,000	1,509	54,291,980
1892	28,422,377	3,810,086	16,362,921	698,068	385,049	824,000	6,500	135	50,509,136
1893	20,314,513	8,445,412	16,249,769	2,335,293	470,179	594,390	3,000	110	48,412,666
1894	19,019,990	8,577,624	16,792,154	3,688,666	705,969	515,746	1,500	42,867	49,344,516
Total.	497,512,870	29,059,479	113,782,343	6,955,532	5,475,419	3,658,843	221,013	48,181	656,713,680

[1] Includes all productions prior to this year.

When Drake opened the way to an indefinite production of crude petroleum there were many coal-oil refineries in active operation ready to turn from the distillation of coal or shale to this cheaper and more tractable article. Two large refineries—one built on Newtown Creek, almost at the site of the present Kings County Oil Works, on Long Island, by L. F. Cozzens, the West Point hotel proprietor, and the original Delmonico; and the other, the Empire Works in South Brooklyn, also on Long Island—had just begun a successful career. The

The first great step forward in the art of refining was the result of an accident. Crude petroleum is made up of a great number of differently compounded hydrocarbons. The earlier methods of rapid running resulted in a simple fractional distillation, these compounds being separated from one another as the degree of heat was increased, and, beginning with the lightest, being vaporized and passed over as a vapor into the condenser-coil, there to be reduced to liquid form by being cooled. Such a distillation produced a series of products following one another in regular order from the lightest in gravity or density down to the heaviest, until the liquid in the still was all vaporized, and nothing was left but the dry or burned oil on the sides and bottom. "Cracking" is the technical term for destructive distillation, whereby the compounds of which the crude substance is composed are separated not only from one another, but to a degree into their component parts, and new compounds are allowed to be formed. The result is that vapors are thrown over into the condenser-worm, and liquefy into products of lighter gravity—in other words, of less density; while the heavy vapors, being condensed in the still before passing into the worm, fall back into the liquid in the still, to be again and again vaporized and decomposed. It was by accident that it was discovered that the compound known as crude oil could, by destructive distillation, be converted into compounds of greater simplicity of construction; the lighter ones, which are more valuable for the production of illuminating oils, being carried over into the condenser-worm to be there liquefied, and the heavier ones left in the still to be further broken up or reduced to liquid residuum in the still, or to a dry sediment or coke on its bottom. Allen Norton Leet claims that the discovery was made at a little works in Newark, N. J., in the winter of 1861–62. This increased the yield of burning oil fully twenty per cent. By means of retarding the distillation the same result in the way of destructive distillation was secured as would have been reached had the distillation taken place under pressure. The heavy vapors struck the upper part of the still, were condensed, and dripped back into the oil below, which was at a higher temperature than the boiling-point of the oil falling back. This produced decomposition in the oils by superheating the vapors. The discovery was soon known at all refineries, both at the seaboard and in the region, and methods of manufacture were revolutionized.

It is no exaggeration to say that 200 different products are now made from crude petroleum. The limits of this chapter will not, of course, permit even mention of each, further than to outline some general classification. The broadest that can be made is to divide the products into those that result from the distillation and those that result from the reduction of the crude article. Every product, we think it safe to say, that has been obtained from crude oil is secured by one or the other, or, in some cases, by a combination of both of these processes. By distillation is meant the converting of the crude by heat into vapors, and the condensation of those vapors back to a liquid, from which the manufactured article is produced. By reduction is meant the driving out of the crude petroleum by heat its lighter portions, leaving the remaining product behind, still in liquid form. Products of both classes can be, and usually are, made by the same process; that is, while heat is converting one part of the crude oil into products by distillation,—that is, turning them into vapor for condensation,—it is at the same time converting the other part into a product of reduction by driving off the very vapors that make the distillate products. Again, both processes are often resorted to in successive stages of manufacture to produce certain articles. A distillate product is afterward reduced, and a reduced product is afterward distilled, in some instances the processes being repeated several times before the finished goods are secured. This is particularly true of the lighter and the heavier parts resulting from the method of manufacture, aiming to convert the major part of the oil under manipulation into some desired product. These lighter and heavier parts are therefore known to petroleum manufacturers as by-products. As petroleum in its crude state is composed of an almost indefinite number of differently compounded hydrocarbons,—that is, combinations of the chemist's elementary substances, carbon and hydrogen, varying in volatility,—and as the manufactured products are almost countless in number, it will be readily understood that the methods of manufacture must be many, complicated, and delicate. In the early days of the industry but one product, refined oil, was sought for, and to-day the staple article of manufacture is that same product, secured, however, in many grades. But the possibility of making other valuable products was soon apparent, and each year experience and study in the art have developed almost unlimited extension of the uses of petroleum.

A considerable portion of our domestic trade in refined oil, and some portion of the trade in lubricating oils, has for many years been done in bulk. By this is meant that no package is used for the product as it passes from the refinery to the consumer. Its course is somewhat as follows: When finished at the refinery it is pumped into large storage-tanks. From these it is delivered in bulk to barges or tank-cars. These carry it to the stations, where it is pumped, again in bulk, into tanks, from which it is delivered to tank wagons. These serve it in bulk to the dealers' tanks, to be by them delivered to the customer, or, in some cases, direct from the tank wagon to the consumer. But this mode of transportation for export trade is of recent growth. The change in the mode of transportation, when it had once begun, was carried forward with startling rapidity. In 1886 two steamers were fitted up, the *Crusader* and the *Andromeda*. The former was filled with a large number (forty-five in all) of cylinder-tanks of different sizes, averaging in capacity 125 barrels, making the total capacity of the ship about 275,000 gallons. The *Andromeda* was provided with rectangular tanks, seventy-two in number, making the total capacity about 685,000 gallons. Neither of the steamers made many voyages. But when the thought was once fairly presented it soon became apparent that it was only mechanical construction which stood in the way of making the change. Sailing vessels carried from 5000 to 8000 barrels each, and made about two and one half to three trips per year; bulk steamers could be built to carry 20,000 to 30,000 barrels, or three times as much as a sailing vessel, and make seven to nine trips per year, or three times as many as a sailing vessel. The result has been that last year as many as sixty-nine different tank steamers carried oil from the United States abroad, and fully ninety per cent. of the total exports of crude and refined oil, other than those in cases, was made in bulk.

Some of these steamers are "converted"—that is, turned—into bulk boats, although built for other uses. They can generally be distinguished by the fact that their boilers and engines are amidships. In the case of the vessels built for this trade the boilers and engines are placed aft for greater safety. Many of the tank steamers are constructed especially for this service. They are models of marine architecture. They are built entirely of iron, the decks included. When loaded the whole body of the vessel is filled with oil, the ship's structure forming the necessary receptacle, the liquid occupying all the space to the "skin" or iron of the sides and bottom. This is a great improvement over such a form of construction as that of the *Crusader* and the *Andromeda*, already referred to, decreasing the cost of transportation by increasing the carrying capacity of the vessel, there being no unoccupied space between the tanks, and decreasing the risk of fires and explosions, as these empty spaces gave room for the accumulation of gas. Both these objections held true against the style of construction adopted later of a double bottom, the bottom of the oil-tanks being elevated a short distance above the actual bottom of the ship. The tank-ships, as now built, have a longitudinal and numerous transverse bulkheads, which, with the stringers and beams put in to prevent the slightest straining, make them, from a structural point of view, undoubtedly the strongest and safest vessels in the mercantile marine.

The change from barrel to bulk transportation means large economies in many ways. Before it was made, oil was filled into barrels, each package weighed by itself, then rolled to the dock front and hoisted up over the side of the ship, lowered into the hold, and stowed away. Each operation required considerable manual labor. The sailing vessel, for a month or six weeks, was then exposed to the delays and vicissitudes of an ocean voyage, arriving at length at its destined port. Here she was unloaded, a barrel at a time, and the oil stored away in packages to be held until used, subject to loss from leakage and serious damage in appearance. By the new method of transportation a steamer comes to the wharf, and the oil is pumped from the refinery storage into her tanks with great rapidity, the largest of the ships being loaded in from twelve to fifteen hours, even though they hold four or five times as much as the sailing vessels of a few years ago. A voyage of two weeks and a few days, perhaps, the time being subject to very close calculation, brings the cargo to the foreign port. Here it is unloaded with the same despatch that was used in loading, the oil being pumped into large storage-tanks on shore, in which it is held without loss or damage until needed, the steamer starting immediately on her return trip. Not a moment is lost, and no item of unnecessary expense incurred.

It seems scarcely credible that the exports of petroleum, which have now attained such enormous proportions, could have begun only thirty years ago. Messrs. Lockhart & Company, of Pittsburg, have been generally considered the pioneers in the export business, having the distinction of sending the first American oil abroad—some 400,000 gallons, in 1862. But Mr. Allen Norton Leet claims that James Day sent 1000 gallons of refined oil to Australia in 1859; and that Colonel A. C. Ferris, in the same year, made shipments to South America, Germany, and Italy. However this may be, there were no exports worthy of the name before 1863 or 1864; so that it is not an overstatement to say that the export trade in petroleum has reached its present proportions in the short space of thirty years.

The following tables show the annual exports of illuminating oil from July 1, 1863, to June 30, 1895, and the average price in barrels each year. The graphical table at the beginning of this article shows the total petroleum exports, aggregating for thirty-one years the enormous quantity of 11,830,068,888 gallons, valued at not less than twelve hundred millions of dollars ($1,200,000,000).

EXPORTS OF ILLUMINATING OIL.

Year ending June 30th.	Gallons.	Year ending June 30th.	Gallons.
1864	12,791,518	1880	367,325,823
1865	12,722,005	1881	332,283,045
1866	34,255,921	1882	488,213,033
1867	62,686,657	1883	419,821,081
1868	67,909,961	1884	415,615,693
1869	84,403,492	1885	458,243,192
1870	97,902,505	1886	469,471,451
1871	132,608,955	1887	480,845,811
1872	122,539,575	1888	456,487,221
1873	158,102,414	1889	502,257,455
1874	217,220,504	1890	523,295,090
1875	191,551,933	1891	571,119,805
1876	204,814,673	1892	564,896,658
1877	262,441,844	1893	642,239,816
1878	289,214,541	1894	730,368,626
1879	331,586,442	1895	714,859,144

Many subsidiary industries have sprung up, based upon the value of oil as an illuminant and as a material to give heat. There are very few houses west of the Alleghanies, in cities of moderate size, where an oil-stove is not to be found; many are also used in the East, but not in as great a proportion. The manufacture of these goods is carried on in Cleveland, Chicago, and New York. Oil-lamps afford employment to the manufacturers of lamp-chimneys, lamps, and lamp-stands. By discoveries in the methods of supplying oil and air to lamps in a better way than formerly, these can now be made of a brilliancy far beyond those of twenty years ago. It may be said that those produced in 1860 did not generally exceed four candle power and those of 1876 twenty candle power, but now it is perfectly practicable to obtain, in any city of the country, lamps giving from sixty to one hundred candle power, larger ones also being manufactured.

AVERAGE EXPORT PRICES OF REFINED OIL, IN BARRELS, AT NEW YORK.

Year.	Cents.	Year.	Cents.
1861	61½	1878	10¾
1862	36⅜	1879	8⅛
1863	44¾	1880	9
1864	65	1881	8
1865	58¾	1882	7⅜
1866	42½	1883	8
1867	28⅜	1884	8⅛
1868	29½	1885	8
1869	32¾	1886	7⅛
1870	26⅜	1887	6¾
1871	24¼	1888	7½
1872	23⅝	1889	7⅛
1873	17⅞	1890	7⅜
1874	13	1891	6⅞
1875	13	1892	6
1876	19⅛	1893	5¼
1877	15½	1894	5⅕

H. C. Folger Jr.

CHAPTER XXXII

AGRICULTURAL PRODUCTS

AGRICULTURE is by far the chief industry of the United States. The agricultural products of the country greatly exceed in quantity and value any other class of products. While the percentage of our population directly connected with agriculture is steadily decreasing, it is still much larger than that engaged in any other calling, and this must long remain true. Agricultural products, as produced, or as transformed by processes of manufacture, are the basis for by far the largest part of the trade and commerce of the country, whether domestic or foreign. Averaging one year with another, agricultural products constitute about seventy-five per cent. in value of all our foreign exports, and nearly or quite one half our total imports.

The growth of the United States in population, as in many other things, has been phenomenally rapid, but the growth in agricultural products has more than kept pace with the increase in population. There are great fluctuations from year to year, but the rule is that we not only feed and help clothe our people, increasing at the rate of from 1,250,000 to 1,500,000 annually, but we have a larger surplus each year to send to other countries. The total exports of merchandise from this country in 1795 amounted to less than $50,000,000. The average value of the agricultural exports alone has been nearly $650,000,000 annually during recent years. This nearly or quite equals the rate of increase in population.

There are no means by which we may determine, with any approach to accuracy, either the area devoted to farm crops or the quantity produced in the United States in 1795. The total population was perhaps 4,500,000. The great majority of these lived on farms or in villages, but the farms were small and, as a rule, poorly cultivated. In a great degree the agriculture of the country was simply self-sufficing. There was a considerable surplus of a few articles, as shown by the exports. Of these tobacco was chief. Even before the beginning of the Revolutionary War as much as 40,000,000 pounds of the weed had been exported in a single year. Prior to 1795 there had been annual exports of some millions of bushels of wheat and some hundreds of thousands of barrels of flour; and the exports of corn had risen to at least 2,000,000 or 3,000,000 bushels in favorable years. There was, however, little incentive to the raising of agricultural products, generally, beyond the needs of the people of the country. The miserable roads, and the lack of transportation except by means of wagons, furthermore made it practically impossible to send the surplus to a seaport, except from neighborhoods near at hand. Even had it been possible to market the surplus, it was not possible to produce any great quantities of most kinds of farm crops. Not one of the great labor-saving machines now in use on farms had reached any considerable advancement, and very few had been invented or discovered. With the exception of plowing and harrowing, nearly all farm operations were performed by manual labor, with the use of rude and relatively inefficient tools and machinery. The plows in use were miserably inefficient in comparison with those everywhere to be found at the present time. Efforts were being made to improve these tools. A patent was granted in 1797 for a cast-iron plow. In 1798 Thomas Jefferson wrote an essay in which he discussed the best form and curvature of the mold-board of plows, this being, so far as is known, the first attempt in this country to apply scientific principles to such a problem. Much of the effort of the farmers was still necessarily expended in enlarging the cultivated areas of their farms—cutting down the forests, removing the timber or stones, etc.

It is obvious that the most persistent and intelligent efforts, under such unfavorable conditions, could not produce any great surplus of food products over the wants of the people, and it must be confessed that the majority of the farmers of the country were far from being intelligent, enterprising men. There were many exceptions, perhaps most notably among the plantation owners of the Southern States; but the rule was that the farmers were poorly educated, very often not especially industrious, and, of course, without any knowledge of what is now known as scientific agriculture. A very few associations for the advancement of agriculture had been organized, but their influence was almost nothing. The agricultural exhibition, the agricultural paper, the agricultural meetings for discussion, were still of the future. As a class the farmers were very poor, only beginning to recover from the great industrial depression caused by the Revolution and the subsequent attempts to establish a stable government. It is an interesting fact, however, that almost every farm crop now produced in the United States had been tried even prior to the Revolutionary War. The chief exception is sorghum—not only the saccharine but the non-saccharine varieties, of which large quantities are now grown as food for farm animals. In comparatively recent years some plants have been introduced which give promise of becoming important farm crops, but no one of them is as yet to be so classed.

This is not the place for the discussion of the subject, but it may be said that the farm animals of the United States were few in number and generally quite inferior in quality a century ago. There were more good horses, relatively, than there were either cattle, sheep, or swine. It may also be pointed out that efforts at improvement of the farm live stock of the country may be said to have begun about the commencement of the century—at least so far as cattle and sheep were concerned. The dairy industry of the country, so important in recent years, and which has made such marvelous advances within the last third of a century, was practically unknown, except in so far as there were attempts to supply each community with some butter and less cheese from small farm dairies. It is the pleasant duty of others to chronicle the marvelous development of horticulture, but it may be noted that the condition of this now great interest was even less advanced one hundred years ago than was the growth of farm crops or the rearing of farm animals.

As we look back one hundred years, then, we see that 1795 was not only a day of small things, of mere beginnings of the nation, but peculiarly was it a day of small things in agricultural work. Compared with the present time the farmers were few in number, poor in purse, poor in implements and machinery; doing most of the farm work with hand-tools of rude design; with little or no idea of the benefit of rotation of crops or the best utilization of manures; with little incentive to produce more of most crops than was sufficient to supply the neighborhood demands; and with the poorest of facilities for transporting any surplus to relatively distant markets in this country, or to seaports for export. All honor to them for what they accomplished under great difficulties; double honor to many of them for their perception of the need for improvement in many lines, and the wise and persistent efforts to secure improvement by the invention and introduction of improved machinery, better varieties of grains and animals, better methods of culture and management, and better facilities for transportation.

Turning now to the present, we find a really marvelous development along many lines. Size is not a proof of excellence, but we may well be interested in the vast extent of our agricultural domain and its annual products. By the census of 1890 there were in the United States 4,564,641 farms, containing 623,218,619 acres, or covering 973,779 square miles. Of these millions of acres, 357,616,755, or over fifty-seven per cent., were improved, and produced farm crops in 1889 valued at $2,460,107,454. These farms, with machinery and live stock, were valued at almost $16,000,000,000. In the more than five years since the census was taken there has been a large increase in these figures. In the decade preceding 1890 there had been an increase of 555,704 farms, and over 87,000,000 acres of the farms of the country. The aggregate value of the yearly product of these farms, inconceivably large as the figures given are, does not include the value of the live stock on the farms, although much of the vegetable product was consumed by it. Of the 357,000,000 acres reported as improved on the farms of the country, not quite one half are in crops which require plowing and cultivating each year. A few great crops occupy most of this area. The corn-field of the United States annually covers an average of about 72,000,000 acres, the wheat about 37,000,000, the oats 27,000,000, and cotton some 20,000,000. From 2,500,000 to 3,000,000 acres are devoted to the potato crop, about 3,000,000 to barley, 2,000,000 to rye, less than 1,000,000 to buckwheat or tobacco. The meadows occupy some 50,000,000 acres. Nearly all the remaining vast area is used for pasturage, or lies practically uncultivated, as no one other crop has, relatively, a large acreage.

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Mere numbers give little idea to most of us when they reach into the millions; but a few more may be given here. Indian corn or maize is the chief grain crop of the United States, as it was the most valuable addition to the world's list of foods contributed by America. This country is far in advance of all others in corn production. The average crop is about 1,700,000,000 bushels. Twice in recent years the official estimates exceeded 2,000,000,000 bushels, and the estimates of the crop of 1895 have made it larger than in any preceding year. In seasons favorable for this crop the product is at least thirty bushels for each man, woman, and child in the country. Corn is more largely used for human food in the United States than in any other country; but the total so used is only a small percentage of the whole crop. Nearly the entire product is consumed in the country, however, as it is the chief grain used in the production of beef and pork, and is largely fed to all classes of farm animals. The quantity exported is large actually, but very small relatively, averaging less than four per cent. for the last twenty-five years. In but one year (1890) did the exports equal 100,000,000 bushels. Earnest efforts have been made in recent years to cause an increased demand from Europe for this grain. As yet no striking effects have been produced, but there is reason to hope that there may ultimately be a large increase in our exports of this greatest of all our farm products. Grown in every State and Territory, by far the larger part of the crop is produced in seven States, lying in the eastern central part of the country—Ohio, Indiana, Illinois, Iowa, Missouri, Nebraska, and Kansas. In a favorable year a single county in one of the great corn-growing States will have a much larger yield than will the six New England States.

In area devoted to the crop and in value of the product wheat has long ranked second among the grain crops of the country. For a series of years recently the average yield has been about 475,000,000 bushels. The maximum crop was over 611,000,000 bushels, produced in 1891 from almost 40,000,000 acres. The rapid and continuous decline in value of wheat, believed by many to be permanent, has had a considerable effect in reducing the acreage. As wheat is the great bread-food grain of highly civilized races of men, as it has been relatively little used as food for animals, and as five to six bushels per inhabitant per year is a liberal allowance, it is obvious that we have had a large surplus for export year by year. The exports of wheat and wheat-flour have long formed a large part of our enormous exports of breadstuffs. In 1892 these articles to the value of over $236,000,000 were sent abroad. It may well be doubted whether wheat culture has not reached its maximum for a series of years, but there is no reason to believe that this grain will cease to be one of the most important of our agricultural products.

Third in area, and of increasing importance among the grain crops, are oats. The average crop for the past six years exceeds 650,000,000 bushels; the crop of 1895 being considerably larger than that of any former year. The quantity of oats used for human food in this country has greatly increased in recent years, actually and relatively; but the grain is still chiefly used as food for farm animals, and, as with corn, the crop is almost entirely consumed in our own country, the quantity exported being insignificant in comparison with that used within the United States.

Among the most valuable of all the farm crops of which any considerable percentage is directly sold is hay. In 1893 the acreage devoted to this crop was about 50,000,000, and the yield over 65,000,000 tons, valued at $570,000,000. Much of this is shipped considerable distances within the country, but only a very small percentage is exported.

The great cotton crop will be separately treated, and space will not permit even the briefest mention of other crops important as some of them are. As has been indicated, many of these crops are used chiefly in the production of animals or animal products. These will be treated in another chapter.

One farm industry is so important and interesting in its rapid spread and development that it deserves at least brief recognition. No agricultural interest of the country has had a more striking growth since the Civil War than has the dairy. Prior to 1860, while much butter and a good deal of cheese were manufactured, dairying received special attention in but few parts of the country. The methods of manufacture were primitive, and much of the product was inferior in quality. Associated dairying—the manufacture of butter and cheese in large factories, which often receive the milk produced on many farms—may be claimed as a system of American origin; and its introduction and rapid spread soon after the close of the Civil War probably did more to cause prosperity and increased intelligence among the farmers over large areas of the country than did any other one thing in connection with our agriculture. In quite recent years there have been most important improvements in methods, and while there has been serious decline in prices,—in part caused by the introduction of substitutes for butter, made from other animal fats,—it seems certain that American dairying is to continue to advance in the extent of the products and, if wise measures be pursued, in the quantity of these exported. Already the value of the dairy exports in a single year has closely approximated $200,000,000. So large a proportion of the milk given by the more than 16,500,000 dairy cows in the country is consumed on the farms where produced that it is almost impossible even to approximate the total quantity.

As was the case with our government, so in relation to agriculture it may be said that all that had preceded the century under consideration was but the preparation for a great and rapidly developing system. Our agriculture, like our government, has characteristics which more or less sharply separate it from that of other countries. The contrasts between our agricultural systems and those of Great Britain are especially striking. Most noticeable of all is the vast extent of our agricultural domain and the vast aggregate of our products. Agriculture is here not only the basal but the chief industry of the country. We export very much more of the products of the farm than we import. In the past, and in large degree in the present, we have had low-priced lands and relatively high-priced labor. Naturally this has given great stimulus to the invention, improvement, and general introduction of agricultural machinery, and we need not be surprised at the fact that a larger percentage of farm work is done with the aid of machinery over much of our country than in any other land. Systems of management are simple, not firmly established, and relatively readily modified. Probably in no other country are farmers more ready to take up the cultivation of new crops or new varieties of plant or animal crops, new machinery, new markets or methods of marketing.

The system of land tenure is still, as a rule, absolute ownership of moderate-sized farms. The percentage of tenant farmers is, unfortunately but perhaps inevitably, somewhat rapidly increasing as the average price for farm lands advances in the more newly settled regions; but more than seven out of ten of the farms of the whole country are still cultivated by their owners. The average size of the farms, estimated at 137 acres, indicates that the division has, as a rule, been for the purpose of direct personal management by the owner, with comparatively little hired labor. Of the 4,564,641 farms reported by the census of 1890, only 58,207 were returned as containing over 500 acres, while there were over 2,000,000 containing between 100 and 500 acres, and over 1,100,000 with between 50 and 100 acres.

As has been noted, our agriculture is still expanding; the acreage in farms, and in a much greater degree the acreage under cultivation, is steadily increasing. This fact suggests an explanation of the apparently uncomplimentary fact that the average yields per acre of our great crops are below those of some other countries with certainly no better soils. In the past the abundance of low-priced lands—much of them to be had almost for the asking—led to their occupation by many who had little experience in farming, little capital, and too often had more expectation of profit from an advance in the price of the land than from the growth and sale of farm crops. Much of the criticism passed on American farming and American farmers has not, however, been just. Compared with their fellows in other lands, the actual working farmers of the United States are more cosmopolitan, coming from many lands, and changing location within the country with too great readiness; they have at least equal intelligence and education, and more of ability to adapt themselves to new conditions and successfully solve new agricultural problems.

Space will not permit an extended review of the causes of the marvelous development of agricultural products in the United States in the last century. Mention may be made of some of the more noticeable ones, however. Of course the most obvious one was the existence of such almost immeasurably large tracts of fertile soil, inviting tillage not only by the descendants of the early colonists, but by millions of immigrants from the more densely populated countries of Europe. But until better means of transportation were discovered than existed a century since it was practically impossible that regions distant from the seaboard or navigable rivers should be settled. Few things have done more to stimulate settlement and the cultivation of the soil than the introduction of the steamboat, the canal, and, most of all, the railroad; but no student can fail to realize that without the invention of improved agricultural machinery it would have been absolutely impossible to have grown, harvested, or prepared for transportation one half of our present annual farm crops.

These and like things well illustrate the great truth, so often apparently forgotten, that no man, and equally no class of men, lives to himself or for himself. That graceful essayist and thoughtful statesman, George William Curtis, well said, "The test of national welfare is the intelligence and prosperity of the farmer." It is equally true that the prosperity of the farmer depends on the prosperity of the other workers of the nation. The government, too, has officially attempted to aid and develop agriculture in many ways. Without going into disputed political questions or pronouncing on the wisdom of all its efforts, it is obvious that the aid granted to the building of railroads, notably the offer of free lands to settlers, the establishment of a national Department of Agriculture, of agricultural colleges and experiment stations, were largely or wholly designed to help agriculture and those engaged in it.

We may not wisely attempt much of prophecy; but the story of the past, with its alternations of great prosperity and serious depression, always tending, however, to advance when viewed for any considerable series of years; with its abundant illustrations of triumph over great obstacles and of the solution of most perplexing problems, leaves no room for pessimistic predictions. We are seeing the beginnings of great changes in our farming systems; we are to see more severe competition with the agriculture of other lands, narrower margins of profit, the necessity for better preparation on the part of those who are to be American farmers; but we need not fear that the agricultural products of our country will decline in quantity or quality, and so long as the nation endures we may confidently expect agriculture to be our chief industry.

G. E. Morrow

CHAPTER XXXIII

AMERICAN LIVE STOCK

THE tastes, habits, and character of a people are indicated by the class of domestic animals they breed; and a nation's advance or decline in civilization can readily be traced in the improvement or degeneration of the animals kept for labor and pleasure, or raised to supply food and raiment. This principle we see strikingly illustrated in the horses and cattle brought to America by the Spaniards in their invasion of South America. The horses of Spain represented the best blood of Arabia and the East, and her cattle that of Andalusia and the Moors. These animals, left in a genial climate, spread through Central America northward; but through the negligence and ignorance of the Mexican the blood of Spain degenerated into the wiry and stubborn Mexican pony. This, again, passing northward into the colder regions of the Indian tribes, became the ungainly and dwarfed Indian pony of the plains, destitute of the style and beauty of the elegant Andalusian, but with all his spirit and hardiness remaining to tell of his Eastern and royal origin.

The animals that came with the emigrants from Europe and the British Isles gave America such a mixed aggregation of traits and types as the world has never before witnessed. From this rare gathering of blood from every civilized land came our native cattle, our wild horses, and the common hog and sheep. From these the pioneers bred, and their sons, in turn, improved by importation and by selection, aided by a temperate climate, fertile soil, rich herbage, and grasses and grains such as no other country had ever furnished for the foundation and development of domestic animals. The mingling of bloods from every nation has given us a class of domestic animals called native or common stock, which has been easily impressed by the use of males of definite or fixed type. The result has been to give to the United States in one century the highest type and greatest number of high-grade and pure-bred animals of any nation on the earth.

The intelligence of man has more to do with fixing the type and character of the horse than has food or climate. Jacob was the first color specialist of history, and succeeded, by his skill in fixing color and breeding from the strongest of the herds, in taking from his father-in-law the best that he possessed. Darwin, in his "Domestication of Plants and Animals," shows that a damp climate does not favor the development of the highest type of the horse. Yet, notwithstanding this, under the courageous and enterprising reigns of William the Conqueror and Henry I., England bred a strong and fleet type of horses for her cavalry, and under William we find the first mention of the horse being used for the purposes of agriculture. In the reign of James, English racing was fostered by matches against time and trials of speed and endurance that verged on cruelty. But the pluck and push of Britain was tending steadily, meanwhile, against the climate, ungenial as it was to the horses brought from Spain and Flanders, to give speed, courage, and weight to the horses of England. So valuable proved this Eastern blood that the stud-book was established in 1791, although the first volume did not appear until 1808. By judicious crossing, training, and feeding, with the selection of the fittest, was evolved the blooded horse, whose descendants in America, under a more favorable climate and brighter skies, have eclipsed the records of Arabia or Barbary.

The type of the thoroughbred was heavier at the beginning of this century than it is now, as the blooded horse was then more used for the improvement of the horses for cavalry and parade. In America the horse has been bred more for business than pleasure. The invention of the elliptic spring and the use of American hickory in the production of light vehicles for pleasure and business, together with the invention of macadam and Telford roads, turned the demand from the running to the trotting horse. Up to that time the best horses were used for the saddle, in parade, pleasure, sport, or war. It needed a country devoted to business, and seeking advancement by the arts of industry rather than those of war, to evolve that purely American type, the trotter. Until the present century the horse was a minor factor in the uses of business and agriculture, the ox, the ass, and the camel being more important servants of the trades and the husbandman. The first private coach was introduced into New York in 1745; but coaches were scarce until after the Revolutionary War, and not until after 1840, when the light one-horse vehicle came into use, did the changed conditions of travel develop a harness-horse for purposes of business and pleasure. The attention of horse owners once attracted to the new demands, a revolution was brought about in the business of breeding and training horses. Along with the change in vehicles incident to the evolution of the trotter came as great a change in the style of harness and trappings. The effect upon trade and commerce of the new lines of industry made possible by the evolution of the trotter is not surpassed by the changes now coming with the bicycle, trolley, and electric motor.

About the beginning of this century there came out from the lines of breeding of the thoroughbred, traceable to such noted horses as Flying Childers, Byerly Turk, and the Darley Arabian, a gray, stoutly built horse, of wonderful power and stamina, with a slashing, open gait, just fitted to found a race of trotters. This was Messenger, foaled in 1780, and he became the progenitor of the trotting families in America. In 1793 Justin Morgan was foaled, sired by one believed to be thoroughbred. Three of his sons, Bulrush, Sherman, and Woodbury, became noted as the sires of horses of intelligence, courage, and speed, and the get of some of them excelled as roadsters and stage-horses. From Black Hawk Morgan, sired by Sherman out of a fast-trotting English mare, has come the beautiful, useful, and courageous line of Morgans. The original horse could trot in 2.40, and died in 1856 at the age of twenty-three. In 1826 or 1827, James McNitt, of Washington County, New York, purchased in Montreal a large dapple gray, "a strong, active, and fast trotter," which has since become famous through the Morse horse, sire of Alexander's Norman.

In 1849 was foaled Rysdyck's Hambletonian, the founder of the most noted family of trotters. He was sired by Abdallah, who traced to Messenger by both the sire and dam, out of a dam by Bellfounder, with Messenger crosses on the dam's side. As early as 1876 the interest in breeding and rearing trotters had become so great that fabulous prices were paid for colts, simply on the strength of their breeding. Two fillies, untrained, sold for $13,000. A lot of thirteen young colts sold for $41,200. The three-year-old colt Steinway was sold for $13,000 in 1879. After the animals had proved their high quality prices still further advanced, and Governor Sprague sold for $27,000 as a five-year-old. Maud S., bred at Alexander's noted stock-farm in Kentucky, was sold to Mr. Bonner for $21,000 when four years old, with a record of 2.10¼, and the title "Queen of the Turf." Smuggler sold for $40,000, Pocahontas for $45,000, Goldsmith Maid for $36,000, Dexter for $36,000, and so on, until we come to Axtell, who sold for $100,000 after he had eclipsed the time of all stallions, and retired to the stud, where his service fee was $1000.

As an illustration of the wealth invested and the possible earnings of a successful breeding establishment we may state that "the money value of the sons and daughters of Rysdyck's Hambletonian that have beaten 2.30 can scarcely be computed. The stallion himself was purchased with his dam for $125, and earned in the stud $205,750. Thirty-six of his get have trotted in 2.30 or better, and the prices for which they could have been sold in their best days amounted to $325,000. Among them were Sentinel, George Wilkes, Jay Gould, and Administrator, all noted sires. Their united progeny was worth many thousands for stud and track uses. Some of his sons, without a 2.30 record, became successful in the stud. Alexander's Abdallah was sold for about $3500, but he got Goldsmith Maid, which made a record of 2.14, and won on the turf close to $250,000; Almont sired twenty-two 2.30 trotters; Belmont got nine with records better than 2.30. So the descendants of Alexander's Abdallah have been worth to their owners hundreds of thousands of dollars." Volunteer was another who ranked among the most successful of the noted Hambletonian sires, having to his credit twenty-three 2.30 performers.

Electioneer, bought by Governor Stanford, proved to be a noted sire, getting the fastest yearling, 2.36½; the fastest two-year-old, 2.21; the fastest three-year-old, 2.19½; and the fastest four-year-old, 2.18¾. The bracing climate of Palo Alto, and the methods of handling peculiar to Governor Stanford's breeding farm, aided in these accomplishments. These are but a few of the thousands of good horses that owe success to the Hambletonian blood. It is not strange that the enthusiasm among lovers of the trotting horse has led many beyond the limits of safe business methods, and that a reaction should follow and prices decline. The value of trotters has been measured largely by their speed, taken as a measure of ability to win future races, or as evidence of blood lines that will make the animal valuable in the stud. Success in campaigning is undoubted evidence of pluck and stamina; and the breeding and training of the trotter, and his contests on the track, have developed these qualities in so high a degree that no other class can equal him. The evolution of the trotting horse has also shown the value of a training peculiar to America as a factor in breeding. Scientific handling, joined with reinforced lines of trotting blood, has led to a gradual reduction of time since the first record was made at Haerlem race-course, the following notice of which appeared in the "Connecticut Journal," New Haven, June 19, 1806, copied from the New York "Spectator":

"*Fast Trotting.*—Yesterday afternoon the Haerlem race-course of one mile's distance was trotted around in two minutes and fifty-nine seconds by a horse called Yankey, from New Haven—a rate of speed, it is believed, never before excelled in this country."

The following table shows how, under skilful breeding and tireless training, the trotting and pacing records have been reduced from year to year:

TROTTING AND PACING RECORDS, 1806 TO 1895.

Year.	Horse.	Time.
1806	Yankey (saddle)	2.59
1810	"A horse from Boston" (saddle)	2.58½
1824	Top Gallant (saddle)	2.40
1830	Buster (saddle)	2.32
1834	Edwin Forrest (saddle)	2.31½
1843	Lady Suffolk (saddle)	2.28
1852	Tacony (saddle)	2.26
1853	Tacony (saddle)	2.25½
1856	Flora Temple	2.24½
1859	Flora Temple	2.19¾
1865	Dexter	2.18¼
1866	Dexter	2.18
1867	Dexter	2.17¼
1871	Goldsmith Maid	2.17
1872	Goldsmith Maid	2.16¾
1874	Goldsmith Maid	2.14
1878	Rarus	2.13¼
1879	St. Julien	2.11¼
1880	Maud S.	2.10¾
1881	Maud S.	2.10¼
1884	Jay-Eye-See	2.10
1884	Maud S.	2.09¾
1884	Maud S.	2.09¼
1885	Maud S.	2.08¾
1891	Sunol	2.08¼
1892	Nancy Hanks	2.04
1894	Alix	2.03¾
1895	No reduction.	

From 1810 to 1824 the record was not reduced. It is pertinent to notice that about this time running races had become common in the Middle and Southern States, while a strong sentiment against racing prevailed in the Northern States. In 1820, Pennsylvania, for example, not only forbade racing, but also enacted that no person should "print or cause to be printed, set up or cause to be set up, any advertisement mentioning the time and place for the running, trotting, or pacing of any horses, mares, or geldings," etc. A similar law was in the statutes of Connecticut until within twenty years. New York passed an act to prevent horse racing March 19, 1802, which was amended March 30, 1821, permitting the "training of pacing, trotting, and running horses" in Queens County for five years. The sheriff was required to be on hand to witness these "trials of speed," as called in the statute. This amendment was reënacted April 3, 1826, without a time limit. In 1825 the New York Trotting Club was organized, with a view of "improving the speed of road-horses." This track was probably the first trotting course in the world. The Hunting Park Association was formed in Philadelphia in February, 1828, and the next year a trotting club was organized in Baltimore. These facts show a changing public sentiment, and the records begin to fall. The keeping of records became an established custom as early as 1829, when the American Turf Register began. The English had not then begun to keep records, but the American custom has enabled us to mark the development of speed and establish well-defined breeds during the threescore and more years it has been in use. Wallace's American Trotting Register was started in 1871 by J. H. Wallace, New York, since which time the business of breeding trotters has increased, until now it is estimated by good authority that the number of registered standard-bred trotters exceeds 120,000. In the early history of the record many animals were admitted to registry that are not now classed as standard-bred. The term "standard" indicates to-day ability of one or more ancestors to trot within 2.30.

The lovers of the Morgan horse have organized an association to publish a stud-book and to breed Morgan horses to meet the growing demand for stylish-going roadsters with the sense and stamina characteristic of the Vermont Morgans early in this century.

Except the produce and incidental benefits to other breeds from the use of the blooded horse of England, no nation or age has produced a race of horses that exemplifies so forcibly the intelligence, pluck, enterprise, and thrift of a people as the full history of the evolution and successes of the trotting horse shows the character of the Americans. He has won his way against the prejudices of every nation and rival, until we find the English, French, German, and Russian are buying the American trotter for the uses of pleasure, business, and breeding.

Before the days of macadam roads and light vehicles, saddle-horses were as common as trotters are to-day. They were of no particular breeding, but traced to the thoroughbred, the Narragansett pacer, or the Scottish Galloway. Herbert suggests that they were of Spanish origin, their ancestors coming from Cuba. They were not only of general use, but were shipped in large numbers from New England to Cuba and the Southern coasts. There is now a revival of interest in the saddle-horse as a luxury, the demand being beyond the supply. A stud-book has been started, and some breeding farms, especially in Kentucky, are engaged in breeding and training saddle-horses of high excellence. The originators of the stud-book hope to establish a breed of American horses of this class that shall combine the highest intelligence with great style and ability to go in any of the acquired gaits, and not to be limited to the walk, trot, and canter. From the ideal set up, and the success that has thus far attended these efforts, it is safe to predict that an improved breed of American saddle-horses will soon have its representatives in every horse show or fair that will give them a class.

Prior to the introduction of railroads Vermont had what Herbert called a distinct breed of cart-horses. He described them as "the models of what draft-horses should be, combining immense power with great quickness, a very respectable turn of speed, fine show, and good action." They had "none of the shagginess of mane, tail, and fetlocks which indicates descent from the black horse of Lincolnshire," and none of the curliness of mane and tail which marks the Canadian or Norman blood. "The peculiar characteristic of these horses is the shortness of their backs, the roundness of their barrels, and the closeness of their ribbing up." The only other breed of American horses we have to notice is the Conestoga, which before the days of the Pennsylvania Railroad was common on the farms and highways of Pennsylvania. It seems to have descended from the stock brought by emigrants from Flanders, Denmark, and Germany. It was a mixture of several breeds, resulting in a large, patient burden bearer, held in high esteem by the Germans of that State.

Although we have not originated and permanently established any American breed of draft-horses, the number of heavy horses has greatly increased, and the quality has improved. The increasing heavy business of factories, jobbers, importers, and transfer and express companies in our well-paved cities has called for a great number of powerful horses. This demand has led to the importing of heavy horses from France, England, Scotland, and Germany. The Vermont cart-horse and Conestoga draft-horse excelled the types of foreign heavy horses, as a rule; and, with the start thus made in such breeds, it is to be regretted that our pride in American animals has not led our people to perpetuate and further develop these useful horses.

Tens of thousands of dollars have been sent abroad since the fad of importing heavy elephantine horses became common in the Western States. The enterprising importers took advantage of the American love of a big thing, and scoured France, England, Scotland, and Germany for the heaviest animals. They imported more than they could sell, and then adopted the plan of leasing stallions for a term of years. Since 1890 there have been many disastrous failures among this class of importers. There were, however, several importers who had truer ideals, and who imported the best type of the draft and heavy coach breeds to be found abroad, establishing breeding farms not excelled in the world. These men will weather the storm and disseminate some of the best blood of the Old World.

The earliest importer of high-class draft-horses was Edward Harris, of Moorestown, N. J. In 1839 he imported two mares and the stallion Diligence, who was in many respects similar to the McNitt horse, but heavier and more compactly built, being a little over fifteen hands high. He left an impress upon the stock of New Jersey and eastern Pennsylvania which has been of great value. The next valuable importation was made by Charles Fullington, of Union County, Ohio, in the spring of 1851. He bought and brought home from France the famous Louis Napoleon, a "short-legged, closely ribbed, blocky, and compact gray, three years old." The style of the horse was ridiculed by horsemen of that region. In 1853 he was sold to A. P. Cushman, of De Witt County, Illinois. After his colts in Union County proved his worth, a company was formed for importing other horses of his type. The author of the "Percheron-Norman Stud-Book" says of him that he was undoubtedly the best-known and most popular French horse ever brought to America. Thus the French blood was introduced into the fertile plains west of the Alleghanies.

The first importations west of the Wabash were made in 1868 by W. J. Edwards, of Chicago, in the great stallions Success and French Emperor. The latter went to Iowa as the property of Hon. J. B. Grinnell. Success was sold to the Fletcher Horse

Company, of which M. W. Dunham, of Wayne, Ill., was an active member. In 1874 he purchased the entire interest of the company, establishing his celebrated importing and breeding farm at Wayne. Of the great horse Success it may be said he was truly named. His colts at the average age of two years and eight months sold at the average price of $450 per head, and in 1874 alone the sales of his get amounted to $36,000.

The Clydesdale has been the strong rival of the Percheron-Norman at the horse shows and fairs. This breed is popular in Canada, and has its most numerous representatives in the Northwest. The secretary of the American Clydesdale Association, Alexander Galbraith, says: "No importations into the United States appear to have been made until about 1870 and 1872, when John Reber, of Lancaster, O., and the Fullingtons of Union County, began the work. From that date small importations were made by various parties, the most prominent being the Powell Brothers, of Shadeland, Pa. Importations steadily increased up to 1888. To-day the largest breeder in America is Colonel Holloway, of Illinois; N. P. Clarke, of Minnesota, and R. B. Ogilvee, of Wisconsin, coming next. These three breeders have among them about 175 brood-mares, and have the very cream of Scotland both in blood and individual merit. As high as $10,000 has been paid for one Clyde. Eight volumes of the 'American Clyde Stud-Book' have been published, containing 8000 entries."

The Shire horse is little esteemed in Canada, but in the American craze for heavy horses he finds admirers. There is an American stud-book of three volumes, with 4100 entries, 3500 of which represent imported horses.

Of the foreign coach-horses the French and German have creditable representatives in the West, where Mr. M. W. Dunham has imported many high-grade specimens of the French, and some other firms have introduced the German breeds.

The hackney is gaining rapidly, and there are some enterprising breeders and importers who are diligently introducing them at the present time. As the importation of heavy draft-horses wanes, farmers and horsemen are becoming interested in breeding horses of more action and style, so that the hackneys and foreign coach breeds are now receiving more attention.

In the West and South the mule, as a draft and farm animal, has long been of great service. General Washington, with his practical nature, appreciated the mule as an animal suited to the plantations of the Southern States. He was America's first successful breeder of mules. Mr. Curtis says the king of Spain presented Washington with a jack from his royal stud in 1787. General Lafayette also presented him one which proved of great value, and which sired Washington's favorite jack, named Compound. To him he bred his best coach-mares, and produced such valuable animals that the Southern planters began to use their thoroughbred mares for raising mules. The mule being more steady at a draft, less liable to injury or disease, less subject to lameness, and being able to endure heat and hardship better than the horse, his price for heavy work has kept as high as that of draft-horses. The number of mules in the United States increased from 559,331 in 1850 to 2,295,532 in 1890. The number of horses increased from 4,336,719 in 1850 to 14,969,467 in 1890, which gives one horse to every family in the Union, more than is possessed per capita by any other nation. We are still importing horses for breeding purposes at the rate of 10,402 in 1890, at a cost of $2,881,657; and 37,675 horses for other purposes the same year, valued at $1,882,976. The number exported for breeding purposes is on the increase, as well as for sporting and general service.

The quality of our horses will undoubtedly improve more rapidly in the next decade. The present low prices have forced the sale and destruction of many thousands of inferior animals. The rapid increase of the low grade of horses from the ranches of the West and Southwest has tended to lower the price of farm and common draft and street horses. The rapid displacement of horses in street-car service by the trolley has had its effect in lowering prices. During the past year new avenues for disposal of the surplus have been opened, as it has been found that the price is now so low that horse-meat, cured, can be shipped to Belgium and Germany at six cents per pound. Fertilizer factories have been known to buy cast-off horses as low as $2 per head. The hide is worth, on an average, $3.25, the bones $1.25, and the fat and tankage about as much more. At these figures many unemployed and disabled horses will find their way to fertilizer establishments, and the land be doubly blessed.

In the salubrious and temperate climate of the United States, with its various elevations and depressions, and with the wealth of rich herbage of the mountains and hillsides supplemented by the variety and abundance of grains throughout the valleys and plains, we have conditions more favorable for the raising of cattle than those enjoyed by any other nation. Our herds have been singularly free from

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any of the diseases which have swept off the cattle of middle and southern Europe by the thousands. Pleuropneumonia and anthrax have entered our shores with cattle imported from lands where such diseases have a hold, but in no case have any of these plagues spread over any great extent of country. Under the efficient organization of our Bureau of Animal Industry, outbreaks of any contagion have speedily disappeared; and while to-day the cattle of the United States are spread from the Atlantic to the Pacific, and from the everglades of Florida to the plains of Dakota, numbering nearly 50,000,000, every cargo of cattle leaving our ports carries with it a clean bill of health. Every epidemic of contagious disease that has ever visited our herds, if we except the epizoötic among horses, has been traceable directly to a foreign source. In our herds is represented the blood of the choicest of the Devon, the shorthorn, the longhorn, the Hereford, the Sussex, and the Norfolk of England; the Ayrshires, Angus, and Galloway of Scotland; the Kerrys of Ireland; the Alderney, Guernsey, and Jersey of the Channel Islands; with the Holstein from Holland, and the cattle from highland and lowland of every land where good cattle are produced. In the century just closing our enterprising farmers and dairymen have imported every year cattle at a cost of many thousands of dollars.

The first English colonial settlement on the James River, we are told, brought cattle from England as early as 1607. Succeeding colonies brought cattle from the countries whence they emigrated. In 1625 the settlers of New York made an importation from Holland, which was followed by further importations, each leaving its impress on the cattle of that region. The English colonies in Massachusetts and New Hampshire, the Dutch in New Jersey, the Swedes in Delaware, and the Danes on the Piscataqua River, all brought cattle from the countries nearest the ports from which they sailed. The cattle of Normandy came in with the French around Quebec, and the Spanish cattle from South America and Mexico made their impress on the Southwest, as seen in what are now called Texas cattle. From all this motley and diverse stock have sprung the common or native cattle of America, giving the foundation on which we have builded. The shorthorns have been more used, perhaps, than any other beef breed for improvement of this native stock; and the early settlers were more interested in developing cattle that could concentrate the wealth of grass and corn of the fertile valleys into beef than into butter and cheese. During the last quarter of the century great attention has been paid to the improvement of dairy cattle. The importation of Channel Islands cattle and Holstein-Friesians has been large, and even the dairy qualities of shorthorns have attracted attention, some of the milking families of the breed bringing advanced prices. The World's Fair dairy test of shorthorn, Jersey, Guernsey, and Ayrshire cattle, continuing through several months, gave a new impulse to the breeding of Channel Islands cattle and dairy shorthorns.

Soon after the Revolutionary War a few shorthorn cattle were imported into Virginia. They were well fleshed, and the cows gave as much as thirty-two quarts of milk a day. In 1783, Matthew Patton, Sr., of the South Fork of the Potomac, imported a longhorn bull. In 1785 three of his sons moved to Kentucky, taking with them some of the half-bred heifers. In 1795 they sent back to Virginia and Maryland for cattle known as "milk cattle." In 1803 the Pattons brought out the "milk bull" Pluto 825, which proved a noted breeder. Descendants of this bull and another named Mars, and a cow, Venus, found their way into the Virginia Reservation of Ohio, and thus Mars, Pluto, and Venus laid the foundation for future improvement of cattle in the West.

In 1817, Lewis Sanders, of Lexington, Ky., imported three bulls and three heifers from England, which were of so good a quality that they laid the foundation of many excellent herds. In 1818, Cornelius Coolidge, of Boston, Mass., imported a heifer and a bull. About 1820 several public-spirited men in the neighborhood of Boston brought out at different times a number of valuable animals, whose descendants are still numerous in New England. In 1823, General Stephen Van Rensselaer, of Albany, N. Y., imported the bull Washington and two heifers. In 1824, Colonel John Hare Powell, of Philadelphia, began to import shorthorns, and bred largely at his estate near the city, selling them to go into Ohio and Kentucky.

The first drove of fat cattle from the fertile Scioto country and the Virginia Reservation crossed the Alleghanies on the hoof in the spring of 1805. Of the sixty-eight head, twenty-two were disposed of at Morefield, Va. The remainder were driven on to Baltimore, where they were sold at a net profit of $31.77 per head. The problem of getting cattle from the grazing lands of the West to the Eastern markets was solved, and its effects were as great as those of the successful shipment later of the first cargo of fat cattle to England, or the first efforts of Swift & Company in sending dressed beef from Chicago to New England. In 1817 Mr. Felix Renick took a drove of 100 fat cattle to Philadelphia, which sold for $134 per head. In 1818 Joseph Harness sent the first drove from the West to New York City. The 100 were sold at $69 per head. From Ohio and Kentucky, also, cows and oxen were driven to Michigan as early as 1825–40, to supply the demands of immigration into that State.

The Virginians of Ohio and Kentucky coöperated in the exchange and improvement of their best cattle. Not content, however, with the slow improvement of cattle, ex-Governor Duncan McArthur, Felix Renick, George Renick, and nineteen others from Ross County, Ohio; William Renick, S. S. Denney, and fourteen others from Pickaway County; M. L. Sullivan and two others from Franklin County; and seven others from Fayette, Highland, and Pike counties, resolved "to try the experiment of direct importation from Great Britain." A company was formed on November 2, 1833, with ample capital and unlimited public spirit, as no subscriber expected any profit on the money invested. Mr. Felix Renick, with E. J. Harness and Josiah Renick, were sent to England to buy the best cattle they could find, regardless of price. Their first importation consisted of seven bulls and twelve cows and heifers. Further importations followed. In 1835 and 1836 Felix Renick had charge of the company's business and the breeding of the cattle, continuing up to the closing sale in 1837, when those remaining were sold at prices ranging from $425 to $2500. Other companies were afterward formed in Kentucky and Ohio. The success of this pioneer company led also to heavier importations by the Eastern men; and Mr. Whitaker, an English breeder, sent 100 head to Philadelphia, which were sold on the farm of Mr. Powell, an extensive breeder and importer.

During the thirties, and even up to this date, the Devons and Herefords had stanch admirers. Henry Clay had been to England and imported Devons, Herefords, and shorthorns, and in a letter to Governor Trimble he advised the Ohio company to bring out Devons and Herefords, as they were "better for the yoke." The Devons were at that time the favorites in New England. "The battle of the breeds," spoken of by Cassius Clay, still wages. The Herefords have been vastly improved in the prairie States, and have been used in great numbers on the plains, to the vast improvement of the range cattle of the West. As beef-cattle they have carried off in later years a full share of prizes with the shorthorns at the Chicago fat-stock shows.

As the farms of the country became improved, and cattle no longer wintered in the forests or open fields, farmers found horns to be an expensive and unnecessary appendage, and a constant menace to the quiet and peace of the herd inclosed in yards and sheds. The shipper, too, finds the horns a source of loss in the pens and the cars of the railroads. Buyers of feeding cattle prefer those without horns, since they can accommodate a greater number with peace and quiet at the feeding racks and troughs. These causes have led to the practice of dehorning cattle intended for the dairy and feed lots. The polled breeds of Scotland and England have been imported extensively within the last decade; and the polled Durham, a new breed of cattle originated in the Miami Valley, is so far established that already the number of breeders and their favorites are numerous, and the type so well fixed that the first volume of the "American Polled Durham Herd-Book" has been issued. At present there are successful herds of polled Durhams in Ohio, Indiana, Illinois, and Iowa.

We now turn from the hornless type to the long-horned Texas cattle. These ungainly beasts are but one remove above the buffalo. They doubtless are of Spanish origin, introduced into Mexico, of which Texas was then a part, about the year 1500. They overran the plains of the Southwest, and were for years killed for their hides and tallow. Before the advent of railroads into the Southwest, Texas was supposed to have one seventh as many cattle as all the other States and Territories. Until Kansas became settled they were driven by trails into the Northwest, and made the base for founding the numerous and extensive cattle-ranches which utilized the wild grasses of government lands. These ranches made a market for thousands of bulls from the older States. The grade steers were a vast improvement on the cattle of the Southwest, and came into competition with the cattle of the States east of the Missouri, in the Chicago and Kansas City markets. The settlers have pushed west and taken up lands along the watercourses of the mountain-ranges, and the ranchmen have reluctantly retired before the plowmen. The vast ranges of the Northwest invited millions of capital from the States and from England and Scotland, until the boom in the cattle business burst, leaving wrecked fortunes and a clearer field for the legitimate production and improvement of cattle on the farms.

The necessity of greater attention to live stock, and of plowing less and grazing more, is recognized by the more intelligent. More capital and thought have gone into the improvement of dairy cattle within the last decade than were ever employed at any other period in the history of the country. The Jersey, Holstein, and Ayrshire can be found in every community, and our milk records and dairy tests show that our improved cattle and our methods of breeding and feeding enable us to excel any records made even in the countries in which dairy breeds originated. Our experiment stations and agricultural colleges are investing in dairy plants and employing every means known to science for the fostering and development of the dairy interests of the people. The States of New York, Wisconsin, Iowa, Indiana, and Ohio have their dairy schools and courses of lectures, stimulating their residents to higher standards and more economical production.

Our foreign trade in dairy products is older than the government. During a part of the first half of this century our shipments of butter exceeded those of cheese. This continued until about 1842, when the introduction of cheese factories led to increased exports of that product. Instead of our American cheese growing in favor abroad, it deservedly lost standing, because of the process of "filling cheese" with lard, unmerchantable butter, etc. The history of the dairy business in America is one of vast fluctuations. The legitimate manufacturer has had to cope with the most ingenious substitutes. The fats of swine and cattle have come into competition with butter fat, by the introduction of oleomargarine, lard neutral, and filled cheese. The business has been demoralized, and the reputation of American butter and cheese impaired. There is no longer any mystery about the character of oleo and filled cheese. Some States have regulated their sale by law, compelling them to be sold on their merits. The change in the values of butter and cheese for the last thirty years has been steadily downward, as shown by the following table taken from the Department of Agriculture report, December, 1890:

BUTTER AND CHEESE, 1861 TO 1890.

Period.	Butter.		Cheese.	
	Pounds.	Price. Cents.	Pounds.	Price. Cents.
1861–70 ..	13,398,053	23.0	44,657,282	14.3
1871–80....	15,245,288	18.0	99,992,441	12.7
1881–90....	18,820,780	17.2	104,158,600	10.0

The fact that the average price of butter imported into England was 23 cents, while our exports of butter the same year averaged only 14.1 cents at ports of shipment, is discreditable to American enterprise and skill. The causes for this disparity of prices are many, the chief being that our best butter and cheese find a ready market at home, and only the lower grades are shipped abroad.

As our dairy exports have declined with the quality of goods offered, our exports of beef-cattle have increased, the quality of stock being improved in the same ratio. One of the first attempts to export cattle from the Southwest was made by a company of ranchmen of Texas. It was before the days of refrigerator-cars and cold storage in vessels. Only fifteen per cent. of a large cargo of the Texas longhorns reached Liverpool. I believe the first cattle exported for beef went to Glasgow about twenty-five years ago. Only two consignments a week were first sent out. The number increased to fifty per week, but as the cost of export was $48.66 per head, shipments were discontinued in 1874. Freights declining, the business was resumed, and has gradually increased as the prejudice against American beef gave way to enthusiasm in its favor. Freights have declined to $10 or less per steer. Since the first trials the business of exporting beeves, either alive or dressed, has grown to mammoth proportions. To Mr. Eastman, of New York, belongs the credit of successfully inaugurating and establishing the business. He is still the largest exporter, his weekly shipments running up into the thousands. His success has been followed by the organization of other similar firms. The effect of the transfer of the choicest beeves to a foreign market has been to stimulate the price of prime cattle. Illinois, Kentucky, and Ohio for years furnished the bulk of export cattle, but now Iowa and Missouri also send many. Mr. J. R. Dodge has estimated that the average value of beeves exported by this country in 1861 was $19.65. In 1878 the average value had risen to $46.68, and in 1894 to $93.14; but this last estimate includes the export of some of the finest breeding cattle sent to Great Britain, twenty-eight head of which averaged $5850. There was but a small surplus of cattle in this country prior to 1850. About that time grass-fed beeves began to find market in Cuba. The real commencement of our export business was in 1877, when the improvement started in Ohio and Kentucky, and worked westward, where cows and grass were abundant and cheap. In 1877 50,000 head were exported to Great Britain, Cuba, the British West Indies, Canada, and Mexico. More than half of this number went to Cuba, and only 5091 to Great Britain. The quality of cattle having improved, the export trade to Great Britain in eighteen years increased to 355,852, worth nearly $32,500,000. France, Germany, Belgium, and the Netherlands took less than $2,000,000. The dressed-meat trade, fresh and salt, represented in 1894 $28,259,863, which, with live animals exported, makes an aggregate of $61,721,785, mostly for animals of improved grades. In 1877 the first shipments of fresh beef in refrigerator-ships were made. In 1870 the value of all shipments of beeves and beef products was $6,194,626. In 1891 the total value was $65,533,564, taking more than 1,000,000 of the choicest cattle from the central corn-growing States. In 1870 an export beef was worth $15.98. In 1891 the average price was $81.26 each, showing that as quality improves price advances. There is no longer any demand for good cattle among country butchers, and the farmer who formerly could fatten one to six prime bullocks has now no market, hence has become a dairyman or grain grower, to the injury of the land. The receipts and shipments, as now recorded at our principal markets, embrace, therefore, a large per cent. of the actual production of the country, the bullocks, pigs, and lambs being all bought up to-day by the country shipper, and in promiscuous lots dumped into the great stock-yards.

The hog crop of America is most closely related to the corn crop. The States in the corn belt west of the Ohio River furnish the surplus pork for export and for home consumption in States where corn is not largely grown. Hogs came with the Cavaliers and Pilgrims, and in the common hog of the country was early found a mixture of types and races from every country where pork was produced. This mongrel was the base, easily impressed by the blood of the China, Neapolitan, Berkshire, Tamworth, and other breeds, known as early as the second quarter of the century. After the settlement of Ohio and Kentucky improvement in hogs was marked. The corn in the valleys and the mast in the timber furnished food in such abundance that the energies of the early settlers were bent upon producing pork and cattle to utilize the superabundance. The West Indies furnished a market for all surplus pork of the Eastern States, and under the stimulus of this trade heavy hogs were produced along the Delaware, before the development of the interest in the country around Cincinnati. The production of hogs in Ohio, Kentucky, and eastern Indiana increased so rapidly that Cincinnati early became the packing center of the West. As the Wabash, the Illinois, and the Missouri valleys and the prairies became vast corn-fields, and the railroad pushed westward, the center of pork production also moved west. Ohio is no longer the leading corn and hog State, being now the seventh; and Cincinnati is excelled as a packing city by Chicago, Kansas City, Omaha, St. Louis, and Indianapolis.

The China and Berkshire, along with the Russian and Irish grazer, were earliest used to cross upon the common hog. In New Jersey the red hog formed the foundation for the large hogs to furnish the heavy meat for the West Indies and the Carolinas. In Chester County, Pennsylvania, the white hog was the favorite, and was improved, and the type called Chester white was established. In the Miami Valley the China, Berkshire, Woburn, Russian, and Irish grazer blood mingled with that of the common hog, and the Poland China breed was evolved and improved to meet the wants of the packer and feeder. In northern Ohio, in the dairy districts, where the conditions of feed, soil, and handling were very different, the white hog of Pennsylvania has been improved, and we find a breed known as Todd's improved Chester whites. The red hog of New Jersey has come West into a land of plenty, and has filled out, and is taking on the plumpness and refinement of bone, ear, and head peculiar to the breeds in a corn-growing country. In northern Indiana we find a breed of white hogs called Victorias, finer in type than the Chester whites, and of more growth than the small English breeds.

The above-named American breeds have become so well fixed and established that each has its record. The Poland China holds about the same relation to other breeds of swine that the short horn does to other breeds of cattle. Pigs of this breed have been shipped to Germany, Russia, Australia, the Argentine Republic, Cuba, and Canada. The improvement of the swine of America has been greater than that of its horses, cattle, or sheep, and with a far smaller outlay for imported animals for breeding purposes. Swine are raised in every State in the Union and on almost every farm. The cotton States consume more pork than they produce. The States producing the surplus are Iowa, Illinois, Ohio, Missouri, Indiana, Kansas, Nebraska, Wisconsin, Tennessee, Kentucky, Minnesota, and Michigan, and their rank is about in the order named. It has been estimated that ninety-five per cent. of the exports of pork, eighty-six per cent. of the exports of lard, and ninety-three per cent. of the total exports of hog products from the United States come from the surplus of these States.

Our unequaled system of transportation is one of the prominent factors which have helped to the remarkable development of the pork business. Pork products are carried from Chicago or St. Louis to New York for only about one third of a cent per pound, a distance of 900 miles. The ocean charge from New York to Bremen is about the same. Direct consignments from St. Louis or Chicago to Bremen have been shipped for a little more than half a cent per pound. Lard production has suffered somewhat since the discovery of the process of utilizing a waste product of cotton. Cotton-seed oil has now come into such extensive use as a substitute for lard and lard-oil, for culinary and manufacturing purposes, that its present annual sale is estimated to exceed the equivalent of 70,000,000 pounds of lard. The production of oleo from beef suet has also furnished the by-product of stearine, which enters largely into the manufacture of lard substitutes, to give body and consistency to imitation lard. This adulteration of lard has brought American lard into disrepute in foreign markets, and reduced the demand. The surplus of pure lard continues great, and its extent fixes the price.

The healthfulness of American pork, like that of our beef, has been a distinguishing feature of our meat products. Our herds have been singularly free from disease; and the superior quality of our pork products, and their low cost compared with that of European products, gave us an immense and growing trade abroad, furnishing a wholesome and cheap meat-supply to the densely populated districts of Germany and France.

On the 25th of June, 1880, the German government issued an edict prohibiting the importation of "chopped, or in a similar manner divided or prepared, pork, and of sausages of all kinds, from America." In the following February France gave a blow to our rapidly growing trade by prohibiting the importation of all hog-meats from the United States. Our pork trade in 1891 with France was $267,804, and in 1883 $4,987,673. Germany not only prohibited the use and sale of American pork, but prevented our using the free ports of Hamburg and Bremen in shipping to other countries. And yet these blows have not paralyzed us, as the improvement of our swine and sales of pork go bravely on, and the farmers of America look upon the porker as their mortgage lifter and taxpayer. The census enumerations for the past fifty years show the increase in the number of hogs raised as follows: 1850, 30,354,313; 1860, 33,512,867; 1870, 25,184,569; 1880, 47,681,700; 1890, 57,409,583.

Exportations as early as 1872 increased to an encouraging degree, amounting to over 500,000,000 pounds, and continued to increase until more than 1,000,000,000 pounds were shipped in 1881. The edicts of exclusion, referred to above, reduced exports to 651,109,020 pounds in 1882, but they shortly ranged up again to 853,298,881 pounds, and by 1890 had reached 1,205,814,813 pounds. In other words, foreign demand has taken about 6,000,000 hogs per annum of our surplus, which is less than one fifth of the entire hog product of the United States. The lowest price of pork per 100 in thirty-three years was $2.85 in 1878–79, and the highest $11.46 in 1864–65, when gold was at its highest premium.

The specified imports and exports of the various pork, cattle, and dairy products, together with live stock, for 1890 are given in the subjoined tables:

EXPORTS AND IMPORTS OF HOG PRODUCTS IN 1890.

	Exports.	Imports.
Hogs	$909,042	
Sausage casings	697,772	$484,958
Lard-oil	663,343	
Bacon	39,149,635	339,178 (Bacon, Hams, Fresh pork, Salt pork)
Hams	7,907,125	
Fresh pork	15,406	
Salt pork	4,753,488	
Lard	33,455,520	
Bristles		1,286,219
Grease	753,409	132,089
Total	$88,304,740	$2,242,444

EXPORTS OF CATTLE PRODUCTS IN 1890.

Kind.	Value.
Cattle	$31,261,131
Bones	271,533
Glue	88,484
Hides	1,828,635
Canned beef	6,787,193
Fresh beef	12,862,384
Salt beef	5,250,068
Cured beef	9,223
Tallow	5,242,158
Oleo	6,476,258
Butter	4,187,489
Cheese	8,591,042
Milk	303,325
Grease	753,409
Total	$83,912,312

IMPORTS OF CATTLE PRODUCTS IN 1890.

Kind.	Value.
Cattle	$244,747
Butter	13,679
Cheese	1,295,506
Glue	471,829
Grease	132,044
Hair	3,026,566
Hides	21,881,886
Hide cuttings, etc	348,440
Hoofs, horns, etc.	236,648
Preserved meats	203,579
Other meats	136,099
Milk	102,954
Oil	3,235
Unenumerated	371,795
Total	$28,468,547

Adding the values of 3501 horses exported in 1890, amounting to $680,410; of 3544 mules, $447,108; of 67,521 sheep, $243,077; and of all other animals and fowls, $97,360, making the grand total of exports of live stock and animal products for 1890, $175,986,750. Our total exports of animals, breadstuffs, cotton, and articles made from these three leading classes of farm products are $627,216,656. The value of all exports other than of animals and farm products is $218,087,172, thus making the percentage of agricultural products exported 74.2, as compared with the total exports, and the percentage of animals and animal products 80, by the same comparison.

The inhabitants of the United States are singularly rich in horses, cattle, and swine. For every 1000 inhabitants we have 239 horses, 264 milch cows, 557 neat cattle, and 917 swine. Great wealth has grown up with our herds, and vital interests surround them. In many parts of the country dairying and animal production have driven out the growth of wheat and oats or other cereal crops, and although the population is not as dense in those regions as elsewhere, the inhabitants seem more prosperous, their houses and outbuildings are larger, and the annual profits are as great. In her live stock America has done more during a century than many older nations have accomplished in ten times that period. Her rise has been rapid, her achievements great, and her future may safely be predicted to bring forth results far more wonderful than those I have been attempting to review.

L. N. Bonham

CHAPTER XXXIV

AMERICAN COTTON

THE introduction of the Whitney cotton-gin laid the foundation for the cotton industry, the present magnitude of which may be judged from the statement of Mr. Thomas Ellison, of Liverpool, the leading authority on cotton statistics, who has said: "The cultivation of the cotton-plant, the manufacture of its fiber, and the distribution of its product afford employment to a much larger amount of capital and labor than any other branch of mechanical industry." Mr. Ellison adds: "And yet, so far as Europe and America are concerned, this vast agricultural and manufacturing system has been built up almost within the limits of the past century."

A number of cotton-machinery inventions made a few years prior to Whitney's had brought about an increasing demand in England for cotton for manufacturing purposes, and there was considerable anxiety on the part of mill-owners in Great Britain as to whether production throughout the world could be so stimulated as to cause it to keep pace with consumptive requirements.

While it is supposed that the cotton-plant is indigenous to America, and it is known that it was cultivated in Virginia as early as 1620, its production was very limited until after the invention of the saw-gin. The total crop in 1791 is estimated to have been 2,000,000 pounds, equal to 4000 bales, of which about 200,000 pounds, or 400 bales, are supposed to have been exported to Great Britain. A shipment of eight bags had been made to Liverpool in 1784, though there are reports of trifling shipments prior to that date, but these are supposed to have been of West India cotton exported via Charleston. This shipment, however, was sold to an English firm, in whose mill was employed at the time Samuel Slater, who in 1790 built in Pawtucket, R. I., a mill for Messrs. Almy & Brown, of Providence. It is supposed that the first mill built in the South was in the same year (1790), and that it was in South Carolina. An old report states that a mill was established in South Carolina in that year, "driven by water" and having "spinning-machines with eighty-four spindles each." Though Slater is regarded as the father of the New England cotton-mill business, cotton manufacturing to a limited extent had been carried on for some years prior to his coming to America, especially household manufacture, Thomas Jefferson having "employed two spinning-jennies, a carding-machine, and a loom with a flying shuttle, by which he made more than 2000 yards of cloth, which his family and servants yearly required."

In 1739 it was testified in an English court that "cotton grows very well in Georgia, and can be raised by white persons without the aid of negroes." When the colonies undertook to encourage the manufacture of cotton goods the home government did everything in its power to hinder the progress of the industry, with a view to compel them to confine their attention to the production of food and raw materials and to purchase their manufactured goods from Great Britain. At the request of English merchants, who were disturbed by the efforts of American manufacturers to export their goods, an act of Parliament was passed imposing a fine of £500 for every offense of exporting such goods, and, this not proving effectual, a law was enacted forbidding the exportation of textile machinery from Great Britain, in order to prevent American manufacturers from getting cotton machinery. Despite all these disadvantages, however, more and more attention was given by Americans to the study of methods to develop the cotton industry. Massachusetts especially took active steps to encourage cotton manufacturing, and in 1786 the legislature gave £200 to two brothers to help them establish carding and spinning machinery. Later £500 was granted to assist another factory, and afterward £2000 to another. Up to this time the progress in cotton cultivation and manufacture had been very slow, and it was felt that some improved method of ginning cotton must be invented before the cotton business could attain much larger proportions. This was a subject of frequent discussion.

In 1792, Eli Whitney, a native of Massachusetts, while in Georgia, had his attention called to the need of a machine to separate the seed from the lint, and succeeded, in 1793, in perfecting a gin which did this.[1] With the introduction of the gin the cotton business in all branches advanced with leaps and bounds. The South's crop jumped from 2,000,000 pounds in 1790 to 10,000,000 pounds in 1796 and to 40,000,000 pounds in 1800, or only four years later; while the yield of 1810 was 80,000,000 pounds, and that of 1820 160,000,000 pounds.

The rapid increase in the demand for cotton, and the profitableness of its cultivation, caused a concentration of the energy and capital of the South in planting; and other industrial interests which had been flourishing declined under the craze for cotton raising. According to Donnell's "History of Cotton," in 1816 the tariff on cotton goods was largely increased, the measure being strongly supported by the South on the ground that it would promote the consumption of its cotton, and opposed by some of the Northern States because of their large shipping interests—another illustration of how tariff sentiment changes as conditions change. From a crop of about 400,000 bales in 1820, production rapidly increased, the growth of this industry probably surpassing in extent and wide-reaching importance any other crop in Europe or America. The energy of the South was turned into cotton raising, and production really increased in advance of the world's needs. Other agricultural interests were not, however, neglected. Diversified farming was the rule, and the South was more nearly self-supporting in the way of foodstuffs —corn, bacon, etc.—than it has been since the war. In general, prices were well maintained for forty years, though gradually tending downward after the beginning of this century. In 1801 the average New York price was forty-four cents a pound, and from this it slowly declined, often with an upward spurt for a year or two, to thirteen and one half cents in 1839.

With prices ranging from thirteen to forty-four cents, and averaging for forty years, from 1800 to 1839, a fraction over seventeen cents a pound, cotton cultivation was so profitable that it is not to be wondered at that the disposition of the people of the South was to concentrate their efforts more and more on cotton cultivation to the exclusion of other industrial interests. Beginning with 1840 there came a period of extremely low prices, and the cotton States suffered very much from this decline. In that year the average New York prices dropped to nine cents, a decline of four cents from the preceding year; and this was followed by a continuous decline until 1844–45, when the average was 5.63 cents, the lowest average price for a year ever known to the cotton trade. Moreover, in 1844–45 the seed was without market value, while now the sale of seed adds largely to the value of the crop, transportation being also very much cheaper than in 1845. In 1847 the crop was short and prices advanced sharply, only to drop back to eight and then to seven and one half cents, the average for the

[1] As there has been much discussion as to who is really entitled to the credit of the invention of the cotton-gin, the following extract from a pamphlet entitled "Cotton as a Factor in Progress," by Mr. D. A. Tompkins, who has made a careful investigation of the snbject, is of interest:

"It appears to be commonly believed that the successful production of large cotton crops in the United States is due to the invention of the gin alone. While this has been an essential element in the problem, yet Egypt, India, and South America, which have the advantage of perfected gins, due to the inventions made in America, produce cotton neither so cheaply nor in such quantities as the United States. I am far from wishing to take from Mr. Eli Whitney any of the credit that attaches to his name for the invention of the cotton-gin. He stands in my estimation at the head of the list of all those whose inventions have been of benefit to mankind. In the invention of the cotton-gin there is glory enough to immortalize Whitney's name, with plenty to spare for the credit of others who did valuable and essential work in the development ot what hc produced.

"When Mr. Whitney first visited Savannah much had already been accomplished in the way of creating conditions for the more economical production of cotton. A commission had been appointed by the State of Georgia, charged with the duty of causing a machine to be devised for the separation of the lint of the cotton from the seed. Mr. Josiah Watkins had in operation a crude machine similar in many respects to the more nearly perfect gin which Whitney constructed. The substitution of the saw for wire spikes seems to have been first made by Colonel O. A. Bull, of La Grange, Ga., and a little later, but independently, by Hogden Holmes, of Fairfield County, South Carolina; and it was this improvement, more than any other one thing, that put the cotton-gin in shape to become such an important factor in the development of the cotton interest.

"While the times were ripe for the invention of the cotton-gin, and many persons were working at the problem, and while the gin wonld probably have been invented even had Whitney never gone to the Sonth, he was just the right man quickly to take up the suggestion of the Georgia State commission. He saw the Watkins machine, worked on the problem himself, heard of Holmes's improvement and went to see it, and to his own ideas and work he added the best of what he gathered from various other workers on the same problem. The resnlt was the Whitney gin."

Whitney realized comparatively little from this invention.

Richard H. Edmonds.

decade from 1840 to 1849 being the lowest of any decade in the history of cotton.

These excessively low prices brought about a revival of public interest in other pursuits than cotton cultivation; and the natural tendency of the people to progress in other industrial matters, as evidenced by the history of the Southern colonies prior to the Revolution, but which had long been dormant, was again aroused, and for some years there was a very active spirit manifested in the building of railroads and the development of manufactures. With 1850 a period of much higher prices was ushered in, and for the next ten years the average was about twelve cents. Then came the war, with its accompanying scarcity of cotton, prices rapidly advancing until 1863–64, when the New York average was 101½ cents. When the war ended the world was bare of cotton. The demand was pressing, and the prices continued very high. But the South was bankrupt. It had no capital on which to operate; its planters were burdened with debt; their houses and fences were destroyed; their labor system was disorganized; and in this condition they were in no position to buy foodstuffs, live stock, and agricultural implements.

Money lenders, however, were ready to make advances on mortgages on unplanted cotton, but not on other crops. Most of them were factors or commission merchants who would agree to advance a certain sum of money, or rather to grant a certain amount of credit at their stores for merchandise of all kinds, for every acre planted in cotton. Under these circumstances diversified agriculture had to be abandoned, and the planter was forced to buy Western corn and bacon from his commission merchant. By the time he had paid nearly double the cash values for his supplies, and had paid commission, storage and drayage, and insurance on his cotton when marketed, the planter usually ended the year in debt to his factor. The profits of the factor, though, were sufficiently large to justify him in continuing his credit, and by doing so the farmer was kept in debt from year to year. The negroes and the tenant class of whites could borrow money on cotton in the same way, and this developed a tenantry system for raising cotton which prevented any attention being given to the improvement of the land. Year after year the farmer was forced into cotton raising to the exclusion of everything else, until it became only too true that "the South kept its corn-crib and smoke-house in the West."

After 1880, although the Southern farmers were still heavily in debt, they commenced to give increased attention to the cultivation of grain and to the raising of early fruits and vegetables. The progress made since then has been very remarkable, but, despite this great increase, the production of corn in the central cotton States does not yet equal the average prior to 1860. In the mean time the cotton crop has increased rapidly, rising from 5,456,000 bales in 1881–82 to 9,900,000 bales in 1894–95. Summing up in tabular form the statistics of the cotton crop since 1840, we have:

COTTON SINCE 1840.

Year.	Crop. Bales.	Consumption in U. S. Bales.	Exports. Bales.	Average Price per Lb. Middling Uplands in N. Y. Cents.
1840–41	1,634,954	267,850	1,313,500	9.50
1841–42	1,683,574	267,850	1,465,500	7.85
1842–43	2,378,875	325,129	2,010,000	7.25
1843–44	2,030,409	346,750	1,629,500	7.73
1844–45	2,394,503	389,000	2,083,700	5.63
1845–46	2,100,537	422,600	1,666,700	7.87
1846–47	1,778,651	428,000	1,241,200	11.21
1847–48	2,439,786	616,044	1,858,000	8.03
1848–49	2,866,938	642,485	2,228,000	7.55
1849–50	2,223,718	613,498	1,590,200	12.34
1850–51	2,454,442	485,614	1,988,710	12.14
1851–52	3,126,310	689,603	2,443,646	9.50
1852–53	3,416,214	803,725	2,528,400	11.02
1853–54	3,074,979	737,236	2,319,148	10.97
1854–55	2,982,634	706.417	2,244,209	10.39
1855–56	3,665,557	777,739	2,954,606	10.30
1856–57	3,093,737	819,936	2,252,657	13.51
1857–58	3,257,339	595,562	2,590,455	12.23
1858–59	4,018,914	927,651	3,021,403	12.08
1859–60	4,861,292	978,043	3,774,173	11.00
1860–61	3,849,469	843,740	3,127,568	13.01
1861–62				31.29
1862–63	War Period.	War Period.	War Period.	67.21
1863–64				101.50
1864–65				83.38
1865–66	2,269,316	666,100	1,554,664	42.30
1866–67	2,097,254	770,030	1,557,054	31.59
1867–68	2,519,554	906,636	1,655,816	24.85
1868–69	2,366,467	926,374	1,465,880	29.01
1869–70	3,122,551	865,160	2,206,480	23.98
1870–71	4,352,317	1,110,196	3,169,009	16.95
1871–72	2,974,351	1,237,330	1,957,314	20.48
1872–73	3,930,508	1,201,127	2,679,986	18.15
1873–74	4,170,388	1,305,943	2,840,981	17.00
1874–75	3,832,991	1,193,005	2,684,708	15.00
1875–76	4,632,313	1,351,870	3,234,244	13.00
1876–77	4,474,069	1,428,013	3,030,835	11.73
1877–78	4,773,865	1,489,022	3,360,254	11.28
1878–79	5,074,155	1,558,329	3,481,004	10.83
1879–80	5,761,252	1,789,978	3,885,003	12.02
1880–81	6,605,750	1,938,937	4,589,346	11.34
1881–82	5,456,048	1,964,535	3,582,622	12.16
1882–83	6,949,756	2,073,096	4,766,597	10.63
1883–84	5,713,200	1,876,683	3,916,581	10.64
1884–85	5,706,165	1,753,125	3,947,972	10.54
1885–86	6,575,691	2,162,544	4,336,203	9.44
1886–87	6,505,087	2,111,532	4,445,302	10.25
1887–88	7,046,833	2,257,247	4,627,502	10.27
1888–89	6,938,290	2,314,091	4,742,347	10.71
1889–90	7,307,281	2,390,959	4,955,931	11.53
1890–91	8,652,597	2,632,023	5,847,191	9.03
1891–92	9,035,379	2,876,846	5,933,437	7.64
1892–93	6,700,365	2,481,015	4,402,890	8.24
1893–94	7,549,817	2,319,688	5,287,887	7.67
1894–95	9,901,251			

A study of the foregoing figures will show that during a period of seven years, from 1885–86 to

1891–92, there was an annual increase in production, a continuous growth unprecedented in the history of the cotton trade. It is doubtful if any leading crop raised can show such an unbroken increase for seven-years. Jumping from 5,700,000 bales in 1884–85 to 6,500,000 bales in 1885–86, there was practically no halting, as the variations in two years were too small to be noticeable, to 9,035,000 bales in 1891–92, a gain of 3,300,000 bales, or nearly sixty per cent. advance in seven years. After this came two smaller crops, but the following year (1894–95) gave a yield of 9,901,251 bales. Moreover, the average weight of the bales that year was considerably above that of preceding years. Based on the same average weight per bale, the crop of 1894–95 was equivalent to 10,089,000 bales of 1893–94 weight, and to 10,099,000 bales of the weight of the next largest crop, that of 1891–92; so that as a matter of fact the yield of 1894–95 was equal to 1,064,000 bales in excess of the largest previous crop.

The average total value of crop and average yield per acre of late years have been as follows:

COTTON AVERAGES, 1875 TO 1894.

YEAR.	ACRES.	TOTAL VALUE OF CROP.	NET LB. PER ACRE.	BALE PER ACRE.
1875–76	11,635,000	$399,445,168	177	0.39⅞
1876–77 ...	11,500,000	252,602,340	171½	0.39
1877–78 ...	11,825,000	255,768,165	181¾	0.40⅜
1878–79	12,240,000	236,586,031	185¼	0.41½
1879–80	12,680,000	313,696,452	206¼	0.45½
1880–81 . ..	16,123,000	356,524,911	188½	0.41
1881–82	16,851,000	304,298,744	145⅝	0.32⅜
1882–83 ...	16,276,000	327,938,137	200⅝	0.42⅝
1883–84	16.780,000	288,803,902	157½	0.34
1884–85 .. .	17,426,000	287,253,972	150½	0.33
1885–86	18,379,444	313,723,080	165½	0.36
1886–87	18,581,012	298,504,215	162½	0.35
1887–88 ...	18,961,897	336,433,653	173½	0.37
1888–89 ...	19,362,073	344,069,801	167⅞	0.35¾
1889–90	19,979,040	373,161,831	173¾	0.36½
1890–91	20,583,935	429,792,047	200⅜	0.42
1891–92	20,555,387	391,424,716	209⅝	0.44
1892–93 ...	18,057,924	284,279,066	176	0.37
1893–94	19,684,000	294,495,711	182	0.38

In the nineteen years from 1875–76 to 1893–94 cotton brought into the South over $6,300,000,000, a sum so vast that the profits out of it ought to have been enough greatly to enrich that whole section. Unfortunately, however, the system (which was developed by the poverty following the war) of raising cotton only and buying provisions and grain in the West left at home but little surplus money out of the cotton crop. The West and North drained that section of several hundred million dollars every year, because it depended upon them for all of its manufactured goods, as well as for the bulk of its foodstuffs. Hence, of the enormous amount received for cotton, very little remained in the South. The increase in diversified farming, the raising of home supplies, the development of truck farming, and the building of factories are now all uniting to keep at home the money which formerly went North and West.

The importance of cotton in our foreign trade relations can be appreciated from the simple statement that from September 1, 1875, to August 31, 1895, our exports of this staple were valued at over $4,200,000,000, while the total exports of wheat and flour combined for the same period were $2,610,000,000, showing a difference of $1,600,000,000 in favor of cotton. Moreover, during the same period we exported over $200,000,000 of manufactured cotton goods, making the full value really $4,400,000,000. Compared with the exports of wheat, flour, and corn combined, the value of which for the period named was a little less than $3,200,000,000, there is a difference in favor of cotton of $1,200,000,000. Going back to 1820, it is found that the total value of flour and wheat exported for seventy-five years was $4,000,000,000, or $400,000,000 less than the value of the cotton exported during the nineteen years from 1875 to 1894.

The growth of the cotton manufacturing industry in this country has not kept pace with the increase in production, nearly three fourths of the crop being annually exported to Europe. With an annual yield of from 7,500,000 to 9,900,000 bales, the total consumption by American mills is a little less than 3,000,000 bales a year. Nevertheless this industry has grown rapidly, and the capital invested aggregates in round figures about $400,000,000. The census returns, being compiled for fiscal years ending with June, always differ somewhat from the commercial reports which cover crop years ending with August. It is necessary, therefore, to bear this in mind.

The number of spindles at present is estimated at about 17,000,000. The "Textile Manufacturers' Directory" of 1894–95 reports this number, and credits the leading cotton manufacturing States with the following: Massachusetts, 6,755,000; Rhode Island, 2,000,000; New Hampshire, 1,350,000; Connecticut, 1,088,000; Maine, 945,000; South Carolina, 720,000; North Carolina, 703,000; New York, 673,000; Georgia, 569,000; New Jersey, 419,000; Pennsylvania, 424,000; and Alabama, 240,000.

The progress of cotton manufacturing in the United States from 1830 to 1890, according to the census reports, was as follows:

SIXTY YEARS OF COTTON MANUFACTURE.

Year.	Capital Employed.	Number of Spindles.	Cotton Consumed. Reduced to Bales of 400 Lbs.	Hands Employed.	Wages Paid.	Value of Products.
1830	$44,914,941	1,246,503	184,000	62,208	$12,155,723	$32,036,760
1840	51,102,350	2,284,631	340,000	72,119	14,000,000	46,350,453
1850	74,500,931	3,633,693	721,393	92,286	17,276,112	65,501,687
1860	98,585,269	5,035,798	1,056,762	122,028	23,940,108	115,681,774
1870	140,706,291	6,621,571	995,770	135,369	39,044,132	177,489,739
1880	208,280,346	10,768,516	1,875,859	174,659	42,040,510	192,090,110
1890	354,020,843	14,088,103	2,794,864	221,585	69,489,272	267,981,724

During the last two years this industry has made rapid progress in the South, and that section promises to dispute New England's supremacy within a comparatively few years. In 1880 the Southern States had 667,000 spindles, representing a capital in cotton manufacturing of $21,900,000. By 1890 this had increased to 1,712,000 spindles and $61,000,000 capital. In September, 1895, the South had 3,000,000 spindles, representing an aggregate investment of about $100,000,000; and the mills under construction would add about 800,000 spindles to this number. The annual report for 1895 of the New Orleans Cotton Exchange gives the relative growth of consumption of cotton in Northern and Southern mills of late years in commercial bales (as distinguished from 400-pound bales) as follows:

MANUFACTURING IN THE NORTH AND SOUTH.

Crop Years.	Northern Mills.	Southern Mills.
1894-95	2,083,839	862,838
1893-94	1,601,173	718,515
1892-93	1,687,286	743,348
1891-92	2,190,766	686,080
1890-91	2,027,362	604,661
1889-90	1,799,258	546,894
1888-89	1,785,979	479,781
1887-88	1,804,993	456,090
1886-87	1,710,080	401,452

Under the activity prevailing in cotton manufacturing interests during 1894–95 Northern mills regained most of the loss of the two preceding years, but their purchases were still 107,000 bales less than in 1891–92, while during the same period Southern mills increased their consumption 176,800 bales compared with 1891–92. The "Commercial and Financial Chronicle" distinguishes between the takings or purchases and the actual consumption, and makes the figures as follows:

CROPS AND CONSUMPTION.

Crop Years.	Actual Consumption.	
	Northern Mills. Commercial Bales.	Southern Mills. Commercial Bales.
1889-90	1,800,000	519,478
1890-91	1,925,000	605,916
1891-92	2,025,000	681,471
1892-93	1,950,000	733,701
1893-94	1,675,000	723,329
1894-95	1,840,769	853,352

According to these figures the actual consumption in Northern mills, while larger, of course, than during the panic year 1893–94, was less than for any year since 1890–91, having been 85,000 bales smaller than in the latter year, and 185,000 bales smaller than in 1891–92. Southern mills, on the contrary, gained nearly 250,000 bales compared with 1890–91, and 172,000 bales compared with 1891–92. In 1890–91 the South consumed less than one third as much cotton as Northern mills; last year Southern consumption was nearly one half as much as Northern.

The Cotton Exchange report gives the following comparison in commercial bales, since 1850:

COTTON TAKEN BY AMERICAN MILLS.

Year ending Aug. 31st.	Northern Mills. Bales.	Southern Mills. Bales.	Total Bales.	Commercial Crops.
1850	475,702	87,067	562,769	2,171,706
1860	786,521	178,107	964.628	4,823,770
1870	806,690	90,000	896,890	3,154,946
1880	1,573,997	221,337	1,795,334	5,701,252
1890	1,789,258	546,894	2,346,152	7,311,392
1892	2,190,766	686,080	2,876,846	9,035,379
1895	2,083,839	862,838	2,946,677	9 901,251

The figures of Southern mills represent actual consumption; those of Northern mills the takings or purchases for the year.

R. H. Edmonds.

CHAPTER XXXV

AMERICAN WOOL

FOOD is essential to human existence; clothing is a concomitant of civilization, and an absolute necessity for mankind outside of equatorial limits. The use of animal food for our race has the sanction of Holy Writ, general usage, and adaptation to support life, impart vigor, and secure health. The science of dietetics has demonstrated, and experience proves, that mutton is generally better adapted to satisfy a cultivated taste, furnish nutrition, and insure health than any other meat-food. Sheep furnish wool for the making of clothing, which, for sanitary reasons, durability, and economy, is superior to that manufactured from other fibers or materials. The food and clothing thus provided are suited to every climate and latitude, and sheep, in their numerous species, find a suitable habitat in all. These considerations add to the teleological evidence that all things are ordered by divine wisdom and power, and that sheep husbandry, which in the pastoral state preceded, and in many localities exists even without agriculture, is of universal utility, and deserves the favor of mankind and of governments.

The antiquity of sheep, wool, and woolen goods is attested in history, sacred and profane. "Abel was a keeper of sheep," and Abraham gave sheep to Abimelech. The sacred record testifies of woolen garments also. The purple robes of the Roman emperors were woven from the merino fleece. The Roman conquest of England brought to that country the first knowledge there of the use and manufacture of wool, which grew in importance until early in the nineteenth century, when English wool manufactures were unsurpassed in perfection. This result was aided by legislation. In 1261, England by statute prohibited the export of wool, or the wearing of foreign woolens. This was followed by other more stringent statutes having the same objects, up to that of 1660, which remained substantially in force until 1824, when wool was admitted free of duty.

The western hemisphere had no sheep when European discoverers and conquerors first visited it. The first mission established in California, in 1697, found two varieties of animals (the *Ovis montana*, "or a species closely allied to it"), one the Rocky Mountain goat, the other the Rocky Mountain sheep. Their bodies were covered with coarse hair, under which was a coat of fur-like fibers, corresponding with noils in our present varieties of sheep. This fur was fine, and adapted to the manufacture of clothing. A subspecies of these animals is found in Alaska—the *Ovis montana dalli*. Spanish sheep were introduced into California in 1773, under the care of the Catholic priests, and woolen manufactures of coarse varieties were produced soon afterward. In South America the European discoverers found "four forms of the genus *Auchenia*—the *guanaco* and *vicugna*, in the wild state, and the *llama* and *alpaca*, known only in the domesticated state." These animals furnished fibers used in making clothing.

The *mouflon* (*Ovis aries*), even yet found wild in the mountains of Sardinia, Corsica, Barbary, Greece, and Asia Minor, with short, coarse fleece resembling hair quite as much as wool, is the parent stock from which all our various breeds have been produced by domestication and breeding. The effect of breeding and feeding is shown in the increase of the weight of fleeces in the United States, as follows: "Weight of fleece, 1840, 1.9; 1850, 2.4; 1860, 2.7; 1870, 3.5; 1880, 4.8; 1887, 5.1; 1891, 5.5; 1893, 5.3; 1894, 5.33; 1895, 6.375 pounds."

The first importation of sheep was made from the Canary Islands by Columbus, on his return voyage to the New World, to stock the island of Hispaniola. Other importations followed from Spain to the same island and to Cuba. Woolen cloth was made in New Spain in 1560. These Spanish sheep "were the progenitors of the immense herds in Mexico, New Mexico, Utah, and Texas. In 1736 there were over 1,500,000 sheep in the Mexican State of Nuevo Leon." These are the parent stock from which came the common coarse, or so-called native, Mexican sheep. Spanish sheep were subsequently imported into South America. Prescott recounts, in his "History of the Conquest of Mexico," that Cortes imported large numbers of merino sheep into what is now Central America. From all of these early Spanish importations sprang the immense flocks of Mexico and all the southwest territory. Wool manufacturing developed rapidly, even the Indians learning to weave. By 1750 sheep raising was the principal business in Mexico.

The first sheep introduced into the American colonies were brought from England to Jamestown, Va., in 1609. In 1633 a few sheep were brought from England to Massachusetts. In 1625, and again in 1630, the Dutch brought some sheep to the New Netherlands. In 1663 a Swedish colony in Delaware imported eighty sheep. In 1645 and 1656 Massachusetts passed laws encouraging the raising of sheep. In 1657 Virginia, by statute, prohibited the export of sheep, and in 1662 a statute prohibited the export of wool, and provided a bounty in tobacco for every yard of woolen cloth made in the colony. In 1664 looms were established by the General Assembly, and provisions made for weavers in each county. In 1682 a statute affixed heavy penalties against the export of wool, hides, and iron. Other colonies, by local statutes, encouraged sheep husbandry.

The Parliament of Great Britain passed an act providing that "after the 1st of December, 1699," no wool produced in the colonies should be exported to the mother country, the preamble to the act reciting that the colonial industry would "inevitably sink the value of land" in England. Other hostile legislation followed, but space will not permit a statement of the details.

In 1798 Hon. William Porter, of Massachusetts, is said to have smuggled from Spain two ewes and a ram, worth, each, $1500, which he presented to a friend, Andrew Craigie, who, in ignorance of their value, consumed them as mutton. They were the first merino sheep introduced into the United States. Seth Adams, at Dorchester, Mass., founded a flock of merinos from a single pair imported from France in 1801. He removed to Zanesville, O., in 1807, and there bred merinos. In 1802 Hon. R. R. Livingston, American minister to France, sent two pairs of French merinos to his New York farm. In the same year Colonel David Humphreys, of Connecticut, United States minister to Spain, sent twenty merino rams and seventy ewes to this country. In 1803 Dr. James Mease, of Philadelphia, imported two black Spanish merinos. In 1807 Dr. Muller imported a few merinos from Hesse-Cassel. In 1809 William Jarvis, United States consul at Lisbon, sent to the United States 3850 Spanish merinos. In 1823 Saxon merinos were imported. Since then the increase in the number of sheep has been too great for such specific mention.

In January, 1895, the sheep in the States and Territories of the United States were as follows:

SHEEP BY STATES AND TERRITORIES, 1895.

States and Territories.	Number.	Average Price.	Value.
Maine	284,435	$1.93	$549,670
New Hampshire	106,233	1.97	208,961
Vermont	226,938	1.60	363,464
Massachusetts	49,383	3.43	169,137
Rhode Island	11,279	2.79	31,468
Connecticut	37,934	3.25	123,243
New York	1,096,560	2.27	2,486,449
New Jersey	50,662	3.41	172,849
Pennsylvania	1,178,795	1.95	2,304,309
Delaware	12,873	2.64	33,921
Maryland	138,174	2.62	361,519
Virginia	449,357	2.17	974,027
North Carolina	357,494	1.34	480,472
South Carolina	78,384	1.64	128,863
Georgia	402,946	1.33	537,530
Florida	110,627	1.56	172,357
Alabama	326,640	1.45	474,804
Mississippi	390,904	1.24	484,331
Louisiana	178,745	1.37	244,112
Texas	3,738,117	1.21	4,541,812
Arkansas	212,328	1.36	288,278
Tennessee	493,782	1.55	767,633
West Virginia	635,535	1.79	1,137,734
Kentucky	1,046,788	1.85	1,934,046
Ohio	3,577,419	1.72	6,139,924
Michigan	1,961,946	1.88	3,697,091
Indiana	836,217	1.89	1,581,454
Illinois	857,370	2.04	1,747,835
Wisconsin	895,756	1.65	1,474,414
Minnesota	489,192	1.79	876,241
Iowa	627,930	2.06	1,292,028
Missouri	860,820	1.63	1,401,587
Kansas	274,883	1.67	458,808
Nebraska	183,448	1.85	339,783
South Dakota	323,482	1.55	532,969
North Dakota	367,171	1.68	616,701
Montana	2,808,717	1.51	4,227,400
Wyoming	1,222,538	1.64	2,004,107
Colorado	1,305,989	1.52	1,984,058
New Mexico	3,008,824	.90	2,692,898
Arizona	746,546	1.21	901,081
Utah	2,039,226	1.47	2,998,885
Nevada	544,077	2.42	1,316,667
Idaho	919,865	1.41	1,299,770
Washington	748,857	1.74	1,304,360
Oregon	2,529,759	1.16	2,945,905
California	3,526,341	1.65	5,817,052
Oklahoma	22,778	2.80	63,760
Total	42,294,064	$1.58	$66,685,767

In January, 1895, there were in the world 571,163,062 sheep. The wool product of 1894 was 2,692,986,773 unwashed pounds, or something less than half this amount clean. The sheep, January, 1895, were, in North America, 48,129,537; in Central America and the West Indies, 505,825; in South America, 101,308,583; in Europe, 192,080,003; in Asia, 74,245,090; in Australasia, 119,204,376; in Africa, 35,689,648.

The production of wool throughout the world for the first fifty years of the present century was 32,360,881,950 pounds, and the yearly average for the first fifty years, 647,217,639 pounds.

The following shows the world's production of wool, in pounds, from 1810 to 1890 inclusive, together with the increase in population:

The sheep in the United States are owned by about 1,000,000 flock-masters. In January, 1893, there were 47,273,533 sheep, of the value of $125,-909,264, with a wool product of 348,538,138 pounds. The decline in numbers, value, and product in two years is great. That this decline is not the result of a diminished consumption is shown by the following statement, which gives the annual consumption of wool during the last five fiscal years. (See Table 1, on following page.)

Our annual consumption was equal to nearly one fourth of the world's wool product, and more per capita of population than in any other nation.

WORLD'S WOOL PRODUCT, 1810 TO 1890.

Year.	Population.[1]	Years.	Production. Pounds.	Yearly Average. Pounds.
1810	269,400,000	1801–10	5,109,663,200	510,966,320
1820	298,900,000	1811–20	5,427,612,600	542,761,260
1830	337,450,000	1821–30	5,753,904,200	575,390,420
1840	384,060,000	1831–40	6,867,524,000	686,752,400
1850	435,223,740	1841–50	9,102,177,950	910,217,795
1860	480,800,450	1851–60	11,035,584,400	1,103,548,540
1870	537,183,250	1861–70	14,883,648,300	1,488,364,830
1880	641,858,085	1871–80	17,080,363,490	1,708,036,349
1890	729,591,430	1881–90	19,462,037,826	1,946,203,782
Total	....	....	94,722,416,960	1,052,371,299

[1] The population in this table includes eighteen nations of Europe. In America: the United States, Mexico, the Argentine Republic, and the Dominion of Canada. In Africa: the Cape Colonies. In Australia: the whole continent. In Asia: India and Turkey.

PRODUCTION OF WOOLS IN THE ARGENTINE REPUBLIC, AUSTRALASIA, AND ASIA FROM 1800 TO 1890, FOR YEARS STATED.

Year.	Argentine Republic.	Australasia.	Asia.
	Pounds.	*Pounds.*	*Pounds.*
1800	1,200,000	No returns.	52,498,150
1810	2,800,000	No returns.	56,993,200
1820	3,750,000	No returns.	68,837,420
1830	5,940,000	2,860,650	70,571,200
1840	14,965,250	13,860,780	85,149,270
1850	24,864,300	42,958,645	104,941,500
1860	55,885,760	69,964,320	121,910,890
1870	166,987,500	179,459,780	134,507,120
1880	259,824,840	345,010,338	135,095,140
1890	360,000,000	400,879,240	264,860,050
1891	376,700,000	550,000,000	....
1894	443,000,000	581,000,000	....

TABLE SHOWING NUMBER OF SHEEP ON DIFFERENT DATES.

Year.	Country.	Number of Sheep.
1871	Australasia	49,773,584
1891	.... do	114,628,301
1892	Australia	111,998,504
1860	Argentine Republic	16,262,827
1870	.... do	61,707,827
1880	.... do	91,582,206
1887	.... do	103,413,817
1891	.... do	....
1888	Cape of Good Hope	13,177,285

Of the wool product of 1894, about 47,000,000 pounds were "pulled wool," the residue, fleece sheared.

Continuing still further, the following figures, which are from official sources and have the approval of the National Association of Wool Manufacturers, show clearly the comparative consumption of wool in the United States since 1840. It will be seen that while our population has increased fourfold, our consumption and production is more than eightfold. (See Table 2, on following page.)

TABLE 1.

Total Consumption of Wool for Years ending June 30.	1891.	1892.	1893.	1894.	1895.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Domestic wool (clip of the previous year)	309,474,857	307,101,507	330,018,405	364,156,666	328,437,858
Imported wool	129,303,647	148,670,652	172,433,838	55,152,558	206,181,890
Wool imported in shape of goods, shoddy, rags, and waste	123,180,240	106,697,637	114,145,545	55,318,050	109,627,188
Total	561,958,744	562,469,796	616,597,788	474,627,274	644,246,936

Estimated total consumption for fiscal year ending June 30, 1895 ...... 644,246,936 lbs.
Estimated average total consumption for the past five fiscal years ...... 571,980,107 lbs.

Estimated increased consumption for 1895 over the average of five years ...... 72,266,829 lbs.

TABLE 2.—WOOL CONSUMPTION, 1840 TO 1896.

Year.	Imports of Wool entered for Consumption, Year ending June 30. Pounds.[1]	Home Production of Wool, Year ending January 1. Pounds.	Domestic Exports. Pounds.	Net Supply. Pounds.	Imports of Wool Manufactures, allowing 3 Pounds of Wool to the $1 in Value. Pounds.	Total Consumption. Pounds.	Per Capita Consumption of Wool. Pounds.
1840	[2] 9,813,212	35,802,114	....	45,615,326	31,095,276	76,710,602	4.49
1850	18,695,294	52,516,969	35,898	71,176,365	58,178,613	129,354,978	5.58
1860	26,125,891	60,264,913	1,055,928	85,334,876	128,497,923	213,832,799	6.80
1870	38,634,067	162,000,000	152,892	200,481,175	105,289,422	305,770,597	7.93
1880	99,372,440	232,500,000	191,551	331,680,889	95,503,641	427,184,530	8.52
1890	109,902,105	295,779,479	231,042	405,450,542	162,496,269	567,946,811	9.07
1891	119,390,280	309,474,856	291,922	428,573,214	129,706,230	558,279,444	....
1892	134,622,366	307,101,507	202,456	441,521,417	107,378,718	548,900,135	....
1893	175,636,042	333,018,405	91,858	508,562,589	110,963,712	619,526,301	....
1894	45,726,056	348,538,138	520,247	393,743,947	58,784,262	452,528,209	....
1895	[3] 206,133,906	325,210,712	4,279,109	527,065,509	109,627,188	636,692,697	....
1896	....	294,296,726	....	....	....	....	....

[1] Quantities for 1840, 1850, and 1860 are imports less reëxports. [2] Year ending September 30th.
[3] Gross imports; imports for consumption not yet reported.

Other interesting figures bearing on this point, taken from the United States census, give us a comparative statement of domestic and imported wool manufactures, with per capita value and percentage of total consumption:

The financial panic which commenced July, 1893, reduced consumption of wool in the fiscal year 1894, and this in turn necessitated increased consumption in the fiscal year 1895. The imports of wool in the fiscal year 1893 were 172,433,833

DOMESTIC AND IMPORTED WOOL MANUFACTURES, 1820 TO 1890.

Domestic Manufactures. (Census.)		Value per Capita.	Per Cent. of Total Consumption.	Net Importations. (Average for Ten Years.)	Value per Capita.	Per Cent. of Total Consumption.
Year.	Value.			Value.		
1820	$4,413,068	$0.46	39	$6,859,702	$0.71	61
1830	14,528,166	1.13	64	8,290,862	0.64	36
1840	20,696,999	1.21	60	13,950,772	0.82	40
1850	49,636,881	2.14	79	13,005,852	0.56	21
1860	80,734,606	2.57	72	31,333,273	1.00	28
1870	217,668,826	5.65	87	33,046,521	0.86	13
1880	267,252,913	5.33	87	39,537,694	0.79	13
1890	337,768,524	6.30	89	43,345,981	0.69	11

pounds, but in 1894 the imports fell to 55,152,588 pounds. In 1895 the imports, with the first two months under the tariff act of 1890, and the last ten months under the free-wool act of 1894, were 206,-181,890, at an import value of $25,556,421, besides rags, noils, and waste.

The total value of imports of wool manufactures for fiscal years specified, with the pounds of raw wool therein, were as follows:

Year.	Value of Wool Imports.	Pounds of Raw Wool in Manufactures.
1891	$41,060,080	123,180,240
1892	35,565,879	106,697,637
1893	38,048,515	114,145,545
1894	19,439,372	58,318,116
1895	36,542,396	109,627,188
Total	$170,656,242	511,968,726

In the fiscal year 1894, the last under the tariff act of 1890, the imports of shoddy, rags, waste, mungo, flocks, and noils were only 143,002 pounds of the import value of $47,522. For the fiscal year 1895, and almost wholly during the ten months of the tariff act of August, 1894, 14,066,054 pounds of similar adulterants, of the import value of $1,980,-464, were imported—an increase of over 1000 per cent. However, it is not within the province of this chapter to discuss the political aspects of wool tariff legislation, nor consider the economic questions growing out of sheep husbandry.

The condition in which wool is marketed depends considerably upon the section of country where it is grown. Wools produced west of the Mississippi River are generally sold unwashed; east thereof much of it is washed on the sheep's back. The average shrinkage in scouring of the fleece-wool of 1894 is estimated at 59.71 per cent.; of the pulled wool, 40 per cent.; the product of all in scoured pounds, 140,292,268. The average weight of fleece in the grease was 6.395 pounds; of the year's product as marketed, "washed and unwashed," 5.33 pounds.

In 1870 the wool product was 163,000,000 pounds, of which there were marketed, washed on sheep, tub-washed, and pulled, 130,000,000 pounds, and 33,000,000 unwashed, from California, Oregon, Nevada, Texas, New Mexico, Colorado, Utah, and sundry Southern States. At that time only twenty-six per cent. of the sheep, or 7,418,000, were west of the Mississippi River; but in 1893 there were west of that river 27,614,699 sheep, or fifty-six and one half per cent. of all, leaving 19,658,854 east of it. With the development of the new States and Territories, with their cheap pasturage, the wool industry westward "took its way," and a comparatively small part of wool is now marketed unwashed.

Fleece-wool is marketed as (1) "unwashed," that is, as shorn from the sheep; (2) "washed," that is, washed in cold water on the sheep; and (3) "scoured," that is, cleaned ready for manufacture. "Pulled wool" is that pulled from pelts. "Tub-washed" includes fleeces broken and washed more or less by hand or machinery. "Unmerchantable" is wool partially washed on the sheep's back, but not sufficiently so to be classed as "washed." After the year 1870, in order to evade the full effect of the wool tariff of 1867, Australasian wool was imported "skirted"; that is, with the belly, head, and breech wool removed from each fleece, thereby adding to its value.

The wool product for the last ten years has been:

Fleece and Pulled Wool in the Grease.

Year.	Pounds.	Decrease.	Increase.
1886	323,031,026	....	....
1887	302,169,950	20,861,076	....
1888	301,876,121	293,829	....
1889	295,779,479	6,096,642	....
1890	309,474,856	....	13,699,377
1891	307,401,507	2,073,349	....
1892	333,018,405	....	25,606,898
1893	348,538,138	....	15,519,733
1894	325,210,712	23,327,426	....
1895	294,296,726	30,913,986	....

Scoured Wool.

Year.	Pounds.	Decrease.	Increase.
1886	149,365,625	....	....
1887	140,556,685	8,808,940	....
1888	136,591,955	3,964,730	....
1889	134,795,350	1,796,605	....
1890	136,628,220	....	4,832,870
1891	139,326,703	301,517	....
1892	145,300,318	....	5,973,615
1893	151,103,776	....	5,803,458
1894	140,292,268	10,811,508	....
1895	125,718,690	14,573,578	....

The clip this year is the smallest since that of 1889, which was again smaller than that of any preceding year since 1881. These figures may aid in illustrating results under the wool tariff acts of 1883, 1890, and 1894.

The following is the estimate of the National Association of Wool Manufacturers, for years specified, of the wool product of the United States:

William Lawrence.

WOOL PRODUCT OF THE UNITED STATES CLASSIFIED, 1893 TO 1895.

	1895.				1894.	1893.
States and Territories.	Wool, Washed and Unwashed. Pounds.	Average Weight of Fleece.	Scoured Wool. Pounds.	Per Cent. of Shrinkage.	Washed and Unwashed.	Washed and Unwashed.
Maine	1,657,116	6	944,556	43	1,889,040	2,392,224
New Hampshire	719,838	7	302,332	58	768,691	950,936
Vermont	1,632,462	7½	652,985	60	2,036,138	2,472,090
Massachusetts	253,038	6	139,171	45	303,708	318,192
Rhode Island	65,508	6	37,340	43	64,224	73,560
Connecticut	215,538	6	120,701	44	232,152	212,395
New York	6,250,392	6	3,000,188	52	8,432,413	9,328,300
New Jersey	245,455	5	127,437	48	274,900	306,230
Pennsylvania	5,899,867	5½	2,772,937	53	8,664,144	9,823,296
Delaware	70,801	5½	38,233	46	68,888	74,531
Maryland	661,165	5	343,806	48	699,595	681,777
Virginia	1,952,455	5	1,112,899	43	2,361,570	2,492,000
North Carolina	1,662,320	5	847,783	49	1,802,520	1,980,575
South Carolina	362,135	5	199,174	45	377,025	391,920
Georgia	1,494,126	4½	866,592	42	1,772,550	1,947,641
Florida	485,655	5	276,823	43	539,025	532,475
Alabama	1,255,280	4½	715,510	43	1,483,808	1,611,711
Mississippi	1,663,295	5	581,749	53	1,952,440	1,862,936
Louisiana	630,970	5	328,104	48	876,220	959,753
Texas	22,669,809	6½	6,800,943	70	23,529,155	30,341,857
Arkansas	1,198,806	6	479,522	60	1,290,408	1,441,956
Tennessee	2,033,150	4½	1,057,238	48	2,440,320	2,977,849
West Virginia	2,149,393	5½	1,139,178	47	4,030,290	4,627,887
Kentucky	5,272,312	5½	3,163,387	40	6,089,980	6,805,359
Ohio	18,534,610	5½	8,896,613	52	20,090,031	21,893,625
Michigan	12,140,524	6½	5,341,831	56	15,194,316	16,370,536
Indiana	4,701,210	6	2,585,666	45	5,589,042	6,482,298
Illinois	5,271,968	6½	2,635,984	50	6,465,914	7,717,638
Wisconsin	5,202,552	6	2,601,276	50	6,199,908	7,189,050
Minnesota	2,841,228	6	1,136,491	60	3,015,480	2,999,646
Iowa	4,219,691	7	1,603,483	62	5,247,480	5,537,301
Missouri	4,906,674	6	2,453,337	50	5,831,550	6,599,688
Kansas	2,296,785	8½	757,939	67	2,535,472	3,117,016
Nebraska	1,475,103	8½	542,531	70	2,421,522	2,452,518
California	23,153,956	7	8,566,964	63	26,275,158	26,808,444
Oregon	19,610,688	8	6,471,527	67	19,853,552	19,648,616
Nevada	4,352,616	8	1,349,311	69	4,047,936	4,441,448
Colorado	8,233,609	6¾	2,881,763	65	8,861,328	9,236,130
Arizona	6,678,603	9	1,803,223	73	6,221,214	5,227,911
North Dakota	2,097,282	6	817,940	61	2,243,825	2,440,000
South Dakota	1,869,078	6	757,631	60	1,916,628	1,994,000
Idaho	6,747,210	7½	2,026,579	67	5,788,140	6,114,096
Montana	19,031,866	7	6,661,153	65	17,642,079	17,696,686
New Mexico	13,948,907	4¾	6,277,008	55	13,389,994	12,285,369
Utah	11,391,114	6	4,100,801	64	11,756,043	14,823,039
Washington	5,158,125	7	1,650,600	68	5,655,531	5,766,775
Wyoming	9,747,300	8½	3,119,136	68	9,861,811	10,187,820
Oklahoma	155,141	7	51,197	67	127,554	....
Total	254,296,726	6.3¾	101,718,690	60	278,210,712	301,538,138
Pulled Wool	40,000,000	..	24,000,000	40	47,000,000	47,000,000
Total Prodnct	294,296,726	..	125,718,690	..	325,210,712	348,538,138

The average weight of fleeces is 6.375 pounds.

The London "Meat Trades' Journal" shows that of the world's sheep nearly one half are of merino blood—so-called "fine wools." A change has recently set in in favor of the long-wool or mutton breeds. The 16,000,000 sheep which Australia has added to her flocks during the last five years have been chiefly "fine wools." Of the total 122,000,000 sheep in Australasia, 110,000,000 are merinos. In South America the increase of the merino has been phenomenal during recent years. Of the sheep in the Argentine Republic not fewer than 45,000,000 are merinos; of the 28,500,000 sheep in Mexico, Chili, Peru, and Brazil, 16,000,000 are merinos; of the sheep in the United States more than three fourths are merinos. In Europe there are said to be nearly 65,000,000 merinos. Spain has more than 12,000,000 merinos; and France, Germany, and Russia each have almost as many fine-wooled sheep as Spain; while the merino either predominates or is bred extensively throughout every other European country outside of the British Isles. Asia and

Africa, with 78,000,000 sheep, have at least 15,000,000 merinos. In addition to these there are various other breeds which have one or more crosses of the merino in them. The British Isles and Canada grow the mutton breeds almost exclusively. The merino is the oldest of all the breeds now known. Its origin is completely lost in the night of antiquity. After the merino the Cotswold can be traced farthest into the realms of the past. With the exception of the Southdown, all our dark-faced mutton breeds are of recent origin. The following estimate of the different kinds of sheep in the United States in 1894 will be found substantially reliable: Pure merinos, 5,000,000; registered merinos, 1,000,000; other merino grades, 17,000,000; cross-breeds (got by merino ewes and rams of English blood), 15,000,000; pure-bred English blood, 2,500,000; registered of English blood, 500,000; natives and inferior grades, 3,000,000; scrubs, 1,000,000.

The classes of sheep in different countries are somewhat variously reported. The census report of 1890 on "Agriculture," differing a little from statistics in the Department of Agriculture, gives the number of sheep in this country as follows:

Sheep on farms		35,935,364
Of these merino "fine wool" (one-half to full blood)	16,725,415	
English breeds, long or medium wool (one-half to full blood)	7,435,471	
All others	11,774,478	
Total of these	35,935,364	
Sheep on ranges, breeds not designated, but to a large extent merino		6,828,182
Total of all		42,763,546

The magnitude of the sheep and wool interests of this country can be best presented through the medium of figures. The wool industry was estimated in 1893 as representing capital, product, labor employed, and wages paid as follows:

Capital in sheep	$120,000,000
Capital in farms and barns for sheep	$400,000,000
Number of flocks and flock-masters	1,000,000
Number of men employed a portion of the year	100,000
Wool produced, pounds	329,410,542
Value	$80,000,000
Number of sheep	45,000,000
Value of sheep sold for pelt and food	$35,000,000
Amount paid in wages	$25,000,000
Value of services of flock-masters	$50,000,000
Cost of washing and shearing sheep	$5,000,000
Total amount paid for labor	$80,000,000

Here is an aggregate capital invested of $520,000,000, giving partial employment to more than 1,000,000 people, with wages and value of services $80,000,000, and with a total product of $115,000,000 annually. This is an underestimate of the value of sheep, based too much on assessors' returns for taxation.

These figures give a correct view of sheep husbandry now, except as the number and value of sheep and the product and price of wool have declined since 1892, and especially since the tariff act of 1894.

The imports of sheep in the fiscal year 1895 were, for breeding purposes, 1942, of the value of $30,885; for mutton, 288,519, of the value of $651,733.

Mulhall's "Dictionary of Statistics" (London, 1892) gives the annual production, in tons, of mutton as follows:

Period.	United Kingdom.	Continent.	United States.	Colonies, etc.	Total.
1831–40..	480,000	1,320,000	170,000	80,000	2,050,000
1851–60	430,000	1,390,000	220,000	163,000	2,203,000
1874–84..	390,000	1,420,000	310,000	350,000	2,470,000
1887.....	365,000	1,480,000	390,000	474,000	2,709,000

The wool tariff acts of 1867 and 1883 placed wools in three classes: First, "clothing," including the various types of merino and "Down clothing"; second, "combing," the wools of the "mutton breeds," including Leicester, Cotswold, Lincolnshire, Down combing, Shropshire, Canada long wool, and similar types; third, "carpet," including Donskoi, native South American, Cordova, Valparaiso, native Smyrna, China, Scotch black-faced, and similar wools. To this third class belongs our American "common wool"—that from the so-called native Mexican sheep. These classes or designations are preserved in the London wool sales, the advertisements frequently specifying twenty-four varieties of clothing, thirty-two of combing, and seventy-seven of carpet.

Under the tariff act of 1890 the Secretary of the Treasury collected 234 samples of foreign wools and other animal fibers used in manufactures, each differing more or less from all others in quality or condition. This act omitted the designations "clothing," "combing," and "carpet," and substituted instead "class one," "class two," and "class three," because by improvements in machinery much of the merino is now combed in manufacturing, and many of the so-called carpet wools are used in the manufacture of clothing goods. The wools of Montana, New Mexico, Utah, Oregon, Nevada, Colorado, Arizona, North and South Dakota, Idaho, Washington, and Wyoming are frequently designated in market reports as "Territory" wools.

Certain terms are used to denote various kinds of wool, so that it has a language of its own. Thus "X and above" means wool of full merino blood; the designations "X," "XX," "XXX," respectively, indicate variations in quality produced by breeding, care, or local influences. "No. 1" means three-fourths blood merino; "No. 2," half-blood merino; "No. 3 and coarse," one-fourth to one-half blood. These include wools of merino blood with crosses of other bloods, such as English and native Mexican. "Medium" includes wools of mixed blood, neither finest nor coarsest in staple.

The merino wools grown in the United States are the best in the world—especially those grown east of the Mississippi River. Thus in Switzler's "Wool Report" of 1888 it is said: "In 1851, at the World's Exhibition in London, four prize medals were awarded to American sheep; and at the International Exhibition of 1863 at Hamburg, where all the finest flocks of Europe were represented, two first-class prizes were awarded to merino sheep from Vermont."

It has been conclusively shown that under proper conditions this country can produce all wools of every kind needed for consumption therein. This would require an increase to about 110,000,000 sheep for existing conditions, with a prospective increase which would more than double the present capital and the wool and mutton product. Among the benefits accruing through such increase would be the achievement of national independence in peace and war for wool supplies; the enlargement of taxable wealth, resources, and power; an increased demand for labor, pasturage, hay, and grain, and thus profits to farmers; the means of preserving the fertility of lands; the utilization of mountain and other regions now waste; the retention of gold otherwise exported to buy foreign wools; and other considerations, all elsewhere amplified. (See U. S. Senate Mis. Docs. Nos. 35, 77, and 124, 53d Congress, 2d Session.)

The annual mutton supply would, with an adequate number of sheep, reach 20,000,000, of a farm value of $80,000,000. A great benefit that would result directly, also, from this advancement in sheep husbandry would be the supply of healthful meat-food it would furnish. The statistics of Denmark and Germany show that in the four years from 1890 to 1893, inclusive, there were slaughtered at Copenhagen 132,294 cattle, of which 33,305 showed evidence of tuberculosis; in 185,755 calves, 339 were more or less tuberculous; in 8292 swine slaughtered 1272 were tuberculous; while in 337,014 sheep slaughtered there was but *one* in which tuberculosis was found. The figures at Berlin for one year, covering parts of 1892 and 1893, show that in 142,874 cattle slaughtered 21,603 showed signs of tuberculosis; in 108,348 calves 125 had tuberculosis; in 518,063 swine 7055 were tuberculous; in 355,949 sheep slaughtered there were but 15 in which there was any sign of tuberculosis.

No less than twenty-five acts of Congress have prescribed, modified, or regulated tariff duties on wool, commencing with the Calhoun act of April 27, 1816, and ending with that of October 1, 1890, repealed by the act of August 28, 1894, which, after a period of seventy-eight years of wool duties, placed wool on the free list. The four acts of March 2, 1867, March 3, 1883, October 1, 1890, and August 28, 1894, mark eras in sheep husbandry. The act of 1867 imposed the heaviest duties. Under it the sheep and wool product was as follows:

Year.	Number of Sheep.	Pounds Wool Product.
1870	28,477,591	100,102,387
1884	50,626,626	337,500,000

The act of 1883 reduced duties somewhat. Under it the sheep and wool product was as follows:

Year.	Number of Sheep.	Pounds Wool Product.
1884	50,626,626	337,500,000
1890	44,336,072	309,474,856

The act of 1890 increased wool duties. Under it sheep and wool were:

Year.	Number of Sheep.	Pounds Wool Product.
1890	44,336,072	309,474,856
1893	47,273,553	348,538,138

The act of 1894 placed wool on the free list. Under it the following statistics appear:

Year.	Sheep in U. S.	Wool Product. Pounds.	Value of Sheep.
1893, January	47,273,553	348,538,138	$125,909,264
1895, January	42,294,064	294,296,726	66,824,621
Decline	4,979,489	54,241,412	$59,084,643

These are statistical facts, without a consideration of the effect of legislation, or other causes, if any, operating to produce them.

The wool tariff of 1867 was the outgrowth of a meeting of wool growers and wool manufacturers of sundry States at Syracuse, N. Y., December 1, 1865, at which a committee representing these two interests was appointed, which drafted a bill, subsequently passed by Congress with modifications, especially reducing the proposed rates on so-called carpet wools. ("Special Rep. Dept. Agriculture on Sheep Industry," 1892.) It is a part of the history of this act that President Johnson had decided to veto the bill, but was finally prevailed on by Hon. Henry Stanberry, his attorney-general, to approve it. The wool tariff of 1883 was the result of the report of the Tariff Commission under the act of Congress of May 15, 1882.

The "Wool Book" of 1895, by S. N. D. North, secretary of the National Association of Wool Manufacturers, gives the number, average price, and value of sheep on farms in the United States, 1810–95, as follows:

STATISTICS OF AMERICAN SHEEP, VALUE AND WOOL PRODUCT, 1810 TO 1895 INCLUSIVE.

From the Annual Reports of the Commissioner of Agriculture.				Pounds of Wool Grown.	
				Department of Agriculture.	1867 to 1885 estimated by James Lynch, New York; 1886 to 1891, by J. P. Truitt, Philadelphia.
Date of Report.	Number.	Average Price.	Value.	Pounds.	Pounds.
1810	10,000,000	....	....	13,000,000	....
1820	....	....	....	14,100,000	....
1830	....	....	....	17,829,000	....
1840	19,311,000	....	....	35,802,114	....
1850	21,723,000	...	....	52,516,969	....
1860	22,471,275	....	....	60,264,913	....
1867[1]	39,385,386	$3.37	$132,774,660	160,000,000	160,000,000
1868	38,991,912	2.52	98,407,809	168,000,000	177,000,000
1869	37,724,279	2.17	82,139,979	180,000,000	162,250,000
1870	40,853,000	2.28	93,364,433	162,000,000	163,000,000
1871	31,851,000	2.32	74,035,837	160,000,000	146,000,000
1872	31,679,300	2.80	88,771,197	150,000,000	160,000,000
1873	33,002,400	2.96	97,922,350	158,000,000	174,700,000
1874	33,938,200	2.61	88,690,569	170,000,000	178,000,000
1875	33,783,600	2.79	94,320,652	181,000,000	193,000,000
1876	35,935,300	2.60	93,666,318	192,000,000	198,250,000
1877	35,804,200	2.27	80,892,683	200,000,000	208,250,000
1878	35,740,500	2.25	80,603,062	208,250,000	211,000,000
1879	38,123,800	2.07	79,023,984	211,000,000	232,500,000
1880	40,765,900	2.21	90,230,537	232,500,000	264,000,000
1881	43,576,899	2.39	104,070,759	240,000,000	290,000,000
1882	45,016,224	2.37	106,596,954	272,000,000	300,000,000
1883	49,237,291	2.53	124,365,835	290,000,000	320,400,000
1884	50,626,626	2.37	119,902,706	300,000,000	337,500,000
1885	50,360,243	2.14	107,960,650	308,000,000	329,600,000
1886	48,322,331	1.91	92,443,867	302,000,000	323,031,026
1887	44,759,314	2.01	89,872,839	285,000,000	302,169,950
1888	43,544,755	2.05	89,279,926	269,000,000	301,876,121
1889	42,599,079	2.13	90,640,369	265,000,000	295,779,479
1890	44,336,072	2.27	100,659,761	276,000,000	309,474,856
1891	43,431,136	2.51	108,397,447	285,000,000	307,101,507
1892	44,938,365	2.58	116,121,270	294,000,000	333,018,405
1893[2]	47,273,553	2.66	125,909,264	303,151,055	348,538,138
1894	45,048,017	1.98	89,186,110	287,105,930	325,210,712
1895[3]	42,294,064	1.58	66,824,621	294,296,726	

[1] The figures previous to 1867 are from the United States Census Reports.
[2] See U. S. Senate Mis. Doc. No. 77, 53d Congress, 2d Session, chart, p. 54; Senate Mis. Doc. No. 35, 53d Congress, 2d Session, p. 81.
[3] Estimate of National Association of Wool Manufacturers.

But it has been shown that the foregoing is not accurate as to number of sheep prior to 1871. According to the census statistics the sheep were as follows:

Year.	Number of Sheep.
1840	19,311,374
1850	21,723,220
1860	22,471,275
1870	28,477,951
1880	35,192,074

Statistics prior to 1810 are not obtainable.

The free-wool provision in the tariff act of August 28, 1894, was first inaugurated in the annual report of the Secretary of the Treasury, December 6, 1886, indorsed by President Cleveland's message to Congress, December 6, 1887, repudiated by the people in the presidential election of November, 1888, but by a change in political parties finally carried into effect and made law in the act of 1894.

The ravages of dogs, wolves, coyotes, and foxes have been a serious obstacle in the way of rearing sheep. In many States legislation has attempted to remedy this by placing bounties on scalps of wolves, coyotes, and foxes, by making the owners of dogs liable for sheep killed, and by taxes on dogs, creating a fund from which to pay for sheep killed. In 1894 the loss of sheep in the United States from all causes was estimated at five and one half per cent. For some years prior to 1892, the loss by dogs in Alabama was estimated at twenty per cent. annually of the sheep. Legislation against dogs has encountered much opposition in many of the States, especially the Southern. Shepherd dogs of five different kinds have been successfully used in herding sheep in many of the States.

Sheep husbandry has diffused its wealth in every State and Territory. Apart from the wool, mutton, pelts, and fertilizer directly produced, it affords an economy of natural resources in the utilization of lands and vegetation otherwise waste. Concerning the single article of wool an eminent authority says: "The value now of the world's wool clip is easily $250,000,000 in first hands; any status which seriously and permanently influences that value cannot safely be ignored." The value of the clip in the United States can be ascertained with comparative accuracy by computation of pounds produced in specific years, with prices. The number of sheep and amounts of wool produced in the United States from 1810 to 1895, inclusive, have been heretofore stated.

There is a difference between farm value and the usually quoted prices at Boston and other Eastern cities, where most of the wool is manufactured and finds its ultimate market. The difference between farm value and the Eastern prices is affected by cost of shipment to market, and other considerations. A reliable authority says of wool freights: "From London [to Boston] freight rates are one third of a cent per pound. From the Western plains it costs from two and one half to three cents a pound to bring wool to Boston; and this difference is practically so much against the Western sheep growers as against the prevailing prices in the London market."

Freights from Melbourne to Boston cost no more than to London. The freight to Eastern markets, local wool buyers' profits, commissions of wool brokers, etc., from Ohio, reach three cents per pound, and from the Rocky Mountain region still more. (Senate Mis. Doc. No. 35, 53d Congress, 2d Session, pp. 66, 249, 250, 253, 271, 273, 329, 379, 380; see Senate Mis. Doc. No. 77, *passim.*)

Wool purchased in large lots at the London wool sales costs but little for commission. In addition to freight charges the wool growers of the United States lose the profits of local wool buyers; sometimes, too heavy discounts, for difference between wool in the grease and scoured; the commission of Eastern wool brokers, insurance, and other expenses. The London price fixes that for the whole world, and forms the basis on which purchases are made, except as values may be enhanced by wool duties. The prices of wool in London and Boston from 1824 to 1895 are given in official documents. (See Special Rep. Dept. Agriculture Sheep Industry, 1892, pp. 569–574; U. S. Senate Mis. Docs. Nos. 35, 77, and 124, 53d Congress, 2d Session; Bulletin National Association Wool Manufacturers, June, 1895; House Mis. Doc. No. 94, 52d Congress, 2d Session, being Treas. Dept. Rep. Chief Bureau Statistics, 1894.)

On the basis mentioned the Boston and the farm values of the wool clip of the United States have been estimated by an eminent authority—Theodore Justice—for specified years as follows:

Year.	Pounds Wool.	Farm and Ranch Value.	Boston Value.
1880....	264,000,000	$80,000,000	$90,000,000 under tariff.
1890 ..	309,474,856	73,000,000	84,000,000 " "
1895...	294,296,726	28,000,000	37,000,000 free wool.

For a decade prior to 1893 the average annual farm value may be estimated at $70,000,000; farm value of mutton sheep at $35,000,000; value of pelts, chiefly in hands of butchers, at $7,000,000; the fertilizers, farm value, at $4,000,000; or a total of all, $116,000,000. Theodore Justice, in a letter of September 19, 1895, estimates that the wool values above given for 1880 and 1890 are probably too small by $8,000,000. Mr. Justice adds: "Our estimate of the scoured value of wool in 1880 would be not less than seventy-five cents per pound nor over eighty cents per scoured pound. Our estimate for the scoured value in 1890 would be not less than sixty cents nor over sixty-five cents, and we are quite confident that for 1895 thirty-five cents scoured is nearly correct." This is Philadelphia value.

The total product exceeds the average annual value of that of all the gold and silver mines of the country during the same decade, which was $919,-964,000, or an annual average of $91,996,400. In the calendar year 1893 our gold-mines produced 1,739,323 fine ounces, of the value, in round numbers, of $35,955,000. The silver product of 1893 was, in round numbers, 60,000,000 fine ounces, of the commercial value of $46,800,000, and of the coinage value of $77,575,757. And as the domestic production of wool is now less than half the needs of the American people, the product of our flocks can, under proper conditions, be more than doubled.

The price of wool has been gradually declining in all the markets of the world since 1860, because of (1) the vast increase of sheep; (2) the increase of wool in fleeces; (3) the extension of wool growing into Australasia, South Africa, and Argentine, where pasturage costs but little and winter feeding is rarely required; (4) the extension of wool growing in the new States and Territories, with much of the grazing free on public lands; (5) since 1873 the demonetization of silver in most of the states of Europe, depressing prices generally (see Vol. U. S. Coinage Laws, 1894, 4th Ed. Government Print); and finally (6), in the aggregate, over-production—the world's supply exceeding the world's demand. Hence in the "Annual London Report" on wool for 1894 of Helmuth, Schwartze & Company it is said:

"The value of wool, though starting from about as low a level as had ever been known, has yet in the course of 1894 suffered a fresh fall of ten to twelve per cent.; and a bale of colonial wool, which during the preceding decade was worth £14 on the average, and in former times (1871) £21, was last year barely worth £11½, and on the basis of the closing sales of the year only £10⅓. The process of depreciation has during the past five years been continuous, and, though more prominent in merino than in coarse descriptions, has not affected one class of wool to the exclusion of another, but has extended to all." (See Bulletin National Association Wool Manufacturers, June, 1895, p. 116.)

This is shown by the following statistics:

IMPORTATION OF COLONIAL WOOL

INTO EUROPE AND AMERICA FROM 1860 TO 1894, WITH APPROXIMATE AVERAGE VALUE PER BALE.

IMPORTS PER SEASON.

Year.	Australasian Bales.	Cape Bales.	Total Colonial Bales.	Average Value per Bale.	Total Value.	
1860	187,000	79,000	266,000	£25¾	£6,850,000	
1861	212,000	84,000	296,000	23¼	6,882,000	£7,000,000 Period.
1862	227,000	82,000	309,000	22¾	7,030,000	
1863	242,000	94,000	336,000	22¾	7,644,000	
1864	302,000	113,000	415,000	24¾	10,271,000	
1865	334,000	109,000	443,000	23¾	10,521,000	
1866	351,000	128,000	479,000	24½	11,735,000	
1867	414,000	135,000	549,000	20¾	11,392,000	£11,000,000 Period.
1868	483,000	156,000	639,000	18½	11,822,000	
1869	504,000	153,000	657,000	15¾	10,348,000	
1870	546,000	152,000	698,000	16¾	11,691,000	
1871	573,000	186,000	759,000	20½	15,560,000	Year of Transition.
1872	554,000	189,000	743,000	26½	19,690,000	
1873	571,000	176,000	747,000	24¼	18,115,000	
1874	659,000	170,000	829,000	23¼	19,274,000	
1875	720,000	197,000	917,000	22¼	20,403,000	
1876	769,000	167,000	936,000	18¾	17,550,000	
1877	835,000	186,000	1,021,000	18¾	19,144,000	
1878	801,000	169,000	970,000	18¾	18,187,000	
1879	826,000	189,000	1,015,000	16½	16,748,000	
1880	869,000	219,000	1,088,000	20¼	22,032,000	£20,000,000 Period.
1881	957,000	204,000	1,161,000	17¼	20,027,000	
1882	993,000	197,000	1,190,000	17½	20,825,000	
1883	1,054,000	199,000	1,253,000	16¾	20,988,000	
1884	1,112,000	191,000	1,303,000	16	20,848,000	
1885	1,094,000	188,000	1,282,000	14	17,948,000	
1886	1,196,000	236,000	1,432,000	13½	19,332,000	
1887	1,207,000	237,000	1,444,000	14	20,216,000	
1888	1,315,000	289,000	1,604,000	13½	21,654,000	
1889	1,385,000	310,000	1,695,000	15½	26,272,000	
1890	1,411,000	288,000	1,699,000	14¾	25,060,000	
1891	1,683,000	322,000	2,005,000	13½	27,067,000	
1892	1,835,000	291,000	2,126,000	12	25,512,000	£26,000,000 Period.
1893	1,775,000	299,000	2,074,000	12½	25,925,000	
1894	1,896,000	256,000	2,152,000	11½	24,748,000	

The average weight of the Cape and Natal bales is about 315 pounds, and the average weight of an Australian is about 365 pounds. But this is an aggregation of greasy and scoured wools and of wools from colonies, which vary in the weight of wool bales. The bales given above, therefore, mean the actual number received in the London market, without reference to their weight. It is impossible, therefore, to compute from the bales any average value per pound. Still the value of bales from 1860 to 1894 sufficiently shows the decline in prices.

But notwithstanding this decline in price, sheep husbandry was fairly remunerative and prosperous under the operation of the wool tariffs of 1867 and 1890, under conditions then existing. The cost of producing wools in the several States and in foreign countries has been elsewhere fully shown. (U. S. Senate Mis. Doc. No. 35, 53d Congress, 2d Session, pp. 83, 293; Bulletin National Association Wool Manufacturers, June, 1895, p. 117; Senate Mis. Docs. Nos. 77 and 124, 2d Session, 53d Congress.) A contrast of the cost of production and the American farm values, or rather prices of wools based on London sales, will form a basis for judging of the reasons for the decline in numbers and value of sheep and wool in the United States, and the necessity for legislation in aid of the wool industry.

The South Carolina Agricultural Society, the pioneer of its character in the United States, was the first to offer a premium for the introduction of merino sheep, in 1785. In 1796 the Massachusetts Society for Promoting Agriculture urged the importance of improving the breeds of sheep. The Pennsylvania Society for Improving the Breeds of Cattle organized at Philadelphia in 1809, and offered premiums for sheep. In November, 1809, a society was organized at Georgetown, D. C., for the purpose of encouraging home manufactures and the rearing of domestic animals, including sheep.

The Ohio Wool Growers' Association was organized in 1863. The National Wool Growers' Association was organized at Syracuse, N. Y., December, 1865, with the Hon. Henry S. Randall, LL.D., of Cortlandt, in that State, president; William T. Greer, of Ohio, secretary; and Henry Clarke, of Vermont, treasurer. Its first work was at its organization, on conference with representatives of the wool manufacturing industry, to formulate a wool and woolen goods tariff bill to be presented to Congress, and which resulted in the act of March 2, 1867.

The subsequent presidents of the association were Hon. A. M. Garland, of Illinois, a member of the Tariff Commission of 1882; Hon. Columbus Delano, of Ohio; and since October 5, 1893, William Lawrence, of Ohio, with Hon. John T. Rich, of Elba, Mich., and governor of that State, vice-president; William G. Markham, of Avon, N. Y., treasurer; and a board of directors. (Senate Mis. Doc. No. 35, 53d Congress, 2d Session, p. 324.) The association has rendered effective service in aid of sheep husbandry, and has been fully heard on all legislation affecting it.

Among all the American industries none is more important or more useful than sheep husbandry. It feeds the hungry, clothes the naked, gives health, vigor, and happiness to mankind, adds to industrial and national wealth, independence, and power. It has never been allied with any evil; it never united with any conspiracy against personal or public right. Its purpose and effect have been to elevate and bless mankind.

William Lawrence.

[1] The reader will find valuable matter on the snbject of this chapter in the documents therein referred to and in the following: North's "Wool Book," Boston, 1895; Bennett's "American Shepherd's Year Book," 1895; Tariff Hearings before Committee of Ways and Means, 51st Congress, 1st Session, 1889–90, p. 216; U. S. Senate Finance Committee, Rep. 2332, 50th Congress, 1st Session, 1888, Part 3, p. 1984; U. S. Senate, Ex. Doc. No. 3, 53d Congress, Special Session, March, 1893; Senate Ex. Doc. No. 1, 53d Congress, 1st Session, March, 1893; Senate Mis. Doc. No. 149, 53d Congress, 1st Session, p. 42; "The American Wool Interest" (Lawrence), New York, 1892; Switzler's Special Rep. on Wool, U. S. Treasury Dept., 1887; Tariff Hearings before the Committee of Ways and Means, 53d Congress, 1st Session, 1893, p. 929; Rep. of Tariff Commission, 1882.

CHAPTER XXXVI

AMERICAN HORTICULTURE

THE pursuit of horticulture, that department of the science of agriculture which relates to the cultivation of gardens, including the growing of vegetables, fruits, and flowers, is the most ancient and honorable of callings. It was Bacon, I think, who remarked that "God Almighty first planted a garden," and he further emphasizes his respect for the gentle art of gardening by saying "a man shall ever see, that, when ages grow to civility and elegancy, men come to build stately sooner than to garden finely; as if gardening were the greater perfection." Dr. Johnson treated the subject humorously when he remarked to one of his friends: "If possible, have a good orchard. I know a clergyman of small income who brought up a family very reputably which he chiefly fed on apple dumplings."

In looking over the field of our own literature of horticulture for the past one hundred years, we encounter, with few exceptions, nothing very coherent or comprehensive until we open Downing's "Treatise on the Theory and Practice of Landscape Gardening adapted to North America" (1841), together with his "Rural Essays." From that time an occasional American milestone in horticultural literature is passed and rapidly noted until we come to Peter Henderson's first published work. In 1858 Frederick Law Olmsted and Calvert Vaux issued a "Description of a Plan for the Improvement of Central Park." In 1859 came Copeland's "Country Life," and Charles Follen's "Suggestions on Landscape Gardening." "The Art of Beautifying Home Grounds of Small Extent," by F. T. Scott, appeared in 1870. H. W. S. Cleveland's "Landscape Architecture as applied to the Wants of the West" was published in 1873, as was William Hammond Hall's "The Influence of Parks and Pleasure Grounds." In 1881 Mr. Olmsted published "A Consideration of the Justifying Value of a Public Park." In 1889 "The Garden's Story," by George H. Ellwanger, was told, and the "Report of the Metropolitan Park Commission of Boston" appeared in 1893.

In addition to these landmarks of the science of horticulture, its progress has been marked by the appearance of other useful books from time to time. One of these was "Elliott's Fruit Book, or the American Fruit Grower's Guide in Orchard and Garden," published in New York in 1857. Notwithstanding the publication of so much valuable matter upon the subject by such writers as Coxe, Lindley, Downing, and Thomas, Elliott's work was welcomed as a useful addition to the literature of the art. This branch of horticulture is a subject so boundless in a country of such extent and capacity of soil and climate as ours that it can only be lightly touched on here. It will doubtless surprise the casual reader to learn that in this little book, published nearly forty years ago, upwards of 1050 varieties of apples alone are enumerated and described as having been the object of experiments.

The student of American horticulture, in delving into this branch of the subject, will have his task lightened by keeping in mind a few of the pioneers who have helped in a large measure, by their labors and investigations, to bring the time-honored pursuit to its present state of importance. In Massachusetts they were M. P. Wilder, C. M. Hovey, Boston; Samuel Walker, Roxbury; B. V. French, Braintree; Robert Manning, J. M. Ives, Salem. In New York, Peter Henderson; Charles Downing, Newburgh; S. B. Parsons, Flushing; P. Barry, George Ellwanger, Rochester; John J. Thomas, Macedon; David Thomas, Aurora. In Pennsylvania, W. D. Brinckle, Philadelphia; Thomas Meehan, Germantown. In New Jersey, Thomas Hancock, Burlington. In Ohio, George Hoadley, J. P. Kirtland, Cleveland; A. H. Ernst, J. A. Warder, Cincinnati; M. B. Bateham, Columbus. In Michigan, Daniel Cook, Jackson. In Indiana, John C. Teas, Raysville. In Wisconsin, F. K. Phoenix, Racine.

It is somewhat remarkable that in a pursuit like horticulture, so largely regarded as a luxurious one, and in a country so young as ours, we should find as far back as 1728 an account of the establishment of a botanic garden in Philadelphia by John Bartram. We of New York were later in the field, although as early as 1750 places were advertised for sale on Long Island, in which, among the inducements offered to purchasers, it was stated that they had "flower gardens attached." In 1756 others were offered as having "greenhouses filled with tropical plants."

To show beyond question that at that early period there was some general taste in regard to the cultivation of flowers, we find that in 1751, at Whitestone, L. I., a pottery was under way which advertised that "any persons desirous may be supplied with urns and flower-pots to adorn their gardens."

In 1767 William Prince, of Flushing, N. Y., offered for sale a large variety of fruit trees, "so packed that they can safely be sent to Europe." He was an enthusiast in all departments of horticulture, and at the opening of the present century had added to his nursery a greenhouse department which contained a very full collection of plants for that time.

American horticulture must always remain greatly indebted to Mr. Prince, who was the pioneer nurseryman in the New World, and laid the foundations of the business here.

In 1801 Dr. David Hosack originated the Elgin Botanic Garden in New York. Its curator in its earlier years was a Mr. Dennison, who began business as a florist in 1814 at a point near where the Fifth Avenue Hotel now stands. Mr. William Wilson was the author of a book on "Kitchen Gardening," and was, with Dr. Hosack, one of the originators in 1818 of the first Horticultural Society in New York. Another prominent horticulturist of that day was Mr. Thomas Bridgman, who was the author of "The Young Gardener's Assistant," to which hundreds of European gardeners, coming here unacquainted with the American climate and plants, were much indebted. To enumerate the various magazines and periodicals devoted to horticulture from an early period of the century up to this time would be of no special interest, although most of them have done yeoman service in diffusing horticultural knowledge all over the land. But I must pay a passing tribute to such pioneers in the art as Charles M. Hovey of Boston and Robert Buist, Sr., of Philadelphia, both of whom in their day were acknowledged high priests of American horticulture. Later on, towards the middle of the century, came such kindred spirits as Patrick Barry, Peter B. Mead, A. S. Fuller, E. P. Roe, and many others of less prominence.

No review of horticulture would be complete without a reference to its real culmination in landscape-gardening, and the history of that branch of the art in America is most interesting. The first and unquestionably the greatest American landscape-gardener was A. J. Downing. His book on the subject, published in 1841, sprang Minerva-like into the arena, and it remains to this day without a superior, or even a competitor, worthy of the name. A true genius in his calling, it remains a great pity that he did not live long enough to complete his labors. In addition to this work on landscape-gardening, he had in course of preparation a book on the fruits and fruit trees of America, which was left unfinished, but which was completed by his brother Charles. The influence of A. J. Downing on American ornamental horticulture cannot be overestimated; in fact, it might not be too much to say that he created it. He had a worthy pupil in Frederick Law Olmsted. It was the latter who took charge of the improvements in Central Park, and practically created that grand pleasure-ground upon what had been a barren waste of rock and swamp. Only this summer, the city of New York set apart, in Bronx Park, a large area of land for the establishment of a Botanic Garden, with an appropriation of $500,000 which has been increased by public-spirited citizens to $750,000.

Another potent factor in developing ornamental horticulture has been and is still an institution which is peculiarly and distinctively American — the rural cemetery. To Jacob Bigelow of Boston is due the original conception of this idea. He agitated the question in 1825, and soon the Massachusetts Horticultural Society lent its aid to the movement, the result being the formation of the Mount Auburn Cemetery Association at Cambridge, Mass. This was the forerunner of Greenwood, Woodlawn, Forest Hills and the numerous park-like cemeteries which now dot the country from the Atlantic to the Pacific, where nature, softened and subdued by man's cunning touch, lends beauty and repose to what would otherwise be only a place of harrowing memories. Every cemetery has its cluster of florists, who derive profit from the sale of plants, with which loving hands make beautiful the last resting place of those dear to them.

By 1840 commercial horticulture had come to be liberally patronized, and nurseries, greenhouses, and market-gardens had been established in Long Island, New Jersey, and New York Island, so that the markets were fairly supplied with fruits, flowers, and vegetables; but scantily, however, compared to the present time.

In 1866 a most important epoch in a century of the art was reached when Peter Henderson sent forth his earliest work, "Gardening for Profit," the first book ever written on market-gardening in this country. This work brought a national reputation to its author, and its value to the United States is beyond computation. Its appearance just after the close of the war rendered it of special and inestimable value to the Southern States. The enormous market-gardening or trucking interests which have been for years and are to-day such a factor in the prosperity of the South, owe their birth and subsequent development entirely to the teachings of "Gardening for Profit." Stimulated by the success of his first book, Mr. Henderson in 1868 issued his "Practical Floriculture," written to show how flowers and plants could best be grown for profit. This book did for esthetic gardening what its predecessor had accomplished for material horticulture, and established thousands of people in a pleasant, safe, and profitable business.

In 1875 Mr. Henderson's prolific pen produced "Gardening for Pleasure," a work intended to meet the wants of those desiring information on gardening for private use. In 1884 he published "Garden and Farm Topics," a series of interesting and instructive essays; and also, in 1884, he, with Mr. William Crozier, wrote "How the Farm Pays." Finally, in 1889, he finished just before his death his most pretentious work, "Henderson's Hand-Book of Plants."

Besides his published works, Mr. Peter Henderson was for thirty-five years previous to his death, in 1890, a constant contributor to the leading American horticultural and agricultural papers. His name is inseparably linked with commercial gardening and floriculture in the United States. Not only by his teachings, but through his wonderful business success, by precept and example, he blazed the way for commercial horticulture, and stands in the same relation to it that A. J. Downing does to its ornamental branch. He it was who saw the possibilities of our varied soils and climate in the production of many plants, seeds, and bulbs which, previous to his time, had been imported from Europe. In the one item of tuberoses alone he changed the current of trade, so that, instead of importing, we now export, thousands of dollars being thus saved to the country annually. He it was who predicted "that California before fifty years will be the great seed and bulb-growing country of the world, as it has the exact conditions of climate necessary for their growth." His prophecy is being fulfilled, and bids fair to be realized even sooner than he anticipated.

When "Practical Floriculture" was issued, florists were few and far between, and their establishments were crude and insignificant in comparison with those of to-day. There are no trustworthy statistics to be obtained of the number engaged in the trade at that time, or the extent of glass in operation; and even now exact information is unobtainable, as the last census is obviously imperfect. Through information gleaned by the Society of American Florists and from private sources, it is safe to estimate that there are in the United States to-day, say, 10,000 florists, the principal ones owning a glass area ranging from 50,000 to 100,000 square feet; while the least among them would own, say, 1000 square feet. After careful consideration, I estimate that there would be a grand average of 5000 square feet to each florist, making a total area of 50,000,000 square feet of glass devoted to commercial floriculture, a small portion being used for raising vegetables during the winter months. Estimating the average yield at one dollar per square foot, we have a total output of $50,000,000 in plants, flowers, and vegetables. Many florists also use the space under the greenhouse benches to grow mushrooms, an industry which is rapidly assuming importance.

In addition to the above, the private conservatories, greenhouses, and fruit houses, and the greenhouses in connection with public gardens, cemeteries, and experiment stations, should be considered in estimating the amount of glass devoted to plant and flower-culture. These combined would probably amount to one fourth of the commercial area, or 12,500,000 of square feet; and their contents are of equal value proportionately.

The interest of the people of the whole country in horticulture cannot be better shown than in the perfection to which that marvelous flower, the chrysanthemum, has been brought, and the remarkable exhibitions that take place annually in every city and town of any importance. To show the strides that have been made in greenhouse structures, I may say that I doubt if there was previous to 1845 in all the United States a greenhouse in use for commercial purposes having a fixed roof; and at this point it seems pertinent to give a short history of the rise and growth of greenhouse construction in the United States. The first one, as far as my researches have been able to discover, was erected early in the last century for Andrew Faneuil in Boston. The credit of having owned the first greenhouse in this country is generally given to James Beekman, the claim being made that it was erected for him in New York in 1764. Be that as it may, however, we have authoritative proof by Gardiner, Hepburn, and McMahon, that greenhouses were in existence in 1804 and 1806, and also that Dr. Hosack had extensive greenhouses in his botanic garden in 1801. Many of these early structures had very little, if any, glass in the roof, and it is the wonder of modern horticulturists how the gardeners in those days were able to grow plants with such crude facilities. It would seem ludicrous now to attempt it in one of the greenhouses described by McMahon as a "modern" structure. "One third of the front side of the roof, for the whole length of the house, to be formed of glass-work"; and so as to get all the light possible, he stated that "to have as much glass as possible, the piers between the sashes are commonly made of good timber from eight to ten inches thick according to their height; the width of the windows for the glass sashes may be five or six feet. The panes of glass in the roof should be six inches by four, this size being not only the strongest, but much the cheapest, and they should lap over each other by half an inch." Compare this with our modern greenhouse structure, its glass 16 x 20, and even larger, its light iron purlins and supports, its light sash-bars, the pitch of the roof—everything calculated to get the greatest amount of light possible, so that flowering plants may get the needed carbon to maintain them in health, and enable them to perfect their blossoms. It is little wonder that perpetual spring and summer seem to reign in the modern home when we have such facilities for the propagation of nature's choicest products. The first published advocacy of the fixed-roof system was made by Mr. Peter B. Mead in the "New York Horticulturist" in 1857. Before that all greenhouse structures for commercial purposes were formed of portable sashes, and nearly all were constructed as "lean-to's," with high back walls, and none were connected. All were separate and detached, being placed at all angles, without plan or system. Then, too, the heating was nearly all done by horizontal smoke-flues, or manure fermenting, although there was a crude attempt at heating by hot water by some private individuals as early as 1835. The first use of heating by hot water on anything like a large scale, however, was in 1839, when Hitchings & Co., of this city, heated a large conservatory for Mr. William Niblo of New York; and yet for nearly twenty years after this time heating by hot water was almost exclusively confined to greenhouses and graperies on private places, as few professional florists in those days could afford to indulge in such luxuries.

All this is changed now. The use of steam, hot water under pressure, and the gravity system of hot-water heating are almost universally in operation, the hot-air flue having been relegated to the past. The best evidence of progress is in the fact that the florist has not waited for the tradesman, but has brought about these improvements himself. In many places to-day the florist puts up his own heating apparatus, and there are many men in the trade who are competent to give learned dissertations on the various systems of greenhouse-heating. It may not be out of place here to refer to the "blue-glass craze" launched upon the country by the late General Pleasanton. Absurd as it seems now, yet there were many hard-headed, practical men among the gardeners and florists who adopted it to a limited extent. In many of the private places it may still be seen, at Newport and along the Hudson River, the owners being either too uninterested to remove it, or perhaps still having a lingering faith in the exploded "fad." In weak imitation of the "blue-glass theory" came the era of "blue whitewash," but that also has disappeared. One thing worthy of record is the great advance made in producing glass in this country. Up to within a very short period all the glass for greenhouses was imported from France and Belgium, the American product being so full of "blisters" that it was useless for the purpose. The consumption of glass in greenhouse structures, both old and new, is something enormous, and undoubtedly stimulated the American manufacturers to better efforts. The result is that for the past few years our American natural-gas-made glass is used exclusively, and is found to be superior to the foreign article.

While we have undoubtedly made great strides in the past thirty years in every department of horticulture, perhaps the most wonderful advance of all has been in the construction of cut flowers into bouquets and other designs. The late Mr. Henderson used to relate that in 1844 he was an assistant in one of the largest floral establishments then in New York City. If a wreath was to be made its base was usually a piece of willow or a barrel-hoop. If a cross, two pieces of lath formed the groundwork, and the work when done was usually such as to reflect but little credit on the "artist." The wire-design-man did not put in an appearance until twenty years later. Bouquets in the forties were usually flat, one-sided affairs. Occasionally a round bouquet was attempted by some artist of local fame, but with a result that must have done violence to the feelings of the flowers that were used in the structure.

The growth of the use of cut flowers at funerals in elaborate symbolic designs is one of the features of modern horticulture. At first it was confined chiefly to the realms of wealth and fashion, but it spread quickly into all ranks. When a public official or popular man in private life died, the offerings of friends and acquaintances in the shape of wreaths, crosses, crowns, anchors, broken columns, gates ajar, etc., etc., were something enormous; in fact, during the early seventies, it is safe to say that "funeral work" was the sheet-anchor of the flower stores. But a change occurred about twenty years ago; exaggeration and bad taste had brought great floral displays somewhat into disfavor. What Murray Hill frowned upon, however, was taken up enthusiastically by Cherry Hill, and a man's popularity during life was soon gauged by the number of "set pieces" sent to his funeral by admiring friends. New designs were created to meet the demand, and a florist on the Bowery—an artist in this particular line—showed much originality in inventing symbolic designs to express the grief of the sender. Lettering on designs came into greater prominence under his régime, and many a good story, tragic and ludicrous, has he told of the composition of these expressions of regard for the dead. One of his best is about a young man who in life belonged to several East Side social organizations. Each club was anxious to outdo the other in the matter of flowers, and great was the display of designs at his funeral. One committee, who ordered a pillow, wanted some original lettering on it. The florist showed them his book of set phrases, "At Rest," etc., etc., but to no purpose. They retired and held a long consultation, and at length ordered the words "He was a Brick" to be lettered on the pillow. It was in vain that the florist mildly suggested a change; and the young man went to his last resting-place with the inscription "He was a Brick" boldly staring out from the pillow in purple letters on its snowy ground of flowers. It was, no doubt, incidents such as this which turned many people against the use of cut flowers in designs at funerals; but the practice, under certain restrictions, must always be appropriate.

There has been a radical change in the character of the flowers used for cut-flower purposes. Fifty years ago camellia flowers retailed freely for a dollar each, and during the holidays Philadelphia used to send thousands to New York florists, getting $500 per 1000; while roses then went begging at one tenth these figures. Now, the rose is queen, and the poor camellia finds none so poor to do her reverence. Decided as the change has been from one class of flowers to another—a vagary of that erratic jade, Dame Fashion—the evolution in the rose itself is more pronounced. As I write, there stands on my desk a vase of roses, Bon Silene, Safrano, The Bride, Catherine Mermet, Maman Cochet, Souvenir de Wootton, La France, Bridesmaid, Perle des Jardins, Sunset, Belle Siebrecht, Meteor, Papa Gontier, Niphetos, Kaiserin Augusta Victoria, Mme. Cusin, Mme. Caroline Testout, Mme. Hoste, Mme. de Watteville, and, crowning all in regal splendor, American Beauty; the latter name, by the way, is a misnomer, as the variety is not of American origin. Paltry, indeed, appear the Bon Silene and Safrano in comparison with the others, and yet, twenty years ago, they were the leading roses grown for the New York market, and they sold, too, around the holidays, at eighteen to twenty-five dollars per 100. During the holiday season of 1894–95 the first one was rated as being worth two to three dollars per 100, and the second was not even given the poor honor of being named in the market list; American Beauty, during the same time, sold at from $30 to $150 per 100; the others, except Belle Siebrecht and Mrs. Pierpont Morgan, which have yet to go through the season—having made their début this year—were quoted at from five dollars to twenty dollars per 100, the difference between the quotations being entirely due to quality, showing the varying skill of the growers.

Only five of the above roses are of American origin: Sunset, a "sport" from Perle des Jardins, which originated with and was introduced by Peter Henderson in 1883; The Bride, a "sport" from Catherine Mermet, which originated with James Taplin and was introduced by John N. May in 1885; Souvenir de Wootton,—named in remembrance of the visit of the Society of American Florists to Wootton, the home of G. W. Childs,—a seedling raised by J. Cook and introduced in 1889; Bridesmaid, a "sport" from Catherine Mermet, which originated with F. L. Moore, and was introduced by him in 1892; Mrs. Pierpont Morgan, a "sport" from Mme. Cusin, which originated with F. W. Miles of Plainfield, N. J., in 1895. All the others are of European origin. I confidently believe that the time is not far distant when we shall compete seriously with the foreign grower in the production of new varieties of roses. In the realm of garden varieties of the ever-blooming class, which is separate from the winter-forcing section, we have already produced many fine

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sorts, which, being raised under the conditions in which they must live, are, for the most part, better adapted to our climate than many imported sorts which are magnificent on their native heath. America can, however, claim the honor of having given to the world one of the greatest classes of roses, viz.: the *Noisette* class, originally produced by M. Noisette at Charleston, S. C., in 1817, and sent to his brother in Paris, by whom it was introduced into European gardens; thus the latter is commonly credited with the honor of having originated it. Among the many famous roses belonging to this class are Maréchal Niel, Cloth of Gold, Wm. Allen Richardson, Gloire de Dijon, and Lamarque. These grand roses festoon the walls and verandas of Southern and Pacific Slope homes, as well as in France and England; and along the Riviera millions of their flowers breathe incense, telling to the American traveler, in their mute way, that his country has done something for rose culture of which he may be proud. Our prairie roses have been improved greatly; such fine sorts as Baltimore Belle, Prairie Queen, Gem of the Prairies, and others adorn walls and fences in our Northern States, where the Noisette roses would not survive the winters. The culture of tuberoses came a little later. The books of Peter Henderson & Co. show that in 1865 their receipts from a house of tuberoses, 10 x 100 feet, were $1500; now they are rarely grown under glass, being mostly a summer crop, and but few are sold in New York, except to the poorest classes.

The increase in the sales of all products of floriculture in the past fifty years has certainly kept pace with most other industries. In 1844 the sales at retail of a New York florist on New Year's Day footed up the sum of $200, and yet this florist did nearly the entire business of the city at that time. In spite of the general depression of business, which, of course, bears heavily against the sale of cut flowers, in all probability the sales at retail on the first of January in 1895, in New York City, reached $500,000, and the aggregate for the past year would run up in the neighborhood of $5,000,000, probably double that of any European city of its size. The greater profits in cut-flower-growing, with comparatively less labor than in general plant-growing, attracted capital, hence the great advance made. With competition has come a cheapening of the product, an advance in its quality, and a consequent shrinkage in the profits of the grower; but up to the present time there has been no apparent check to the growth and sale, but rather the reverse, as on all sides new structures for growing cut flowers are going up and old ones are being remodeled to adapt them for this use.

A few years ago nearly all the growers for the large cities sold their own product by sending men from store to store with the day's cut, but this is no longer possible, the output being too great for such a primitive method. Then came the commission dealer and the cut-flower exchange, and now an association of cut-flower growers has been organized in New York City for the sale of their product at wholesale to retail dealers. It is a company, and it claims to control $750,000 worth of flowers. Probably twice as much will be sold by the commission dealers and the cut-flower exchange, amounting to perhaps double what it was ten years ago.

The growth around New York, although more pronounced than elsewhere, is not exceptional, as every large city and town throughout the country has felt the stimulus and advanced accordingly. Taste has advanced as well. The day of huge wads of flowers, by courtesy termed bouquets — bare stems and wires, coarse garden flowers and arbor vitæ for green — has given way forever to the light, graceful bunch, long, natural stems with foliage, of fine roses, lilies, carnations, violets, orchids, etc., etc., with maiden-hair fern and filmy asparagus fronds for garnishing.

Of the many remarkable developments in commercial floriculture during the past ten years, there is one that stands out prominently above all others, being the expansion of the trade in decorative plants — palms, ferns, and allied plants. The use of palms and decorative plants has been general in Europe for many years, and even now the American grower draws heavily on Europe for his supplies. From the present outlook, however, the day is not far distant when we shall produce all we need ourselves. It is difficult to give trustworthy figures showing the development of this branch, and we must depend on comparative showings to get near the true result.

It may be safely stated that ten years ago it was a rarity to see a group of palms in the average florist's establishment, and equally rare was the sight of a palm in the windows of dwelling-houses. Even five years ago, it was the exception to find them in a commercial florist's greenhouses, yet to-day there is not a florist doing a general plant trade, be it large or small, who does not keep some in stock and buys constantly. In all the large cities and towns palms are found in the homes of people of taste and refinement, and even in country hamlets the catalogues of the large seed and plant houses do their missionary work, and young palms, of which one firm makes a specialty, are there found growing. Not a ball, wedding, or social function of any pretension is complete now without a decoration of palms. Large greenhouse establishments are devoted exclusively to their culture. Florida and the extreme Southern States have their palm establishments, and palm nurseries have been established in Trinidad and Jamaica by American florists, in order to keep pace with the growing demand for their product in this country.

When an industry of any kind assumes imposing proportions, one of the first things that occurs is that it becomes broken up into departments, or specialized. American horticulture to-day is no exception to the general experience, for within the last ten years, whether in practical work, in its different associations and societies, or in its literature, the tendency is to specialize. Not only have we exclusive rose-growers, carnation-growers, and those who devote themselves entirely to the cultivation of the chrysanthemum or the violet, but even in the representative national association, the Society of American Florists, the minor divisions at their annual meetings devote their time almost entirely to the consideration of some particular plant, in whose cultivation or management they have an absorbing interest.

Up to this point I have dwelt but lightly upon one division of American horticulture which, from a financial point of view, far exceeds in importance the ornamental department of the business. I refer to market-gardening, or, as it is now known in the Southern States, the trucking interest. For thirty years previous to 1875, market-gardening was a most profitable business in and around New York. Thirty years ago the New Jersey market-gardener, mainly located in Hudson County, grew better vegetables than the Long Island men, but their limited area of land becoming less and less annually, in consequence of the inroads made for building purposes, the Long Islanders forged ahead. The Long Island men, however, have not had it all their own way, for of late years a formidable competitor has been met by them in the large truck-gardens of the South. While this competitive factor has certainly lessened their profits, even at the lower prices that prevail to-day there is still a fair profit in the business for them, certainly more than in ordinary farm crops.

It is a matter of regret that only a hurried additional reference can be made to that other great branch of horticulture, fruit-growing. The truck-gardener of the South has a valuable field for profit in strawberries, blackberries, and raspberries. Florida owes much of her prestige to her orange groves, and California is more indebted to her fruits than to her gold-mines for her prosperity. All over the length and breadth of the land are felt the beneficent results arising from a variety of fruits. Our export of apples is no mean item. This industry really began in 1845, when a trial shipment was made from Boston to Glasgow. The season of 1880 and 1881 saw a total exportation to Europe of 1,328,806 barrels, and in the season of 1891 and 1892, 1,450,336 barrels were exported. The history of the American grape would of itself be sufficient for a separate article. American horticulturists have taken our native grapes and produced the fine named varieties now known. The American grape has been the salvation of European vineyards by providing stocks for their vines which successfully resisted the phylloxera, and it has supplied us with cheap and wholesome native wines; it has given employment to thousands, and has taken millions of acres out of idleness. Its usefulness is growing, and will strengthen with the years. However brief this sketch must be, I must refer to the debt of gratitude the country owes to John Adlum for his work in connection with our native grapes. He it was who first saw with accurate vision that it was absolute folly to continue using the varieties imported from the old country and to follow the methods of culture practised there. To him, above all others, is due the credit of rescuing our native grapes from the danger of destruction by advancing civilization, and the utilization of them to develop the fine varieties of to-day after crossing with the imported varieties. To establish his theory on a basis of fact, he started an experimental vineyard at his own expense on Rock Creek, in the District of Columbia, after vainly applying to the national government for aid. He planted a complete collection of imported and native sorts, and finally discarded the imported varieties. The lessons of the past are not fully understood, or else many who should know are ignorant of them, and, as a consequence, English and continental planters in the Southern States since John Adlum's time have gone on planting imported varieties, and in nearly every case failure has resulted. Read what he said: "The way is to drop most kinds of foreign vines at once (except a few for the table), and seek for the best kinds of our largest native grapes, and if properly managed there can be no doubt but we can make as much wine, if not more, than any part of the world on the same space of ground, as far north as the forty-third degree, if not farther north, and of good quality." In 1823 he published the first book on indigenous-grape culture, and stated that his only desire was to be useful to his countrymen. He has an additional claim to gratitude from the people of to-day in the introduction of the Catawba grape. He laid the foundations for Rogers, Ricketts, Haskell, Rommell, Jaeger, Moore and others, and, like Bull, who introduced the famous Concord grape, and who died very recently a dependent on public charity, poor Major Adlum, prodigal of his substance for the benefit of others, passed away practically unnoticed, except for the grateful recognition accorded to him by Rafinesque, when he named our beautiful "mountain fringe" *Adlumia* in his honor. The peach, also, has found a congenial home here, and has added millions to the wealth of the nation. The blackberry, although indigenous to this country, has been greatly improved by American horticulture. Its possibilities were foreseen many years ago by Downing, when he wrote: "The sorts (blackberries) are seldom cultivated in gardens, as the fruit is produced in such great abundance in the wild state; but there is no doubt that varieties of much larger size, and greatly superior flavor, might be produced by sowing the seed in rich garden soil, especially if repeated for two or three successive generations." As showing the wonderful diversity of our soil and climate, the same authority remarks that many of the so-called new varieties of fruits, especially from the West, prove to be old and well-known kinds, altered in appearance by new soil and different climate.

The outgrowths from the results of successful horticulture are many, and I am compelled, for want of space, to pass many of them by in silence. There is one, however, that is far too important to be ignored, however brief the sketch may be. It is the canning industry. What the metallic cartridge is to the breech-loader and vice versa, canning may fairly be considered in relation to small-fruit and vegetable-growing; this must be obvious to the most casual observer. This method of preserving fruits and vegetables is credited to a Frenchman; but it first became an assured and recognized success in this country. To Ezra Daggett and Thomas Kensett, in 1819, is due the credit of having first canned fruits and vegetables, and in 1825 President Monroe signed patents to them to protect them in that industry. Its growth has been marvelous and far-reaching in its benefits. At the present time it is estimated that there are twenty thousand factories in North America employing directly or indirectly over a million hands during the canning season, a result entirely traceable to the advance in American horticulture. Following the process of canning came drying fruit by fire heat; then came the Alden drier, about 1870; then Williams and others brought in the "evaporated" product, now a staple article of commerce and the salvation of the California fruit grower.

In a brief summary of matters upon which the exigencies of space will not permit me to enlarge, it may be stated that auction sales of plants and flowers were started in New York about 1847.

America has led the way in improving garden and farm-tools, and bettering the methods and systems of horticulture, and as a result, while we pay more wages and live better, the cost of trees and plants is on an average less in America than in Europe, where they still cling to slow and cumbersome methods. This is noticeable in many important details, but in none more than in packing plants for shipment, the system in vogue here being of the simplest kind, differing entirely from the European method, and being a result of the necessities forced upon us by the higher price of labor. In the old country the ball of soil is generally wrapped in moss and then tied round and round with string, the plants when so prepared being laid in layers and each layer fastened with a cleat—a process unnecessarily slow and expensive. With us, when the ball of soil is sufficiently firm and well protected with roots, we wrap it in paper, leaving the top uncovered. This wrapping in paper not only serves to keep the ball of soil intact, but it also, to some extent, relieves the pressure of the plants upon each other. In packing the plants in a box, they are placed alternately in layers, with an inch or two of "excelsior" between. In cold weather the boxes are lined with heavy felt paper, with two inches of sawdust on the bottom, sides, and top; and rarely is there any injury from frost even in the coldest weather. In spring and summer light baskets and open boxes are used, and, contrary to the European custom, no charge is made to the customer for either boxes or packing. Mr. Peter Henderson, in "Practical Floriculture," relates how he sent some fifty plants to a London florist, in a basket packed in the American style, and only two plants failed to live. A return shipment of about the same quantity was sent by the florist referred to, packed in hampers, each one of itself weighing forty pounds, without the contents, and three-fourths of the plants were dead when received, due, he states, entirely to the cumbrous manner of packing. The advancement in our gentle art has been phenomenal in America, and there is no symptom of halting. Both national and State governments have recognized the importance of horticulture, and special legislation has been enacted to foster it. The scientific researches which the business man could not undertake are accomplished at the experiment stations, founded on the Federal law known as the Hatch Act, which went into effect in 1887. There are now fifty-five of these stations in the United States, constantly making tests of new varieties and methods, as applied to agriculture and horticulture. They issue bulletins, which have a free circulation, as often as necessary, and publish annual reports. In 1892 and 1893 these stations issued 564 bulletins and reports, of which 110 were devoted to horticulture. The agricultural colleges lend valuable aid in this work, and there are a dozen scientific bureaus and divisions connected with the Department of Agriculture at Washington, three of which are purely horticultural.

To attempt to record in a space as brief as this the history of horticulture for a century must necessarily result in an inadequate and imperfect account. At the best I have only been able to touch upon what seemed to me to be the most prominent features in the history of the craft. Still, we who man the ships composing the horticultural squadron of to-day, as we look back over the billows of the past, have some right to feel proud of the great development the "most ancient of professions" has attained in the last 100 years. At the same time, we doubt not the chronicler of our art in 1995 will have a still grander record of progress to relate, for, paradoxical as it may seem, the dawn of American horticulture is only fairly above the horizon as the sunset of the nineteenth century fades away.

Alfred Henderson

CHAPTER XXXVII

AMERICAN SUGAR

THE history of the sugar industry in this country forms one of the most interesting chapters in the development of its resources and growth. Sugar, which was known to the ancients as a product of the far East, reached Europe as an article of commerce in the fifteenth century. Spain, in its colonies, was the first to engage in its cultivation; but for centuries it was regarded as a luxury, and so slowly did it find its way into general use that in England the consumption for the year 1800 was but a little more than 100,000 tons, and in 1837 but 216,000 tons, or sixteen pounds per capita, whereas the consumption in England to-day is over seventy pounds per capita.

The first cultivation of the sugar-cane in the West Indies was in St. Domingo, where it was found at the close of the fifteenth century, and for a long time the Europeans derived their principal supplies from that island. By the beginning of the eighteenth century the culture had been largely established in the West Indies, as also in Central America, Mexico, and the northern countries of South America. In the earlier history of the United States the very small amount of sugar consumed was imported chiefly from the Spanish colonies and the West Indies.

Sugar-cane was first introduced into Louisiana by the Jesuits in 1751, but they failed to produce a merchantable article of sugar. In 1779 better results were obtained, but it was not until 1795 that sugar was successfully made in any considerable quantity, Étienne Boré, of that State, having succeeded, meanwhile, in developing an improved method of extraction. At the end of seven years more, in 1802, the entire crop of the State of Louisiana amounted to about 2500 tons. The mills which produced the cane were driven by horse or cattle power, and even at so late a date as 1882 there were over 150 of such mills in operation in the State.

The success of Boré attracted general attention, and additional capital was soon invested in the new industry. Steam-mills were introduced, and thenceforward the progress of the industry was rapid. Planters from other States migrated to Louisiana and engaged in the sugar culture, and the business steadily increased. In the year 1816 a duty was imposed upon imported sugars of three cents per pound, which still further stimulated the production, the crop of 1832 reaching 40,000 tons. In that year the duty was reduced to two and one half cents per pound, which apparently checked the sugar production; but after the panic of 1837 it revived again, and in 1840 the number of sugar plantations was estimated at 525, the production of that year being 50,000 tons. In 1850 it reached 104,000 tons. From this time on, with a growing demand, the yield steadily increased, notwithstanding a reduced protection against imported sugar, until, in 1861, with a tariff of only one-half cent per pound, the crop reached 240,000 tons. The outbreak of the Civil War nearly obliterated the sugar production of Louisiana, which in three years fell to less than 6000 tons.

A generous protection from 1861 to 1870, in the form of import duties equivalent to more than three cents per pound, furnished an opportunity for the rebuilding of the sugar industry in the South. The increase of the crop, however, in view of these favorable conditions, was very slow, the entire amount of cane-sugar raised in the United States in 1875 being only 75,000 tons; and in 1880, with an average protective duty of two and one half cents per pound, was less than 125,000 tons. In 1890 the import tax on raw sugars was abolished, and a law passed giving the planters a direct bounty equivalent to something more than two cents per pound for fifteen years. Under this stimulus large amounts of capital were immediately invested in sugar culture, and the crop of cane-sugar in the year 1894–95 is stated as being more than 315,000 tons.

It remains to be seen what the effect will be of the repeal of this bounty law in 1895, and the substitution of an import tax affording a protection to the planter of about one half the amount. The representatives in Congress of the Louisiana planters insist that this industry cannot survive without a larger protection in the form of import duties or direct bounties, inasmuch as, in addition to the danger from drought or floods, they are also constantly in peril from early frost. Even in the most favorable seasons it is necessary to cut and windrow the cane before it matures, to save it from freezing, thus reducing by a considerable amount what would be its normal yield if the climate would admit of its maturing in the field. The culture of sugar-cane has been practised to some extent in Texas, and, under the recent bounty law, gave promise of a considerable development. The only other of the Southern States in which any attempt has been made to raise the sugar-cane is in Florida, where thus far, however, it has not been commercially successful.

During the war repeated experiments were made in different sections of the country—principally in the West—with the hope of producing sugar from a species of cane called sorghum. These experiments were fostered by the government, and the reports of the Agricultural Department from 1875 to 1877 promised practical results on a large scale. Factories were established in Illinois, Iowa, and Kansas, and, on a smaller scale, in New Jersey and several other States; but after several years of experiment the attempt was practically abandoned, the sugar made being of inferior quality, and the cultivation carried on at too great cost to make it commercially profitable. Small amounts of sorghum-cane are still raised in some districts, but the product is generally used by the local community in the form of syrup.

There are but few facts to be obtained concerning the production of maple-sugar in the United States. In 1860, as nearly as can be ascertained, this product amounted to over 50,000,000 pounds, supplied by the New England States, New York, Pennsylvania, Ohio, and Michigan. In 1870 it was less than 30,000,000 pounds. The production has been steadily diminishing, and it has ceased to be an important factor in the sugar-supply of the country.

The extraction of sugar from the beet-root was begun in France in the time of Napoleon I. The production, fostered by the imposition of high duties on foreign sugars, rapidly increased, until in 1838 it reached about 40,000 tons. The cultivation of sugar-beets extended to Germany, Austria, Belgium, and Russia; but so recently as 1858 this industry amounted to only 400,000 tons. Under the patronage of those governments, in the shape of bounties, enormous strides have been made in beet-sugar cultivation in Europe, until in the year 1894 the crop amounted to 4,842,000 tons, or fifty-eight per cent. of the entire sugar production of the world.

Fifty years ago attempts were made to introduce the sugar-beet in this country, and during succeeding years these efforts embraced several Eastern States, Illinois, and Wisconsin; but, owing to unfavorable soil or climate, the results were unsatisfactory, until the tide of experiment reached the Pacific slope, where, at Alvarado, Cal., after repeated failures, the first approximation to success was reached in 1887. This was followed by the erection, by Claus Spreckels, of a large factory at Watsonville, Cal., in 1888. The Oxnard Beet-Sugar Company, in 1890, after a careful analysis of soil and climate, established a large and well-equipped factory at Grand Island, Neb., and, later, one at Norfolk, in the same State. These factories have been yearly in operation since that time, as has been for the last three years, also, a factory located at Lehi, Utah. The only place, however, where beet-sugar cultivation has been commercially successful on any considerable scale up to this date is in California, a third factory having been erected in that State in 1891 by the Oxnard Company, at Chino, which, in addition to those above named, is now in successful operation. The entire output of the beet factories in the United States during the year 1893 was about 20,000 tons.

In the earlier history of the country the sugar consumed was almost entirely what is known as raw sugar; that is, sugar as made from the cane-juice on the plantation. This varied in color from a dark brown to a light straw-color, but, owing to the imperfect processes of manufacture then known, contained more or less of syrup and a large amount of impurity. Such refined sugar as entered into consumption was imported in the shape of loaves, which were counted a great luxury and were correspondingly expensive.

The raw sugar came principally from the West Indies and South and Central America, and was imported in great tierces and hogsheads, weighing from 1200 to 2000 pounds, in which form it was delivered to the grocers. Before it could be weighed out to the customer it was necessary to run it through the grocer's hand-mill to break the coarse lumps, and as the bottom of the hogshead was reached the proportion of "foots" or syrup settlings increased. This sugar was sticky and dirty, but sweet, and, in ignorance of the insectivora and impurities it contained, our forefathers consumed it with avidity. Molasses, the drainings of the sugar in the plantation sugar-house, being somewhat cheaper than sugar, entered also largely into consumption, and was used to sweeten tea and coffee, as well as to serve many culinary purposes for which only sugar is now used.

Early attempts at sugar refining were crude in the extreme. The first was made in England in the sixteenth century. Melting in solution, removal of some of the foreign matter by the laws of gravitation assisted by the coagulation of bullocks' blood, filtration through linen bags for the purpose of separating the floating particles, and boiling to the point of recrystallization, constituted generally the tedious and, compared with present methods, far from effective process. For, while it is true that melting, filtration, and recrystallization remain to-day the fundamentals in the art of sugar refining, the means of accomplishing them have greatly changed. Discoveries from time to time improved the product of the refinery in one respect or another. Seventy years ago the claying process, which consisted in washing the refined crystals in molds, produced a very good quality of white sugar. Up to fifty years ago the difference between the cost of the raw and the refined sugar was ten cents per pound.

The first refinery in this country was probably Rhinelander's, which stood on the present site of the Rhinelander Building, at the head of William Street, in New York City. The growth of population and the increase of the per capita consumption were much more rapid than the increase in the refined product, and profits were large; the result being competing refineries, which, with new machinery, greatly reduced the time of refining, improved the quality of the product, and augmented the capacity of the plants, thereby reducing the cost of operating. In 1838 steam for heating purposes established itself as a factor. The vacuum pan, for crystallizing the sugar at a low temperature,—a most important invention,—was adopted about 1855, the charcoal filter at a somewhat later date, and the granulating-machine, for drying the damp white sugar and reducing the grain, in 1848. In 1860 the centrifugal machine, for separating the syrup from the crystallized sugar, introduced a new era in sugar refining, and the really active competition in the business began.

But more radically important even than improvements in machinery were the improvements in methods which began to show themselves shortly after the war. Soleil's polariscope, a French invention, made its appearance in this country about 1870, and exerted the most marked influence upon the art and business of sugar refining. With a single flash of light this wonderful little instrument designated in accurate figures the commercial value of any grade of sugar to a fraction of a degree. The result was that the attention of the more progressive refiners was at once turned to the chemical possibilities involved in the industry. The exact proportion of crystallizable sugar, scientifically designated sucrose, and uncrystallizable, or glucose, being determined by the polariscope, attention was directed to methods of treatment which would accomplish at once the preservation of the former and the utilization of the latter. Improvements in machinery had reduced the cost of operating, enhanced the grade of the product, and greatly increased the capacity of the refinery; but the possibility of wresting from chemistry her long-kept secrets brought new methods into prominence as a factor in the art of sugar refining.

It soon transpired that, with equal advantages in the matter of machinery, one refiner, by the discovery of some simple fact and its application in the matter of method, obtained a decided advantage over another. Instead of two weeks, the usual time for the refining process, the time was reduced for "soft" refined sugars to sixteen hours, and for granulated sugar, of which by far the greatest quantity is sold, to but a few hours longer. Sugar refining became a thing of mysteries, each refiner seeking to discover for himself the method of treatment which would enable him to improve upon that of his competitor. These changes of methods involved the practical remodeling of the older refineries, and so great was the advantage of the more modern houses that the older and weaker ones were driven to the wall.

Among the earlier firms engaged in the sugar-refining industry the more prominent were those of R. L. & A. Stuart and the Havemeyers. The Stuarts, who had flourished and acquired great fortunes under the old conditions, when the margins in the business were large, found themselves, through the advent of new methods and the fierceness of competition, unable to contend with their younger rivals; and, rather than attempt the remodeling or rebuilding of their refineries, they went out of the business.

The house of Havemeyer was founded in New York in 1805 by A. & D. Havemeyer, in a little building on Vandam Street, twenty-five by forty feet; four or five employees, with the proprietors, being sufficient to manufacture and deliver their product. In 1828, William F. Havemeyer, afterward mayor of the city, and his cousin, Frederick C. Havemeyer, who were sons of the original Havemeyers, entered into a partnership in the same business, and continued until 1842. F. C. Havemeyer resumed business in 1851, and in 1861 the firm of Havemeyers & Elder was formed. This firm up to 1887 were the largest refiners in this country.

In 1875 there were forty-two refineries in the United States, with an estimated aggregate output of about 25,000 barrels per day. The margin between raw and refined sugar was reduced from ten cents per pound in 1838 to three cents per pound in 1876, at which time raw sugar costing eight cents per pound was sold for eleven cents refined. The forty-two refineries in existence in 1875 dwindled to twenty-seven in 1880. Of these, twelve were located in New York and vicinity, five in Boston, four in Philadelphia, two in New Orleans, two in San Francisco, and one each in Portland, Me., and St. Louis, Mo.

It now became a question of the survival of the fittest. The first movement in the direction of self-preservation was made in the winter of 1882, when, by mutual agreement, the refiners in New York and Boston adjusted their meltings from week to week to the demand of the market. This agreement was in the nature of an experiment only, and necessarily but temporary. It was repeated from time to time, but at last found to be utterly futile. The movement toward community of interest, in which direction only lay the possibility of permanence of coöperation, did not crystallize until the summer of 1887. The number of refineries had been further reduced, and the unequal war of methods and means had still further reduced the margin between raw and refined sugar, until the losses of the refiners brought rumors of impending disaster to hitherto prosperous concerns. Finally nineteen of the refineries, after months of laborious negotiation, were brought into an agreement by which they were capitalized on the basis of $50,000,000, under the designation of the Sugar Refineries Company.

Under this organization the autonomy of each of the refineries was preserved, but all the capital stock of the several companies was held by a board of trustees, who issued against it certificates of common interest. These trustees, as the stockholders, elected the directors and managers of the several properties, thus insuring unity of action; and, through economy of management and prevention of over-production, the financial results were eminently satisfactory. The success of the company, and the then popular notion that all combinations were of necessity inimical to the public interest, led to attacks upon it, the result being that the form of organization was adjudged illegal by the courts in the State of New York, on the ground that it was a combination of corporations; whereupon a new company was incorporated under the laws of the State of New Jersey, and in January, 1891, the entire business of the Sugar Refineries Company was transferred to The American Sugar-Refining Company, with the same amount of capital. Under this new organization the business was still further unified, there being but one board of directors and one set of officers, the result being still greater simplification and economy in management.

At this time there were four independent refineries in Philadelphia, two of them being of large proportions. In 1892 all these refineries were acquired by The American Sugar-Refining Company, its capital stock being increased to $75,000,000. Under this great corporation the American consumer is supplied with the purest and best refined sugar made in the world. At the same time, by new and improved processes, the cost has been lessened, until the average margin at the present time between raw and refined sugar is less than one cent per pound, as against three cents per pound in 1876—a net gain to the consumer of two cents per pound.

The supplies of the refineries are drawn from all parts of the world, wherever they can be purchased to the best advantage. The lowest forms of crude sugar from Jaggery and the Philippine Islands, as well as the higher grades of the Dutch East Indies, Hawaii, the West India Islands, South America, and, in addition, a portion of the beet crop of Europe, are put under contribution to supply the 1,500,000 tons annually required for the consumption of this country, in addition to the domestic crops of cane and beet sugars, of which, also, about one half pass through the refineries before going to the consumer.

The refineries of The American Sugar-Refining Company are the largest and most complete in the world. The collateral industries dependent upon the business are themselves of great magnitude. In the item of cooperage alone there are consumed annually for barrels 200,000,000 staves, with corresponding hoops and heading. This material furnishes over 5000 car-loads of freight to be transported by the railways from the Western States to the refineries. Not less than 800,000 tons of coal are annually consumed in the manufacture of refined sugar. Fully one mile of the water-front in Brook-

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lyn, N. Y., is occupied by these mammoth refineries, their cooperage establishments, and the railway terminals which have been constructed solely with a view to handling their product. Other vast establishments are located in Jersey City, Philadelphia, Boston, Baltimore, New Orleans, and San Francisco.

Each succeeding revision of the tariff laws has witnessed a reduction of the protection to American refiners against foreign refined sugars, until at the present writing, with a forty per cent. ad valorem duty on all grades of sugar, the discrimination in favor of refined is but one eighth of a cent per pound, as compared with one half to six tenths of a cent under the McKinley law of 1890, and three quarters to one and one half cents per pound under the previous law. This has largely stimulated the production of foreign refined sugar for the American market. Under conditions existing prior to 1887 the American refining industry would be obliterated by this law. It remains to be seen whether, with the advantages growing out of large facilities in the purchase of raw sugars, and the economies possible only to so great a corporation, The American Sugar-Refining Company, and the independent companies which live under its lee, will be able successfully to compete with the refined product of Germany, where a direct bounty is paid on the exportation of unrefined sugars to this country.

Jno. E. Searles.

CHAPTER XXXVIII

AMERICAN RICE

RICE is the greatest of grains and the principal diet of one half of the human kind, a statement which cannot be made of any other edible. It stands preëminent as regards the number of persons who consume it, the area devoted to its culture, and the amount annually produced. This holds especially true in the far East, where its merits are more thoroughly appreciated. In China and its dependencies, with a population of 400,000,000, or twenty-five per cent. of the total population of the world, rice is the principal food-supply. The same may also be said of India with its population of 275,000,000, and Japan with its 40,000,000. In addition to these, it is a chief article of diet with other peoples of Asia and Africa, whose population is estimated to amount to 100,000,000. The total reaches 815,000,000, or, as above stated, over fifty per cent. of the total population of the earth, which is estimated (1890) at 1,500,000,000.

The foregoing enumeration does not include the Americas, Europe, or Australia, for while the culture of this grain receives considerable attention in these sections of the globe, and rice is there largely consumed, it cannot be said to be the most prominent of their food supplies in comparison with wheat, rye, maize, and other grains. In the United States there is a growing appreciation of its value, yet the amount at present consumed seems insignificant in contrast with the older countries of production. Our annual consumption, measured by the receipts of milling centers and trade for the past five years, was 4.7 pounds per capita. There is good reason to believe, however, that the amount is considerably larger than the figure indicated, as that which is grown throughout all parts of the South for local use fails to appear in the commercial movement, and is consequently not included in the commercial estimates. The consumption per capita in Bengal and the central provinces of India is placed at about one pound a day, and in the presidency of Bombay and Sind at half a pound. Higher figures are given for Burmah, with an intimation that their trustworthiness is impaired by several sources of possible error. Official figures, however, for Japan, for the five years 1887 to 1891, indicate an annual average of 308.75 pounds per capita. The consumption per capita in European nations is as follows: France, 3.8 pounds; Germany, 5.9; Great Britain and Ireland, 9.6; Italy, 13.7.

The value of rice as a food has for many years been a subject of lively discussion, some scientists and economists claiming that it is lacking in potential energy or fuel value. Investigation and experiments disclose that one pound of rice contains 3.12 per cent. more nutriment than corn or rye, 3.45 more than wheat, and 11.97 more than oats. When compared with potatoes or meats, the difference is still greater in favor of rice as an article of food; a pound of rice yielding more than four times as much nutriment as a pound of potatoes, three times as much as lean, and almost twice as much as fat beef. Dr. Frankland, in his "Comparative Value of Foods," places them in the following order of excellence, both as to economy and effect: Rice, oatmeal, flour, bread, potatoes, and lean beef. In corroboration of this scientist's conclusions are noted the famous porters of Constantinople, who are veritable Titans in burden-bearing, and live almost exclusively on rice; also a recent report (1895) received from Dr. J. Talmage Wyckoff, stationed at Basrah, at the head of the Persian Gulf, who states that there are no finer specimens of human physique to be found in the world than are characteristic of a tribe (the Telekafe) living in the vicinity of ancient Nineveh. Many of them earn a livelihood as laborers on the light-draft steamers plying on the river Tigris from Bagdad to Basrah. They carry the heaviest burdens from boat to shore, bales of Manchester cottons weighing from 500 to 1000 pounds being an ordinary load. Their food is entirely rice, and practically attests that it is indeed "strong meat" for the working man; possessing not only every requisite essential to general health and well-being, but in an unusual degree those elements which create and conserve physical strength.

In the South, rice is upon the table every day, it taking the place of potatoes and bread. It can be served in a variety of ways; as the Frenchman remarked in commendation of the egg, "there are 250 culinary combinations in which it may play a prominent and advantageous part," but it is especially adapted for use at the breakfast hour as a cereal or at dinner as a vegetable in lieu of potatoes. Good digestion will wait on both, thus contributing health and comfort to the "inner man." One reason perhaps for its limited use in the country at large is because of ignorance in the matter of cooking. How often rice appears, a repulsive, sodden mass, whereas it should be a dish tempting to the eye and inviting as food, each snow-white grain being separate and distinct. To sum up the merits of rice, its digestibility is unchallenged, its assimilative qualities unequaled, and the waste, as a consequence, is less than with any other food consumed by human kind.

Whether in retrospect or prospect, the rice industry within our own borders may be regarded with satisfaction. The beginnings were ndeed small, but the results have been great, and there is fair reason to expect that the production of this cereal in the United States will ultimately surpass that of wheat, and a fair possibility of its outcome equaling that of all other grains combined. While not indigenous to the Western Hemisphere, it took promptly to our congenial soil and climate. Possibly due to the high latitude, the initial attempt at rice culture by Sir William Berkley in Virginia in 1647 failed to have satisfactory results, its practical introduction not taking place until 1694 in lower Carolina. Its incoming was due to an accident. A vessel bound for Liverpool from Madagascar, blown out of her course and in need of repairs, put into Charleston. Before starting on the homeward voyage the captain, in exchange for courtesies received, gave Landgrave Thomas Smith a small parcel of rough rice, suggesting that it might possibly grow and afford an additional article of food. Being of good seed, cast on good ground, the gift proved valuable, for it increased at biblical ratio, soon becoming adequate for the immediate territory, and early in the following century it began to furnish a considerable amount for export. In 1707 seventeen ships left Carolina with cargoes of rice. During the years 1730 to 1739 the shipments to Great Britain and other ports were 223,787,200 pounds. In 1754 the exports to England were over 100,000 barrels of unhusked rice (30,000,000 pounds cleaned), still leaving an ample supply for home consumption. The yield might have been much greater had the system of water culture now in use been practised at that time, but this was not introduced until 1784. With sparse population during the colonial period, and because of the natural trend of commerce toward the Old World and the West Indies, most of the rice went thither until the present century. The following table will give an idea of the culture at the opening of the century covered by this article, its progress and present condition, together with prevailing tariffs. For the purpose of brevity statistics are grouped in periods of five years, with annual average:

PRODUCTION OF RICE IN THE UNITED STATES FOR 100 YEARS, 1795 TO 1895, WITH TARIFF RATES PREVAILING FROM 1789 TO 1857.

Five Years ending June 30.	Production for Five Years. (Pounds.)	Average per Year.	Tariff on Rice.	
			Year Enacted.	Rate Ad Valorem.
1800. ...	320,631,803	64,124,361	1789	5 per cent.
1805....	240,044,600	48,008,920	1792	7½ "
1810.....	274,477,000	54,895,400	1794	10 "
1815....	274,867,800	54,973,560	1800	12½ "
1820.....	282,397,800	56,479,560	1804	15 "
1825.....	333,447,000	66,689,400	1812	30 "
1830.....	417,333,600	83,466,720	1818	15 "
1835.....	457,282,200	91,456,440	1832	Free.
1840.....	429,585,600	85,917,120	1836	15 per cent.
1845.....	481,669,200	96,333,840	1841	20 "
1850....	543,494,400	108,698,880	1857	15 "
1855.....	483,279,600	96,655,920		
1860.....	545,592,600	109,118,520		
1865. ...	115,738,680	23,147,736		
1870.....	160,837,790	32,167,558		
1875.....	276,704,430	55,340,886		
1880.....	415,332,000	83,066,400		
1885.....	534,720,400	106,944,080		
1890.....	675,950,400	135,190,080		
1895.....	762,698,460	152,539,692		

DUTY FROM 1861 TO 1894.

Specific Duty.	Cleaned per Pound.	Uncleaned per Pound.	Paddv per Pound.	Flour Granulated.	Ad Valorem Equivalent.*
	Cts.	Cts.	Cts.	Cts.	Cleaned Rice.
1861.....	1	½	....	....	41 per cent.
1862. ...	1½	1	¾	....	48 "
1864.....	2½	2	1½	....	94 "
1876....	Hawaiia	n Rice			Free
1883.....	2¼	1½	1¼	ad val. 20% specific	110 per cent.
1890.....	2	1¼	¾	¼	99 "
1894.....	1½	$\frac{8}{10}$	¾	¼	88 "

* Ad valorem equivalent of specific duties imposed is given for purposes of comparison. In explanation of the apparent disparity under similar tariff rates, the prime cost diminished and thus the ad valorem equivalent increased. The per cents given cover the period during which the different rates were in force.

Even at the risk of being charged with national predilections, it is due to this country to state that it produces "the best rice in the world," for it has here shown its finest development. This was true of its main crop before the war, and the magnificent quality grown by many planters to-day shows that its culture is not a lost art. The high standard previously established was owing to a generous rivalry among Carolina planters, who sought the best seed and methods of cultivation. At the front in its day, and of historic fame, was Ward's "long grain Carolina" rice. Equal in grain to the largest Honduras head, but of more crystalline character, it was properly described as "an elongated pearl." Mr. Ward made it a practice to gather the heaviest and best-filled heads, and in the course of a few years he possessed seed unequaled in the world. It paid doubly, making him a prince among planters, as well as yielding rich returns for his purse.

While the cultivation for local consumption was carried on to a considerable extent in almost every Southern State prior to the late war, only that of the Carolinas and Georgia was of national importance. The rice fields where the commercial crop is mainly grown are reclaimed cypress swamps and tide-water lands along the coast. Many of the best plantations, however, are among the marshes higher up the rivers and upon level tracts in the interior, so situated as to be easily irrigated. Upon all of these the system of water cultivation is generally followed. The tide-water lands lie along the rivers in such a position, above the meeting of fresh and salt water, that they may be flooded by fresh water at high tide, and drained when the tide is low. They are protected by means of dikes from salt water (always fatal to rice), coming from below, or from freshets from above. These lands were formerly valued from $200 to $300 per acre, but owing to a cessation of culture during the war, the difficulty of obtaining labor, and other adverse conditions, are now obtainable at $20 to $30 per acre. As incidental protection was derived from the tariff, the rehabilitation of plantations at the close of the war was undertaken with considerable vigor, but of late years production has somewhat declined, owing to a want of energy and economy on the part of the planters.

The falling away in the culture along the Atlantic Coast, however, has been more than made up by the wonderful enlargement in the Southwest. That the retention of the tariff and incidental protection were beneficial and stimulating is demonstrated by the fact that the total culture (including that of Louisiana), which was fairly under way by 1870, was, in the decade following, more than doubled, and at the end of the second had quadrupled, as will appear by reference to the foregoing table. Since the war other Southern States have exhibited an increased interest in the cultivation of this product, but the growth outside of the old rice-growing States above mentioned, excepting Louisiana, is still principally for local use. The culture in Louisiana dates back to 1718, and it continued of minor importance, principally confined to the parish of Plaquemine, until after the close of the Civil War. At this time planters were rich in lands, but poor in purse, and the necessity of the hour was for a crop requiring the least possible outlay, yet offering an assured and prompt return. Sugar was out of the question, as the investment required was large, and the outcome questionable and delayed. As a result there was a general turning to rice, and this crop almost immediately sprang from local to national importance. By 1875 Louisiana furnished thirty per cent. of the total yield of the United States, and in each of the five years following, 1880, averaged forty per cent.; 1885, sixty per cent.; and 1890, sixty-five per cent. In 1895 it is seventy-five per cent. of the aggregate production. The development during the past thirty years has been so marvelous that it is worthy of statistical illustration.

PRODUCTION OF RICE IN LOUISIANA.

Five Years ending June 30.	Pounds.	Average per Year.
1865	9,667,080	1,933,416
1870	35,268,590	7,053,718
1875	81,756,030	16,351,206
1880	176,694,000	35,338,800
1885	255,516,200	51,103,240
1890	422,775,000	84,555,000
1895	555,595,400	111,119,080

Prior to the War, the annual product was about 1,000,000 pounds.

More recently the culture of the older localities along the Mississippi River has been somewhat reduced because of the delusive sugar bounty, which tempted planters from a good and profitable crop into the growth of the saccharine exotic. In 1885 a new era was entered upon by the opening up of the southwestern part of the State, and it now contributes the largest portion of the entire product of the United States. This section, known as the "Calcasieu Country," extending from the Atchafalaya River on the east to the Sabine River on the west, embraces several parishes containing thousands of acres of land, in a virgin state, and most

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admirably adapted to the culture. Like the country chosen by Lot of old, the section is level, yet well watered, rivers and bayous extending in every direction, making irrigation an easy matter. In this lies the secret of the gigantic strides made by the culture in that part of the State. When once the planter has his levees made, which can be done at a small cost with the improved machines in vogue, they can be kept up with slight expenditure, and good crops raised almost every year beyond any contingency. The streams also afford cheap transportation by barges. Another reason for the great enlargement of the culture in that locality is the fact that machinery can be employed from start to finish, the cost of production being nominally the same as wheat, while the yield per acre is manifold greater.

Up to 1820, as already suggested, the crop was largely marketed abroad, but with an enlarging population, home consumption became of prime interest. New York was the main point for distribution, and rice was largely used as a medium of exchange between the North and South, finding its way into the hands of dealers in dry-goods, boots, shoes, machinery, etc., and these in turn jobbed the product in a small way to the grocery fraternity. Results were unsatisfactory to the producer, as they bought supplies on long time, paying a long margin, while in selling their product realized short prices. This cutting on both sides of planters' interests lasted until 1841, when the founder of one of the oldest firms in the line took up rice as a specialty, concentrated the receipts, and from a business of barter made it one of cash, thereby enhancing its value as a staple product. Even up to the time of the War exports to foreign markets were large, but since then the whole product has found a market at home, and is inadequate to the demand. The annual import of this grain is from 200,000 to 300,000 bags, of two hundredweight each, as will more exactly appear by the following statistics:

IMPORTS OF EDIBLE RICE.

Five Years ending June 30.	Pounds.	Average per Year.
1865	248,657,641	49,731,538
1870	228,772,804	45,554,561
1875	268,234,740	53,646,948
1880	254,373,855	50,874,771
1885	361,053,545	72,210,709
1890	362,810,988	72,562,198
1895	415,421,957	83,084,391

In addition to the rice required for eating purposes, there is a large amount which enters into manufacturing channels, to which that grown in the United States contributes but an insignificant per cent. The following table gives an exhibit of imports for such special uses:

IMPORTS OF RICE FOR MANUFACTURING.

Five Years ending June 30.	Pounds.	Average per Year.
1865	....	....
1870	....	....
1875	855,350	171,070
1880	6,833,458	1,366,692
1885	111,510,875	22,302,175
1890	258,089,459	51,617,892
1895	352,214,257	70,442,851

Rice is a good crop, as the yield is more than that of any other grain; the outcome under equal conditions is quite double, and not infrequently is three or four times greater than wheat. Good lands yield from forty to fifty bushels per acre, and at a low average price, say fifty cents per bushel, the outcome in comparison with wheat will be quickly appreciated. It is easily cultivated, any one acquainted with other grains having the assurance of success from the start. Occasions are not exceptional when the outcome of a single crop has paid for the farm, as well as given support to the farmer and his household. In the immediate future southwestern Louisiana is the most promising field. Here are tracts of land nearly level, almost surrounded by a natural levee, with an abundance of water for irrigation, and sufficient elevation for ample drainage. In the four initial items of rice farming, leveeing, plowing, pulverizing the soil, and sowing, the average increase in the capacity of a man to do work has been 500 per cent in the past five years. Every process of rice cultivation has been changed by the introduction of machinery. A decade ago twenty acres of rice required as great an individual expenditure of force, time, and money as 100 acres to-day. There is no reason why the United States should not produce the largest rice crop in the world. There are millions of acres lying along the Atlantic and Gulf coasts suitable for rice culture, otherwise being of little value. When these waste lands are brought under tillage the United States will have an abundance for its own requirements and will be a serious rival of the East in the markets of the world.

CHAPTER XXXIX

AMERICAN FLOUR

IT takes about 2,500,000,000 bushels of wheat a year to feed the race, most of this being ground into flour. The flouring industry is older than history. It is the first manufacture recorded in American annals. Its annual product exceeds in value that of any other manufacturing industry carried on in this country. It employs more power, with the exception of one, and supplies more home demands and foreign markets, than any other industry. During the past one hundred years our output of flour has brought to our shores more European gold, and redeemed from foreign hands more American indebtedness, than all other American manufacturing industries. The American miller has never asked for government protection and support.

The first wheat was brought to this country by Bartholomew Gosnold, and landed at an island in Buzzard's Bay in 1602. Thence it came to Virginia in 1611. In 1648 Virginia had planted several hundreds of acres of wheat, and was sending it to the New England colonies. During the ten years just preceding the Revolution, Virginia exported 800,000 bushels of wheat per annum. But in the memorable year of 1776 the Hessian fly alighted upon our coast, and made a more successful raid upon the American wheat-fields than the Hessian soldiers were able to make upon the American patriots, and as a result practically drove the wheat industry across the Alleghanies. As early as 1718 the first wheat went into the Mississippi Valley. In 1746 the port of New Orleans received 600 barrels of flour from the Wabash. In 1833 one Illinois county raised 900,000 bushels of wheat. In 1836 the first cargo of 3000 bushels went from Lake Michigan to Buffalo, and two years later the first shipment of thirty-nine bags went out from Chicago. For seventy-five years the growing of wheat and the flouring industry have been following lake navigation into the Northwest, which is now the chief locus of the world's bread-basket.

The first flour-mill mentioned in American history was the hand-mill, which consisted of two small millstones, one having a handle, rubbed upon the other. In the year that Peter Minuit bought Manhattan Island for $24, namely, in 1626, it is recorded that François Molemacker built upon it a horse-mill. Two years later Minuit erected two or three windpower grist-mills. About the same time the first windmill in New England was erected near Watertown. A "Dorchester mill" is mentioned in the records of 1628. The first Van Rensselaer who went up the Hudson took with him a millwright and a pair of millstones. In a few years nearly every hill on the Atlantic coast had its windmill, superseding the hand-mill, ox-mill, and horse-mill, and the stone and pestle of the Indians. The first water-mill in New England is credited by history to Israel Stoughton, and was built on the Dorchester side of the Neponset in 1634, thus being the prototype of the water-wheels of New England industry. About the same time John Jenney was granted leave to erect "a mill for grinding and beating corn upon the brook of Plymouth." In ten years Massachusetts was sending wheat and mill-stuff to Portugal. In 1649 Virginia had four windmills, five water-mills, and numerous horse-mills, and was exporting breadstuffs. In 1678 New York was doing a considerable business both in the manufacture and export of flour. At that time bolting was a separate industry, in which New York enjoyed a charter monopoly. When the charter was repealed in 1694, the cry was raised that the withdrawal of the monopoly "hath produced anarchy in the province, and destroyed the reputation of New York flour."

Perhaps the most celebrated flouring-mills in the period immediately after the Revolution were those of Delaware, on the Brandywine. Twelve merchant flouring-mills, with twenty-five pairs of stones, ground 400,000 bushels of wheat per annum. Wilmington exported 20,000 barrels of superfine flour a year, in addition to the ship-stuff. There were 130 mills within a radius of forty miles. It was then claimed that "the manufacture of flour was carried to a higher degree of perfection on the Brandywine than in any State in the Union."

Baltimore, on the Patapsco, also came into early prominence as a milling center. As early as 1769 Baltimore exported 40,000 tons of flour and bread, made in the Baltimore district. Its flour ranked high before the Revolution, and it was the first milling point to take up with the new improvements invented by Oliver Evans. Up to 1785 the different milling processes were separate and largely done by hand; but Evans, by the introduction of the elevator, conveyer, and other mechanisms, combined the different steps into a continuous system, dispensing with one half of the labor formerly required, and enabling the miller by machinery alone to take the grain through "from wagon to wagon again." The Brandywine millers, conscious of their superiority, were slow to take up with the revolutionary improvements of Evans; and thus the invention and the milling development passed from the Brandywine to the Patapsco. In 1787 there were 325 barrels daily made in Baltimore, the labor saving as a result of Evans's improvements being estimated at $4875 per annum, and the increase in value of product being placed at $32,500. In 1840, within the thirty miles in which the Patapsco fell 800 feet, there were sixty flouring-mills, which ground several hundred thousand barrels of flour per annum, finding a ready market in South America and the West Indies, and being in demand because of its high quality.

After the Brandywine and Patapsco came the falls of the James, which made the mills of Richmond celebrated in home and foreign markets up to recent times. The fame of the Gallego and Haxall mills is traditional. In 1845 a writer in the "National Magazine and Industrial Record" says: "The Gallego and Haxall mills are the largest in the United States, the great mills at Rochester not excepted, and the flour turned out from them commands better prices than any other. It is almost exclusively shipped to and consumed in South America." There were twenty-one flour-mills at Richmond in 1840, which made and shipped a large quantity of superior product, regarding which the government agricultural report of 1864 paid the following high tribute: "The flouring-mills of Richmond are probably equal to any in the world, both in the perfection of their machinery and in the quantity and quality of flour produced." At that time the Gallego mills had thirty-one pairs of burr-stones and a yearly capacity of 190,000 barrels, while the Haxall mills had a capacity of 160,000 barrels. The Richmond brands commanded fifty cents to one dollar per barrel more than most grades of flour, because of their peculiar quality of keeping sweet on long voyages and in hot climates, thus commanding Latin-American markets.

It is something over three quarters of a century since Rochester and the Genesee Valley sprang into fame as a region of wheat and flour production, and obtained a name which was celebrated on two continents for half a century. The 2300 square miles of the Genesee Valley were unsurpassed in alluvial fertility, and its wheat took prize medals at European exhibitions. Within the city limits of Rochester the Genesee River had successive falls aggregating 268 feet. The Erie Canal, Genesee River, and Tonawanda Railroad brought to the Rochester mills not only the famous wheat of the Genesee Valley, but also that of Ohio and Canada. Rochester was not platted until 1812, but in 1835 there were twenty-one Rochester flour-mills, with ninety-five runs of stone and 5000 barrels' daily capacity. The Rochester brands were on sale in all Atlantic markets. In 1860 there were nineteen flouring-mills, with a yearly product valued at $2,500,000. In 1865 the flour output was 800,000 barrels. In 1870 Monroe County had thirty mills and a product worth $4,600,000 a year. Rochester continued to be the "Flour City" of the continent until, in recent years, the growth of the nursery business caused the spelling of the name to be changed to "Flower City."

During the present century the wheat and flour industries of the United States have steadily progressed toward the lake region and Mississippi Valley. The Western trend is shown in the fact that, as early as 1840, the five States of Ohio, Kentucky, Indiana, Illinois, and Michigan had a total of 1200 flouring-mills, which turned out 2,000,000 barrels of flour, or about thirty per cent. of the country's product. In 1850 the milling product of Ohio alone was greater than that of the New England States, New Jersey, and Delaware. In 1860 the Western States produced more flour and other mill products than the New England and Middle States combined. Ohio was second only to New York in value of flour product, while Illinois stood fourth and Indiana fifth in the rank of flour-manufacturing States. Over one half of the flour of the United States in 1860 was produced in the Mississippi Valley and westward. The first trend of flour production westward was down the Ohio River. A steam flour-mill of 700 barrels' weekly capacity was built in Cincinnati in 1815. Pittsburg had a steam-mill with three pairs of burrstones in 1808. Barges were floated down the Ohio to the Mississippi, and thence to New Orleans, before the era of canals and railroads developed the lake region and the upper Mississippi. Cincinnati, St. Louis, and New Orleans rejoiced in a flourishing business in breadstuffs when Buffalo, Chicago, and Milwaukee were in their cradles, and long before Minneapolis had its first house. Cincinnati possessed ten steam flour-mills in 1840 and thirty-one in 1860, when its mill product reached about $2,000,000 a year. The flour trade of New Orleans, which began with 600 barrels in 1746, was about one hundred times that figure in 1846, and exceeded 1,000,000 barrels ten years later. Cincinnati's flour receipts rose from 200,000 barrels in 1846 to 500,000 in 1856; and its wheat receipts in that period rose from 400,000 bushels to 1,000,000. But after 1856 Cincinnati began to ship its wheat North and East, instead of to New Orleans, and the latter port rapidly declined as a shipping port for breadstuffs. The delay, risk, and uncertainty of river and Gulf navigation, and the danger to flour and grain from warmth and moisture in the Gulf and lower river climate, made the lake region the natural channel of transportation, as soon as the canals, lake ports, and Northern railway system were equipped for the traffic. The receipts at New Orleans during the past few years are about 700,000 barrels a year, of which only about 100,000 barrels are exported. St. Louis is the one point on the lower Mississippi which has maintained its place as a manufacturer and shipper of flour. Starting with two flour-mills in 1840, St. Louis was turning out 400,000 barrels a year in 1850, and 800,000 in 1860. The million point was passed in 1869, and the two-million point reached in 1879. Since then the output of the St. Louis mills has run from 1,600,000 to 2,000,000 barrels per annum. St. Louis in addition receives over 1,000,000 barrels a year from other points, and ships to Eastern and foreign markets over 2,000,000 barrels per annum. It was the leading flour-manufacturing center just before Minneapolis forged to the front, and is still among the first, being excelled in volume of product by only Minneapolis and Superior.

The era of Northwestern development in flour and grain production and trade dates from the completion of the Erie Canal, October 25, 1825. The New York canals delivered 1,000,000 barrels of flour in 1835, and 3,000,000 barrels in 1850; and of wheat they took to tide-water about 700,000 bushels in 1835, and 19,000,000 bushels in 1860. Of all kinds of grain the New York canals handled 11,000,000 bushels in 1850, and 41,000,000 in 1860. The flour receipts of Buffalo grew from 139,178 barrels in 1836 to 2,846,022 barrels in 1862; while the wheat receipts mounted up from 304,000 bushels in 1836 to 30,000,000 bushels in 1862. Oswego and Toledo were telling similar stories of growth. The breadstuffs which were giving this enormous traffic to the New York canals and shipping ports were being produced by the rapidly multiplying population which was pouring into the lake States. Michigan, which in 1818 did not have farmers enough to supply the local grain demand, began exporting in 1835. Ohio was second only to New York as a producer of wheat in 1845, and soon after stood at the top of the list, with an annual product of 20,000,000 bushels and over. In 1860 the four leading States in wheat production—Illinois, Indiana, Wisconsin, and Ohio—were all northwest of the Ohio River. The total grain product of what were then called the Northwestern States increased from 200,000,000 bushels in 1840 to 600,000,000 in 1860. Chicago began to ship wheat in 1838, and Milwaukee in 1841. The Illinois and Michigan Canal was constructed in 1848. The railway mileage of Michigan, Wisconsin, Iowa, Illinois, Ohio, and Indiana advanced from 1250 miles in 1850 to over 10,000 miles in 1860. The lake vessel tonnage, mostly grain, increased from 76,000 in 1845 to 390,000 in 1860. The upper Mississippi grain trade, beginning at about 1855, sent 6,000,000 bushels of wheat to Lake Michigan in 1863. Chicago's flour and wheat shipments grew from 78 bushels in 1838 to 22,000,000 in 1862. The wheat and flour shipments of the St. Lawrence, for the four years ending with 1871, as compared with the four years ending with 1859, advanced 165 per cent. Minnesota, which had no railways in 1860, had 3000 miles in 1880, and has 6000 miles at the present time. The Minnesota wheat crop has advanced correspondingly, from 1401 bushels in 1850 to 18,000,000 bushels in 1870, and to 60,000,000 bushels for the present crop year. The Dakotas, which raised 945 bushels of wheat in 1860, and less than 3,000,000 in 1880, have just harvested a crop exceeding 100,000,000 bushels of hard spring wheat. The above facts give eloquent evidence of the enormous development of the Northwest in breadstuffs in recent years, and indicate the resources upon which rests the world's chief flouring industry. Chicago entered upon the manufacture of flour in the forties. In 1855 its flour output was 80,000 barrels; in 1865 it reached 288,000 barrels, going to 575,000

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in 1885, and dropping to 444,000 in 1894. In flour shipments, Chicago rose from 6320 barrels in 1844 to 3,714,000 in 1894. Milwaukee has been a prominent flour-manufacturing point ever since the war. Its product of 142,500 barrels in 1859 went to 752,000 in 1879, rising to 2,117,000 in 1892, and stopping at 1,576,000 in 1894. Its receipts from other points aggregate over 2,000,000 barrels more, and its annual shipments are over 3,000,000 barrels. Milwaukee vies with St. Louis and Superior for the second place among flour-manufacturing cities.

The Minneapolis milling industry, which now seems to be easily the first in the world in the volume of its product, dates back to the first merchant mill of 1854. It is a matter of interest, however, that the first grist-mill at the Falls of St. Anthony was erected for the government by a detachment of fifteen soldiers from Fort Snelling, in 1823. The plant was billed at $288, and consisted of one pair of burrstones, some plaster of Paris, and two dozen sickles. With this harvesting and milling machinery was reaped and ground the first wheat in Minnesota. The first custom grist-mill did not appear until nearly twenty years later. In 1859 occurred the first shipment East, 100 barrels being sent to Boston at a cost of $2.25 per hundred for freight, which is $2 more than the present cost of transportation. In 1865 there were six mills running, with an aggregate daily capacity of 800 barrels; and three years later there were thirteen mills, which turned out 220,000 barrels of flour, valued at $1,875,000. Down to 1870 the milling process in the United States was that invented by Oliver Evans, with some minor and gradual improvements. From 1787 the nether and upper millstones, the former stationary and the latter balanced to rotate upon it, ground the flour of America. The stones were set close together, to produce as much flour as possible at one grinding. This produced friction and heat, and often brought about chemical changes which injured the color, taste, and quality of the flour. In the early milling history of Minneapolis, when enterprising manufacturers rushed the speed of the stones to secure a large product, the flour came out dark, and so hot the hand could not be held in it. The old Cataract mill of this city cooled its flour with an old-fashioned water-cooler having a circular pit thirty feet across, around which traveled a double sweep. Minneapolis spring wheat-flour then stood low in the scale, and was sometimes branded, at the request of buyers, "St. Louis flour from winter wheat." The hard spring wheat, rich in gluten which made it tough, rendered difficult the separation of flour from bran, and thereby yielded a dark-hued flour which brought a low price in the market. The soft and starchy winter wheat, on the other hand, yielded readily to the old low-grinding process; the bran was more easily separated, and the flour was lighter in color and less damaged by hard grinding. The color and quality of spring wheat-flour were somewhat improved in the best mills by a reduction in pressure and speed and by scientific stone dressing; but the main difficulty remained. The difficulty in grinding spring wheat by the old process was with the middlings, or that part of the kernel between the bran covering and the starchy central body. The middlings, although known to be rich in the gluten which gives wheat-flour its chief value with the baker and pastry-cook, were associated with the bran; and the richer the wheat in gluten, as in the case of hard spring wheat, the more difficult was the process of separation, because the gluten was the cause of the toughness. The first experiments were made with a view to the purifying of middlings. In 1868, E. N. La Croix, a French millwright, came to Faribault, Minn., and experimented in making a middlings purifier, like one he had seen in France. In 1870 he moved to Minneapolis and continued his experiments. At length a machine was made, and a sample batch of flour was sent to New York. Word came back by wire that the new flour was selling at fifty cents a barrel higher than other brands. The La Croix machine was crude and in some respects unsatisfactory, and George T. Smith went to work and produced a superior machine, different in many points, but retaining the same principle, and obtained a patent. As a result of the new middlings purification process the mills using it added fifty cents a barrel to their profits in the first year, $1 the second year, and from $2 to $4 per barrel the third and fourth years. Thereupon Mr. George H. Christian, representing the Washburn mills, a number of head millers from other mills, and myself, representing the Pillsbury mills, went to Europe and made a thorough study of the Hungarian "high-milling" or gradual-reduction roller and middlings process. As a result some of the Minneapolis mills adopted the Hungarian process bodily, middlings purifier and all, and in a few years were compelled to throw away some of the complex machinery with which they were loaded. The Pillsbury mills, however, adopted only what seemed to be the best features of the Hungarian process, such as the rolls, made modifications all along the line, and retained the American middlings purifier invented by Mr. Smith. We found that the Hungarian system needed simplification to increase its efficiency, to save labor, and especially to avoid dangerous accumulation of mill-dust. The new and improved high-milling system of Minneapolis and Minnesota thus established made the hard spring wheat of the Northwest the best flour material on the globe, immediately added ten to fifteen cents per bushel to its market value, and gave Minneapolis flour the first place among the cooks and bakers of the world. By the new process chilled-iron and porcelain rollers gradually came into use in place of the old millstones. The grain, in place of being ground in a single pair of millstones, was run through six or seven sets of rollers, being sifted and graded after each breaking by the rollers. The old process aimed to get as much flour as possible at one grinding; the new seeks to get as little flour as possible at the first two or three breakings. The old millstones were set so close together that the weight of the upper stone rested almost wholly upon the grain. The first rollers in the new process are set so far apart that the kernel is simply split for the liberation of the germ and crease. The old process sought to avoid middlings as far as possible, because they entailed loss of flour. The new process seeks to produce as much middlings as possible, because out of the middlings comes the high-grade "patent" flour. In the handling of the middlings the new process exhibits the highest art. The gluten, which gives flour its "strength" or "rising" power, is saved and made available to the baker, and made a prominent source of profit both to the farmer who raises the wheat, the miller who grinds the flour, the baker who makes the bread, and finally to the consumer, in whom it is transformed into brain and muscle.

With the introduction of the new milling process came the big mills which have made Minneapolis famous, and the development of the spring-wheat industry which has made the Northwest known around the globe. In 1873 was erected the Washburn "A" Mill, then the largest in the world, and a few years later the Pillsbury "A," which since then has borne the palm. In 1884 there were twenty-three mills equipped with the new process machinery and possessed of a daily capacity of 30,000 barrels. In 1876 the flour shipments of Minneapolis were 1,000,000 barrels; in 1884 they were 5,000,000; and at present are nearly 10,000,000 barrels per annum. The output increased from 940,000 barrels in 1878 to 9,400,000 in 1894. Dividing the fifteen years from 1880 to 1894 into five three-year periods, we find that the second period, 1883–85, gained 6,214,000 barrels over the first; the third period, 1886–88, gained 5,214,000 over the second; the fourth period, 1889–91, gained 1,156,000 barrels over the third; while the fifth period, 1892–94, including the panic period, gained 7,572,998 barrels over the three years preceding. The twenty-five mills of the city now have a capacity of not quite 60,000 barrels a day, and grind about 50,000,000 bushels of wheat per annum. In the calendar year of 1892 Minneapolis received 72,000,000 bushels of wheat, of which 51,000,000 bushels were converted into 9,750,000 barrels of flour by the Minneapolis mills. During the week preceding this writing the output was 298,900 barrels, which was something more than double the combined outputs of the two next largest milling centers in the United States. Its heavy receipts as a primary wheat market, and extensive shipments as a direct exporter of flour to foreign markets, are prominent factors which have contributed to the development of Minneapolis as a flour-manufacturing center. In the past ten crop years Minneapolis has received 492,000,000 bushels of wheat, nearly double the receipts of any other primary wheat market in the country; and of this has consumed in its mills 370,000,000 bushels. During these ten crop years Minneapolis has exported to Europe 25,000,000 barrels of flour, or not quite twenty-five per cent. of the flour exports of the United States for that period. The wheat receipts increased from 1,000,000 bushels in 1867–68, when the first elevators were built, to 10,000,000 bushels in 1880, when Minneapolis ranked eighth among the primary wheat markets of the country. Four years later Minneapolis was the leading primary wheat market, a position which has been maintained during the ten years succeeding. The first flour exports to foreign markets were made in 1878, with an entering wedge of a little over 100,000 barrels. It took considerable effort and time to overcome European prejudice, but at the end of a dozen years Minneapolis was able to place 2,000,000 barrels of its high-grade product in the hands of Europe's bakers and housekeepers, and the trade is still growing. American flour is used abroad both alone under its own name, and also as an ingredient to mix with European flour. Contrary to the general habit here, English millers often mix one kind and grade of wheat with another, so as to produce flour which shall be adapted to their particular needs. Their climate is moist, and their bread is baked in larger loaves than those to which we are accustomed. Little bread is eaten in the United States that is over thirty-six hours old, while that which has been made twice as long is frequent on British tables. There is little consumption of flour there in biscuits, such as are made by the ordinary American housewife in large quantities. In spite of all these differences, flour from this side is in great request abroad, and is now essential to the English baker and householder.

The flour output and direct exports of the Minneapolis mills for eighteen crop years, ending with August 31st of each year, are given in the table attached:

OUTPUT AND EXPORTS OF MINNEAPOLIS FLOUR.

Year.	Output. Barrels.	Exports. Barrels.
1894–95	9,418,225	2,377,090
1893–94	9,321,630	2,362,551
1892–93	9,349,615	3,066,972
1891–92	9,500,255	3,668,380
1890–91	7,434,098	2,576,545
1889–90	6,863,015	2,091,215
1888–89	5,740,830	1,557,575
1887–88	7,244,930	2,617,795
1886–87	6,375,250	2,523,030
1885–86	5,951,200	2,288,500
1884–85	5,221,243	1,834,544
1883–84	5,317,672	1,805,876
1882–83	4,046,220	1,343,105
1881–82	3,175,910	1,201,631
1880–81	3,142,972	1,181,322
1879–80	2,051,840	769,442
1878–79	1,551,789	442,598
1877–78	940,786	109,183

Superior, St. Louis, and Milwaukee, in the order named, are the milling centers next in size, following Minneapolis. Then follow Duluth, Toledo, Kansas City, Indianapolis, Buffalo, and Niagara Falls; the next group being Chicago, Baltimore, Cleveland, Cincinnati, Detroit, Philadelphia, and Peoria. Superior has made the most remarkable progress during the past two or three years, increasing its output from 60,000 barrels in 1892 to 2,028,000 in 1894. Superior and Duluth, the twin head-of-the-lakes towns, have produced during the first nine months of this year 2,387,375 barrels of flour, as against 1,969,135 for the same months last year, and 710,000 for the corresponding period in 1892. Toledo has been showing marked advancement of late, having pushed its 1892 output of 589,000 barrels to 869,000 barrels in 1894. Kansas City exhibits a still larger advance, climbing up from 275,000 barrels in 1892 to 725,000 last year. The Buffalo and Niagara Falls mills have a desirable location and have taken rank as flour producers within the past few years. Their production of the past two seasons, however, has shown no increase. Buffalo's 729,000 barrels of 1892 became 678,500 in 1894, and the outside mills allowed their output to drop from 696,770 to 614,032. Cincinnati and Indianapolis, in the valley of the Ohio, have shown recent increase in production; while the lake ports of Chicago, Milwaukee, Detroit, and Cleveland have dropped somewhat, as also have Baltimore, St. Louis, and Peoria. The 1894 products of the dozen chief milling centers were as follows:

PRODUCTS OF TWELVE MILLING CENTERS.

Place.	Barrels.
Minneapolis	9,400,535
Superior — Duluth	2,946,292
St. Louis	1,656,645
Milwaukee	1,576,064
Buffalo — Niagara Falls	1,292,565
Toledo	869,500
Kansas City	725,390
Indianapolis	690,096
Chicago	444,000
Baltimore	420,373
Cleveland	402,000
Cincinnati	335,821

The flour export trade of the United States is almost as old as the flour industry. It dates back over two hundred years. Virginia and New York were exporting breadstuffs and building up a trade with Spain, Portugal, and the West Indies a century before the Revolution. The New England colonies were sending flour to the West Indies in 1720–30. In 1729 Philadelphia exported 35,438 barrels of flour, together with enough bread and wheat to bring the export value of breadstuffs for that year to $300,000. In 1865 Philadelphia's exports of breadstuffs reached the value of over $2,000,000. In 1771 that city's flour exports were 252,000 barrels. When, in 1770, the total flour exports of the colonies reached 458,000 barrels, Lord Sheffield announced in Great Britain that he doubted that this country would ever be able to exceed that figure. Edmund Burke, in his speech of 1774, paid the flour export trade of America the following exuberant and ponderous tribute: "For some time past the Old World has been fed from the New. The scarcity you have felt would have been a desolating famine if this child of your old age, with a true filial piety, with a Roman charity, had not put the full breast of its youthful exuberance to the mouth of its exhausted parent."

Just one hundred years ago this year the flour exports of the United States were 687,369 barrels, and the breadstuffs comprised about one third of the total exports. In the first year of the present century the flour exports passed the million-barrel point, and in 1811 passed a million and a half. But the export trade was extremely fluctuating, and did not pass the two-million point until forty years later. During the twenty-five years 1820–44 the average value of flour exports per annum was about $5,000,-

000, which was about ten per cent. of the value of all exports. In 1844 our shipments of breadstuffs, mostly flour and bread, to Latin America were not quite $7,000,000, which exceeded the exports of all other manufactures, and was more than one third of our total Latin-American exports. During the first half of the century, flour, next to cotton, was our chief dependence for export. Then there was a sudden and radical dropping off in the flour trade, with no signs of recovery during the next twenty-five years.

The reason why, from 1850 to 1875, this country lost its foreign trade in flour, and shipped its wheat for European mills to grind, was that milling during that period was making rapid progress on the other side of the ocean, while we were still clinging to the old process of 1800. As early as 1810, Ignaz Paur, of Austria, invented a middlings purifier. Experiments began with the roller-mill in Paris, Vienna, and Switzerland in 1820. Pesth and half a dozen other milling centers successfully used roller-mills before 1840. Ten years later roller-mill machinery was exhibited at the London Exhibition, and was thereafter used in Great Britain. Gradual improvements were made down to 1873. This development in the art and science of European milling called for large quantities of American wheat to be used in European mills, and gradually shut out American flour from European markets. In 1854 our millers sent 1,846,000 barrels to Great Britain; while in 1865 they sent only 200,000 barrels to all Europe. During the five years ending with 1830, 99.5 per cent. of the value of wheat and flour exports was flour; in the five years ending with 1835, flour constituted 97.5 per cent. of the total value of wheat and flour exports; and in the ten years ending with 1845, still 92.5 per cent. of the total wheat and flour exports was flour. Then came the hungry demand of European millers for American wheat. From 2,900,000 bushels in the five years ending with 1845, they increased their demands to 21,864,000 for the five years closing with 1855, to 178,000,000 for 1860–65, and to 296,000,000 bushels for the five-year period 1870–75. The percentage of flour exports dropped to 43 per cent. in 1860–70, and finally to 27.8 per cent. for the five years ending with 1875. The percentage of flour in the total wheat and flour exports had declined over 70 per cent. in forty years.

But the improved milling process and the hard wheat of the Northwest have in a measure retrieved our lost ground in the European flour market. Our flour exports to the United Kingdom have risen from 1,231,324 barrels in 1875 to 9,987,179 in 1894, and our exports to the Continent have been multiplied by fifty, increasing the insignificant 31,718 barrels of 1875 to 1,853,156 barrels in 1894. During the past two fiscal years, ending June 30, 1895, this country has exported $120,000,000 of flour, as against $103,000,000 of wheat. In other words, the percentage of flour exports to wheat has about doubled since the new milling process was established in the hard-wheat region twenty years ago. We have shipped to the United Kingdom during the past two fiscal years $73,000,000 of flour, as against $63,000,000 of wheat. To Latin America and the Orient flour is the chief export in breadstuffs, being about $5,000,000 for the Orient and $23,000,000 for Latin America during the two fiscal years. With the milling cities of the Pacific coast to supply the Orient, where, indeed, they are now building up a good trade; the flour manufacturers of Baltimore, Richmond, St. Louis, and the valley of the Ohio to supply the Latin-American markets, as they are now doing with success; and the milling centers of the lake region and upper Mississippi to meet the demands of Europe, the United States is in a fair way to take care of the world's hungry. That our efforts in this line are not vain is shown by the fact that the exports of the milling industry nearly equal all the exports of the other manufacturing industries.

Until 1890 the flour industry led all other manufacturing industries in the value of its annual product. In 1890 it was exceeded only by the meat-packing industry. The flour industry still turns out a product greater in value than that of the iron and steel industry, the foundry and machine, the lumber, clothing, or than that of all the textile industries. The annual product of the flour industry was valued at $135,000,000 in 1850, at $223,000,000 in 1860, at $444,000,000 in 1870, at $505,000,000 in 1880, and at $513,971,000 in 1890. The iron and steel industry follows, with a product valued at $430,000,000; the foundry and machine industry, with a $412,000,000 product; lumber, $403,000,000; and clothing, $378,000,000. The total value of textile product, including cotton, woolen, silk, and linen goods, is about $500,000,000. The slaughtering and meat-packing industry, in 1890, tops all others in the value of its product, which is placed at $564,000,000; although it is represented by only 1367 establishments, as against something over 18,000 flour and grist mills.

Until 1890 New York was the leading State in the aggregate value of its flour and grist mill product.

New York's mill product was valued by the government census bureau at $16,900,000 in 1840; $33,000,000 in 1850; $35,000,000 in 1860; $60,000,000 in 1870; $49,000,000 in 1880; and $52,000,000 in 1890. It is noticeable how radically New York's product fell in the ten years between 1870 and 1880, when the new milling process was being adopted in the hard spring-wheat region, thus changing the seat of the flour industry from the winter-wheat States to the Northwest. In 1890 Minnesota rose to the place formerly held by New York. In 1840 Minnesota made no flour; in 1850 the value of the product was $500; in 1860 the State is credited with a product worth $1,300,000; in 1870 the product is still worth only $7,500,000; but in 1880, with the new process successfully established, the product suddenly rises to $41,500,000, and in 1890 to $60,000,000. New York, Pennsylvania, Ohio, Illinois, Missouri, Indiana, Wisconsin, and Michigan follow in the order named, with products running from $52,000,000 down to $22,000,000.

The part which the American flour industry has had in redeeming the country's indebtedness and in bringing to our treasuries European gold appears in the fact that during the one hundred years ending with June 30, 1895, this country has exported something over $1,700,000,000 worth of flour, which is about ten per cent. of the entire flour and grist mill product of the United States for the century.

Chas. A. Pillsbury

CHAPTER XL

AMERICAN GLASS INTERESTS

THE products of the glass-furnace, according to the ancient records, date back from four to six thousand years. Rawlinson states that glass was known in Egypt in the pyramid period, which he places at 2450 B.C.; and from that period down to the Christian era there is no doubt that the art had reached a high state of perfection, from the beauty of the specimens that are still in existence. Glass making has always attracted much attention, and had made much progress in Europe before the discovery and settlement of America. One of the first articles manufactured in this country was glass. Mr. Joseph H. Weeks, who has had charge of the glass interests for the census of 1880 and 1890, says, in a carefully prepared history of glass making in this country, that the first American glass was made within a mile of Jamestown, Va., in 1608. The hope of sudden wealth from the discovery of gold and silver was doubtless the chief cause for the formation of the London Company and its first attempt to colonize Virginia. It was, however, a commercial venture with the hope of profit; and, with the shrewdness characteristic of the English merchant not only of that but of other periods, this company did not forget the possibilities that were near at hand in its search for what it believed would be greater ones in the near future. The vessel which carried Captain Newport on his second voyage in 1608 brought out also eight Poles and Germans to make pitch, tar, glass, mills, and soap-ashes, and the first exports of manufactures from what is now the United States were the results of the trials made at the first furnace erected in this country. It is said the works were destroyed at the massacre in 1622.

In 1795, the time from which this record is to be made, there is no record of any glass-works in Virginia. In the census of 1810 Virginia does not appear as a glass-making State. In the census of 1820 a glass-works is reported in Brooke County. It made that year $20,000 worth of glass; had $12,000 capital; paid out $8000 for wages and $12,000 for materials and contingent expenses, or exactly the value of the product. It employed 14 men and 12 boys in 1827. It is reported that glass decanters of great beauty were made at these works, and white-flint and green-glass wares were made that rivaled the foreign. At the Tariff Convention in 1831 there were two flint-furnaces, with twelve pots, reported in operation in Wellsburg, and one, with six pots, at Wheeling, Va. Two window-glass furnaces were also reported at Wheeling. In 1840 one glass-works is reported in Brooke County (the Wellsburg), and three in Ohio County (the Wheeling).

The first mention of a glass-works in Pennsylvania is found in a letter written by William Penn, in August, 1683, to the Free Society of Traders. In this letter he alludes to their tannery, sawmill, and glass-works. Where these works were located, or what kinds of glass they made, is not known. In 1795 there was doubtless some glass made in Pennsylvania. A glass-house was sold on March 6, 1800, to Joseph Roberts, Jr., James Rutlans, and James Rowland, for $2333, subject to $15 ground-rent. They carried on these works under the firm name of James Rowland & Company, and in 1801 had their store at 80 North Fourth Street. The works were afterward carried on by several parties, and finally, in 1833, were sold to Dr. Thomas W. Dyott. In eastern Pennsylvania, prior to 1831, a number of attempts seem to have been made with but little success, and the works carried on by Dr. Dyott were evidently looked upon as being of national importance. It is stated that President Jackson visited this establishment, which in 1833 consumed 15,000 barrels of rosin for fuel. From 250 to 300 men and boys were constantly employed; five furnaces were operated, which used both wood, coal, and rosin, melted 8000 pounds of batch a day, and produced about 1200 tons of glass a year, which was blown into apothecaries' vials, bottles, and shop-furniture. Dr. Dyott failed in 1838, and the works passed into other hands, and at this time are operated in the manufacture of green glass, and have quite a reputation for the making of demijohns.

Of early glass making in western Pennsylvania full accounts are given. It is claimed that Albert Gallatin commenced the first glass-works there at his settlement of New Geneva, ninety miles south of Pittsburg, on the Monongahela River. It seems to be generally accepted that the works were started in 1797, and were used for the manufacture of window-glass. The furnace was a small one, with eight pots, using wood as fuel and ashes for alkali. The glass-house was forty by forty; three sides frame and one side stone. One man could lift the pots, while now it would require four men to lift the pots used in window-glass works. The title of the firm was Gallatin & Company, but was afterward changed to the New Geneva Glass-Works. It is said that for a time this enterprise was exceedingly profitable, there being but two or possibly three other window-glass works in the country, most of the glass for that purpose being brought from England. The glass was sold at $14 per box of 100 feet, but was doubtless of inferior quality. A works at New Geneva was reported as late as 1832, but when they were finally abandoned Mr. Weeks was not able to learn.

In 1796 Major Isaac Craig and Colonel James O'Hara erected the first glass-house in Pittsburg. It is claimed that these were the first works west of the mountains to make glass, and they are said to have started a month before those of Mr. Gallatin. These were the first works to use coal as a fuel, and were located at the south side of the Monongahela River, just above where it unites with the Allegheny to form the Ohio. The site, or part of it, has been continuously occupied as a glass-works, Thomas Weightman & Company occupying it until quite a recent date. The use of coal was an innovation, and even as late as 1810 this fuel was not used in any of the glass-works in the United States other than those in Pittsburg. Messrs. O'Hara and Craig were the pioneers in its use, and to them should be given the credit. As was the custom in window-glass factories in those days, one or more of the pots were used for the making of bottles, and among Colonel O'Hara's papers, found after his death, was a memorandum in his handwriting, stating: "To-day we made the first bottle, at a cost of $30,000."

As in all new enterprises, and particularly the making of glass, it is only men of perseverance and determination who succeed; and had not Messrs. Craig and O'Hara been men of that character the venture would have fallen the first year. As a rule, the men who are secured from old-established glass factories are really not the best men; and not only did the early manufacturers suffer from a lack of experience, but also from the fact that their employees were not always capable of doing the work they were engaged to do. And it may be said that at the present time no new works, established in a location in which glass has not been made, can make a profit of any moment the first two or three years; and the first year must invariably be counted as a losing one. Major Craig wrote to Samuel Hodgson, of Philadelphia, August 5, 1803: "With respect to our glass manufacturing, the establishment has been attended with greater expense than we had estimated. This has been occasioned partly by very extensive buildings necessarily erected to accommodate a number of people employed in the manufacture, together with their families, and partly by the ignorance of some people in whose skill of that business we reposed too much confidence. Scarcity of some of the materials at the commencement of the manufacturing was also attended with considerable expense. We have, however, by perseverance and attention, brought the manufacture to comparative perfection. During the last blast, which commenced at the beginning of January, and continued six months, we made on an average thirty boxes a week of excellent window-glass, besides bottles and other hollow ware to the amount of one third the value of the window-glass, eight by ten selling at $13.50, ten by twelve at $15, and other sizes in proportion."

In the fall of 1807, Mr. George Robinson, a carpenter, and Mr. Edward Ensell, an English glass worker, commenced the erection of a flint-glass works in Pittsburg, on the banks of the Monongahela, under the firm name of Robinson & Ensell. They appear, however, to have lacked capital, and were unable to finish the establishment, which, without being completed, was offered for sale. In August, 1808, Mr. Thomas Bakewell and his friend, Mr. Page, who were visiting Pittsburg at the time, were induced to purchase this plant, on the representation of Mr. Ensell that he thoroughly understood the business. This was the beginning of the firm of Bakewell & Page, which by itself and successors continued in the manufacture of flint-glass until some time after the census of 1880. Mr. Bakewell experienced the trouble usual in a new business. The difficulties he met with would have disheartened a less determined man, and the lack of skill on the part of his workmen, and the inferiority of the materials, interfered at first with his success. His furnace was badly constructed; his workmen were not highly skilled, and would not permit the introduction of apprentices; and his materials were received from a distance at a time when transportation was difficult and expensive, pearl-ash and red lead coming over the mountains in wagons from Philadelphia, and pot-clay from Burlington, N. J. The sand was obtained near Pittsburg, but was yellowish, and up to that time had only been used for window-glass and bottles. The saltpeter came from the caves of Kentucky until 1825, when the supply was brought from Calcutta. These difficulties in time were overcome; good clay was procured from Holland, and purer materials were discovered, and Mr. Bakewell rebuilt his furnace on a better plan, competent workmen being either instructed or brought over from Europe. Through his energy and perseverance the works became eminently successful, and there is no doubt that Mr. Bakewell is entitled to the honor of erecting and operating the first flint-glass works in this country. The furnace built or completed in 1808 held six twenty-inch pots; this was replaced in 1810 by a ten-pot furnace, and in 1814 another furnace of the same capacity was added to the works. The establishment was burned down in the great fire of 1845, but was immediately rebuilt. The site is now occupied in part by the Baltimore and Ohio Railroad depot.

During the last one hundred years Massachusetts has played a very important part in the production of glass, which was manufactured as early as 1639 at Salem. But, from all the records that exist, the history previous to the Revolution was one of failure. Shortly after the Revolution Boston again commenced the manufacture of glass, which for many years was one of the leading industries of Boston and Massachusetts. The new enterprise, the Boston Crown-Glass Company, which was really the first successful glass-works in this country, was greatly helped by the liberal action of the State. In July, 1787, Messrs. Whalley, Hunnewell, and others received from the legislature a charter conferring upon them the exclusive right to manufacture glass in Massachusetts for fifteen years, and imposing a fine of $500 upon any one infringing on this right. The capital stock was exempted from all taxes, and the workmen from all military duty. To counteract the effect of the bounty paid by England on the exportation of glass from the kingdom, a bounty was paid for every table of glass made. Owing to the many difficulties incident to the starting of a new industry, the operation of making glass did not commence until 1792. The company commenced with the manufacture of crown window-glass, and in 1798 produced glass to the value of $82,000 per annum. This concern was incorporated in 1809, and under the influence of the State bounty the proprietors were encouraged to continue their efforts, and became very successful. The glass was said to be superior to the imported, and well known throughout the United States as "Boston window-glass." These works were continued until 1826, when the company failed, from bad management. This early establishment led to the commencement of many others, but none of them could be considered successful. Many attempts have since been made in Massachusetts to establish the manufacture of window-glass. In 1860 a large establishment was erected for the manufacture of sheet window-glass, but its operation proved unprofitable, and at this time there is only one window-glass works in the State, which is located in Berkshire County, in the western part.

The manufacture of flint-glass grew out of the Essex Street works. Mr. Thomas Caines, who was an employee there, was also a skilful blower and metal mixer. He prevailed upon the management to allow him to build a small six-pot furnace in a part of their works at South Boston. This furnace was fully employed during the War of 1812, and was the beginning of the flint-glass industry in Massachusetts; but it was compelled to cease work, and although several attempts were made to operate it between 1820 and 1840, they all failed. About the time this furnace was started, the Porcelain and Glass Manufacturing Company was incorporated, and built a factory at East Cambridge. The furnace was a small one, containing six pots. Workmen were brought from abroad, but it proved a failure. The plant in 1815 was leased to a firm of workmen, Emmet, Fisher & Flowers; but they failed to agree, and in 1817 the Porcelain Company sold the property at auction to the New England Glass Company. This was the beginning of one of the most successful glass companies in this country. The works, when they commenced, had a small six-pot furnace, the pots holding about 600 pounds; 40 hands were employed, and they produced glass to the value of $40,000. It was really the foundation of the flint-glass industry in the United States. The management was broad and liberal from the beginning; for fifty years they led in the production of flint and colored glass of all varieties. Workmen were brought from abroad, and every means employed that capital and skill could compass to produce results equal to anything in the world. In 1865, which was probably the highest point reached in their history, they operated five furnaces of ten pots each, each pot

James Gillinder.

holding 2000 pounds; 500 hands were employed, and glass to the value of $500,000 was produced yearly. The influence of the New England Glass-Works has been felt all over the land, as many of their employees and managers have been the means of establishing the industry in other parts of the country. Fine-blown, cut, and pressed glass were made in great variety. The works are not now in existence.

When the Western manufacturer commenced to make lime-glass with bicarbonate of soda and lime, in place of lead and pearl-ash, the thought in the minds of the management of the New England Works was that its success would be only temporary, and they failed to meet the changed condition. A very large proportion of their production at this time was pressed glass, and for several years, in the attempt to meet the competition of the cheap products of the Western manufacturers with their more costly products, the works were run at a loss, which amounted during the last year they operated to more than $40,000. In 1879 they ceased operation, after a successful career of sixty-two years, and were then leased by William L. Libbey & Son, and operated by them until August, 1888, when they moved to Toledo, O., and the old works were dismantled.

In 1825 a plant was established at Sandwich, commencing in a small way, with one eight-pot furnace, and melted 7000 pounds of glass. In 1865 it had been increased to four furnaces, ten pots each, and a melting capacity of 100,000 pounds weekly. It was in these works that the modern invention of pressing glass was first successfully introduced, in 1827. Of this I will speak later on. The same cause that brought about the failure of the New England Glass Company caused their failure, and in 1888, after several years of financial loss, the company suspended operation. They had built up quite a town at Sandwich, and up to 1865 had been prosperous and successful, employing for sixty-three years a large number of people, and making a fine line of cut, blown, colored, and pressed glass.

During the period in which these two Massachusetts factories were in existence they were in the lead, and while a number of others had been established, none had reached the success of these two noted works, which are now only a part of the record. Quite recently an attempt has been made to operate one of the furnaces at Sandwich, the success of which is yet to be demonstrated. At this time there are only four flint-furnaces operated in Massachusetts, two of them being at New Bedford, one at Somerville, a suburb of Boston, and one at Sandwich. There are, besides, the window and part-plate works at Berkshire. So that Massachusetts, that in 1860 led the flint-glass industry in this country, has almost ceased to be a factor at this time.

Maryland was quite an important State in the early production of glass, and the records show that the attention of Congress was called to the value of the industry by Mr. John Frederick Amelung, who petitioned Congress to extend its patronage to his works at New Bremen. A motion was made in Congress by Mr. Carroll to loan him not exceeding $8000, on his giving security for its repayment. The motion was debated for several days, during which was brought out the fact that Mr. Amelung had spent over £20,000, and brought over from abroad over 200 workmen, in his attempts to establish the industry. The motion was defeated. We have an after record that in 1794 Mr. Amelung, with Mr. Whalley, of Boston, presented a petition for an increase of duties. These works appear to have been built at Fredericktown, but were afterward moved to Baltimore. They were not a success, and it is probable he crossed the mountains and helped to start the flint-works at Pittsburg. According to Howard, a plant was established for the making of window-glass in 1790, known as the Baltimore Glass-Works. These are the window-glass works operated by Baker Brothers until quite recently, and said by them to have been established in 1790. They have operated them since 1852. Maryland, however, since that period, has been quite a glass State. Window-glass and green and flint bottles have been made to a greater or less extent, and according to the census of 1890 the State has eleven works, producing wares to the value of $1,256,697, and employing 1363 hands.

One of the earliest glass-works in this country was located at Allowaystown, in Salem County, N. J. It was the beginning of the glass industry in that State, and was built about the year 1760 by a German named Wister, who carried on the works until his failure in 1775. The workmen then went from this place to Glassboro, and established the industry there. Plenty of pine-wood for fuel was found in this locality, and a very fair grade of sand, which was good enough for bottles, jars, vials, and the common kinds of green glass made by them. Glass making has been carried on at this place ever since that time. The first establishment commenced with a six-pot furnace, but gradually extended until a town surrounded the works, and they now report a capital of $1,106,499.95, and manufacture from 50,000,000 to 60,000,000 bottles each year. A member of the present firm, Mr. John P. Whitney, is said to be a descendant of one of the original workmen who established the works.

Up to 1870 there were glass factories erected at thirty-seven different localities. Many of them ran for only a short period. The cheapness of wood and sand no doubt led to the building of many, and the fact that expensive buildings were not required, most of them being frame structures built of the cheapest materials. With the exception of a flint-works at Jersey City and one at Camden, the glass made in New Jersey was bottles, jars, vials, and window-glass, and in 1880, according to the census, New Jersey produced bottles, jars, and vials, under the head of green glass, to the amount of $1,681,015, the largest amount produced by any one State; window-glass to the amount of $729,155; and glass-ware, under which head come flint-glass bottles, valued at $400,000.

New York is now losing ground as a glass-producing State, but during the past one hundred years large quantities of glassware have been made, and some of the works have had a national reputation. In January, 1785, Leonard de Neufville and his associates, the proprietors of a glass factory located ten miles from Albany, at Dowesborough, in the midst of a well-wooded pine forest, applied to the legislature for aid in the undertaking, giving as a reason that £30,000 annually was sent abroad for glass. In 1793 the legislature of New York voted to loan them $3000 for eight years without interest, and five years at five per cent., but by this time the works had passed out of the De Neufville family. The history of glass making in New York State shows that up to 1850 there had not been much headway made in establishing it on a permanently successful basis. Many factories were started, but ran for only a short time, and none of those in operation in 1850 are now in existence.

In 1820 some workmen left the New England Glass-Works at East Cambridge and built a factory in New York City, under the firm name of Fisher & Gilland; but in 1823 the partnership was dissolved, and Mr. Gilland removed to Brooklyn, where he established what were known as the South Ferry Flint-Glass Works. Mr. Gilland up to 1850 was evidently very successful. He had the reputation of making the finest flint-glass made in this country, and at the London Exhibition in 1851 took a medal for the best flint-glass on exhibition. He afterward failed, and the works are not now in existence. In the census of 1880 New York had nine window-glass works, producing glass to the value of $1,157,571; nine green-glass works, producing glass to the value of $722,322. This record shows that the establishments were not very extensive, as they average only a little more than $75,000 per factory.

From all the information obtainable, glass had been made up to this time in fifteen States in the Union. In Maine and Connecticut there is no glass made at the present time. It is impossible, owing to the imperfect state in which the census was taken, to get anything like an accurate account of the value of the product, or the number of people employed, previous to the census of 1870. Like other industries in the United States, the history of the glass business was, between 1850 and 1860, one of great depression. Fine glass was made in New England and in New York and in one or two factories in Pittsburg, but the bulk of the product was of poor quality, and the window-glass did not in any way measure up to the imported glass. During this period, however, a great impetus was given to the flint-glass business by the making of coal-oil from coal and the later discovery of petroleum. The demand for lamps and lamp-chimneys was very extensive. One of the first to make a specialty of glass for lighting purposes was Christopher Dorflinger, who started with a capital of $1000 in 1852, in Concord Street, Brooklyn. The furnace held five small pots, and was afterward increased to hold seven, until in 1861 he was operating four furnaces. The first year his sales amounted to $30,000, and he employed eighty-five people. When he left Brooklyn in 1865 his sales amounted to $300,000. The factories increased in Brooklyn, from 1858 to 1865, from two to fifteen, mostly making the same class of ware, which was principally for lighting purposes—lamp-chimneys, gas-globes, and lamps. In 1865 Mr. Dorflinger moved to White Mills, and established what is now one of the best-known and largest of the manufactories of cut glass, while at the same time the reputation of the Dorflinger cut glass is second to none. Mr. Dorflinger has a record of forty-three years in the manufacture of flint-glass.

In 1860, from the best records we can get, the product of the glass factories did not exceed $7,000,000. 1861 and 1862 were off years. The excitement incident to the commencement of the war produced great depression, but from 1862 until 1870 the increase in production was very great, and the census showed 154 establishments, with 15,367 employees, producing glass to the value of $16,470,507, with a capital invested of $13,826,142. It was during this decade that great improvements were made in the making of pressed glass. The modern discovery of pressing glass was an American invention, and the credit is given to the Sandwich Glass Company, who, at the solicitation of a carpenter, in 1827 made a mold to press an article he wanted made. After that the mold increased rapidly in favor, but was used only for the commoner class of goods for many years, until the New England Glass Company, by a series of expensive molds, had produced some very fine effects in pressed glass. The triumphs of pressed glass in this country, however, came from Pittsburg. James B. Lyons & Company, of the O'Hara Glass-Works, Pittsburg, made for many years pressed glass only, and in 1867 made an exhibit at the Paris Exposition, and took the first prize for fine pressed glassware. Goblets and wine-glasses were made almost as fine and delicate as those made by the old mode of blowing and cutting. Prior to 1864 the pressed glass was either made of flint-glass, the ingredients of which were the best of sand, pearl-ash, refined saltpeter, and oxide of lead, and was a very good crystal glass, or from what was then known as German flint or lime glass, the ingredients of which were soda-ash, lime, nitrate of soda, and sand. This latter made a very inferior glass, apt to crack, and very poor in appearance. It was used principally in common tumblers and some lamp-chimneys.

In the winter of 1864, Mr. William Leighton, Sr., of the firm of Hobbs, Brockunier & Company, of Wheeling, made a series of experiments with bicarbonate of soda, with pure sand, lime, and refined nitrate of soda, and produced a very clear, brilliant glass, at a cost for the batch of not more than one third that of the lead-glass or flint batch. The result was a complete revolution in the pressed-glass business. It was impossible for the manufacturer making flint-glass to compete, and the result was that all had to adapt themselves to the change, and some were driven out of the business. Up to this time (1870) there had been very little change in the furnaces, which were mostly the old-fashioned type of round furnace, with the coal fired over the bench, or the Frisbie bucket-teaser, where the coal was pushed up from below. But the close competition and the desire for increased production led to the effort to get better results from the furnaces, and between 1870 and 1880 larger furnaces were built, into which, by a series of flues, hot air was introduced to the combustion-chamber, and much greater heat secured with much less fuel. Many of the furnaces also hold from thirteen to fifteen pots, and many of the pots each hold two tons of glass.

In 1880 the census reports show that the number of establishments had increased to 211, employees to 24,177, production to $21,154,571, and that the industry was divided among sixteen States. It was during this decade that the Centennial Exhibition held in Philadelphia gave a large impetus to so many industries. One of the great attractions was the glass-works operated by Gillinder & Sons, of Philadelphia. It was a complete establishment, showing the processes of melting, blowing, pressing, cutting, etching, and annealing. The furnace held six pots, and melted double the amount of glass made by the first flint-glass works operated in this country by Bakewell & Page, in 1808. This was the first time anything of this kind was attempted in an international exhibition. The product was sold as souvenirs, and realized $96,000. Over $14,000 was paid to the Centennial Board of Finance as commission on the sales.

At the close of 1880 the glass trade was in a very prosperous condition. Prices were good, and the outlook looked promising for the future; and it is from this period we must date the wonderful progress of plate-glass making in this country. In 1880 there were but four plate-glass works in this country, and only three in operation. They were located at New Albany, Ind., Jeffersonville, Ind., Crystal City, Mo., and Louisville, Ky., the latter plant being idle. The first attempt to make plate-glass was made in 1852, when Messrs. Tilton, Pepper & Scudder started a factory at Williamsburg, now part of Brooklyn, N. Y. The works were under the management of Cuthbert Dixon, a plate-glass worker from the Thames Plate-Glass Works, London, England. They produced a good quality of rough plate, but, owing to the ruinous competition of the English and German manufacturers, at the end of two years they were compelled to close. There is some dispute as to where the first plate-glass was made in the United States, but there are existing proofs that the Williamsburg works were the first, based upon the records found in an old diary of the late William S. Dixon, of Pittsburg, who was employed there as pot maker, his father being the manager.

Attempts were made to make plate-glass at Cheshire, Mass., Lenox Furnace, Mass., and at Greenpoint, L. I., previous to 1860. There are records of polished plate-glass being made at Lenox in 1865, but it was not continued. The successful founder of the plate-glass industry in this country is Mr. James B. Ford, of Pittsburg. In the year 1869 Mr. Ford conceived the idea of making polished plate-glass, and with this in view visited the works at Lenox, gathered what information he could from the workmen who had been imported from abroad, and returned to New Albany with the determination to make plate-glass. Machinery for this purpose was imported, and the new plant was speedily successful so far as the production of plate-glass was concerned; but, like all new enterprises of the kind, it was not profitable, and in 1872 Mr. Ford withdrew. The factory was continued by William C. de Pauw until his death, and afterward by his heirs. To the indomitable will and perseverance of this gentleman this country is indebted for the early success of the industry, as he demonstrated, after a hard struggle, that polished plate-glass could be made here at a profit. Mr. Ford afterward built a factory at Louisville, Ky. It had two twelve-pot furnaces and was equipped with the old-style French machinery. He ran these works for two years and sold out, removing to Jeffersonville, Ind., where he built a plant that he operated until he moved to Creighton, Pa., in 1881.

Shortly after the building of the New Albany plant, Mr. E. B. Ward, of Detroit, and others, attracted by a very extensive deposit of sand of fine quality, originated the American Plate-Glass Company, with a capital stock of $250,000, and began in 1872 the erection of works at Crystal City, Mo. The capitalization was increased in 1874 to $500,000, and the works were operated until 1876, producing some glass of good quality; but, owing to lack of experience, the management failed to make a profit. In 1877 the works were reorganized, new capital was secured, Mr. A. E. Hitchcock, of St. Louis, president of the old company, continuing in charge. Mr. G. F. Neal, a practical plate-glass manager, took charge of the works, and a Siemens furnace was erected. The works have been largely increased, and plate-glass is made in Crystal City equal to any found in Europe. This was the condition of the plate-glass business when Mr. Ford built the Creighton Works in the midst of a rich gas-coal country. He built a factory with a capacity of 70,000 square feet per month. It was equipped with two sixteen-pot furnaces, eight grinding and sixteen polishing machines. This was really the first plate-glass works in this country that paid for the large investment required in its establishment.

While the success of these works was very largely helped by the experience that Mr. Ford had gained from his previous ventures, a new factor was introduced that had never been used in the making of plate-glass before. This was natural gas, which it was found could be used as a fuel. The Rochester Tumbler Works had used it in their leers, and partially in their furnaces, as far back as 1875; but not having sufficient for the furnaces, it was not a success. At about the time Mr. Ford was starting at Creighton, wells had been drilled that promised inexhaustible quantities of the new fuel. For glass making it is impossible to conceive of a more perfect fuel—no labor required for firemen, no dirt, no ashes, and a uniform heat, or just what was required. Natural gas was a great factor in the success of these works, which were sold by Mr. Ford to the Pittsburg Plate-Glass Company, who enlarged them in 1883, and increased the output from 70,000 square feet to 110,000 square feet finished product. Having a great desire to own and operate his own works, Mr. Ford, in 1884, commenced the building of a plant at Tarentum, Pa., with a capacity of 150,000 square feet per month. Before it was completed the Pittsburg Plate-Glass Company made him an offer, which he accepted, and the Tarentum plant became part of the Pittsburg Plate-Glass Works. The success of their plants resulted in the building of plate-glass works at Butler, Pa., in 1886, and at Cochran Station, Pa., in 1889.

Natural gas had been discovered in Indiana. A large plant was built at Kokomo, Ind., under the name of the Diamond Plate-Glass Company. The gas being in abundance, this same company erected another large factory twenty miles away, at Elwood, in 1891; and the extensive works at Charleroi and at Irwin, Pa., were erected the same year. The Pittsburg Plate-Glass Company in 1887 commenced the erection of what are now the largest plate-glass works in the world. The company bought 480 acres of land, and a town was laid out, and named Ford City, in honor of Mr. J. B. Ford, who is one of the largest stockholders. Under his personal supervision the works were built, which have a monthly capacity of 400,000 square feet.

In 1891 the De Pauw Plate-Glass Company built a small plant at Alexandria, in the heart of the gas belt, in Indiana; but the panic of 1893 caused its suspension, and it has not been operated since.

The works mentioned have an aggregate monthly capacity of 1,785,000 square feet, or an annual maximum production of 21,420,000 square feet, while the consumption in this country has never exceeded 14,000,000 square feet; 3,075,491 square feet were imported in the fiscal year ending June 30, 1895. This great over-production, with a reduction in the tariff, has caused greatly reduced prices, in consequence of which several of the factories have remained idle and none has operated to its full capacity since 1893. In 1894 a movement was made by some of the companies for self-preservation, which resulted in the outright purchase by the Pittsburg Plate-Glass Works of all the plate-glass works in the United States, with the exception of those at Butler and Irwin Station and the De Pauw plants of Indiana.

The total number of furnaces is forty-three of twenty pots each, and two of sixteen pots each. Of this number there are in operation at this time only twenty-three furnaces, containing 460 pots. Plates of glass are made containing 180 square feet, or, say, twelve by fifteen feet. The success of the plate-glass business, which really dates back only twenty years, is one of the wonders of our age. Much credit must be given to Mr. J. B. Ford, and especially when we consider that when the factory at Creighton was started he was over seventy years of age, and had to impress upon the capitalists his own faith that the business could be made to pay. So far as Pennsylvania was concerned it was an entirely new venture, the census of 1880 showing that no plate-glass was then made in Pennsylvania; while in this year (1895) Pennsylvania has capacity enough, including the 3,000,000 feet imported, to supply the whole country. The imports of 1894–95 are fifty per cent. more than the imports of 1893–94.

Mr. Ford is now trying to make us independent of other countries in soda-ash, and at eighty-four years of age is demonstrating that soda-ash can be produced in this country at a profit. He erected a factory at Wyandotte, Mich., for the production of fifty-eight per cent. alkali. After a very large expenditure of money and a loss of $150,000 it proved a flat failure; but, not discouraged, he started again and almost entirely rebuilt the plant, and now has much better success, and is producing fifty tons per day of as good soda-ash as ever was imported. He is now adding to this plant, to increase his output to 100 tons per day. He has since purchased 143 acres of land to erect a factory to produce 150 tons more, and he says when this is done his ambition will be complete. It is to men of like ambition and character that this country is indebted for its commercial greatness.

From the year 1880 may be dated also the great success of window-glass making. Prior to this time, with few exceptions, the old furnaces and flattening-ovens that had been in use for fifty years were still prevailing. Fully twenty-five per cent. of the window-glass used in this country was imported. For many years the workmen have been organized into a union, which not only takes in the blowers, but the gatherers, flatteners, and cutters; these last two being practically unskilled labor, and paid as such in European countries. Then, to mend matters and make the competition worse, the manufacturers of Belgium and England had adopted what is known as the tank-furnace; no pots were required, a more uniform quality of glass could be depended upon, and a much larger production. Mr. James Chambers, of Pittsburg, who had succeeded his father in the manufacture of window-glass, was in 1887 operating four furnaces, with thirty-six pots, using natural gas in his furnace and flattening-ovens. He had the improved flattening-ovens, but he came to the conclusion that something had to be done to put the window-glass business upon a better basis. He made a trip to Europe, obtained all the information possible, came back to Pittsburg and organized the Chambers & McKee Company, and, as president, planned, built, and operated the plant at a place on the Pennsylvania Railroad, twenty-seven miles east of Pittsburg, called Jeanette. The foundation of the tanks was laid in 1888, and in the spring of 1889 they commenced making glass. Glass workers and manufacturers all over the country, with few exceptions, had predicted that the tanks would be a failure, and that window-glass could not be made that way; but the tanks were a success from the first.

Mr. Chambers had associated with him in the building of these tanks Mr. George F. Moore, afterward general manager of the works; W. D. Hartupe, as engineer; and H. L. Dixon, a furnace builder, in charge of the construction of the tank-furnaces, leers, ovens, etc. Their furnaces at that time were the largest tank-furnaces in the world. Each furnace holds 800 tons, has a melting capacity of 30 tons for every twenty-four hours, and turns out 480 boxes of single and 250 boxes of double strength every twenty-four hours. There are three of these furnaces at Jeanette that are 20 feet wide and 120 feet long, inside measure. Owing to financial disagreement, Mr. Chambers withdrew from the Chambers & McKee Company, and in 1892 formed a company and erected a factory at New Kensington, nineteen miles from Pittsburg, on the Allegheny Valley Railroad, and built two continuous tanks that are said to be the largest in the world. They are 25 feet 6 inches wide, 130 feet long, inside measure; each furnace will hold 1000 tons of molten glass, and has a melting capacity of 35 tons, turning out 600 boxes of single and 300 boxes of double strength every twenty-four hours. This is said to be the largest and most complete establishment in the world for the manufacture of window-glass.

Although it has been only six years since the first window-glass tank-furnace was started in this country, other manufacturers, quick to see its advantages, have adopted the system, and now sixty per cent. of all the window-glass made in this country is made in tanks, and it needs no prophet to say that in the year 1900 there will be very little window-glass made in pots. The total capacity of the country is 1664 pots, of which Pennsylvania has 12 tank-furnaces, with capacity of 532 pots; Indiana, 7 furnaces, capacity 282 pots; New York, 1 furnace, capacity 36 pots; New Jersey, 1 furnace, capacity 48 pots; Ohio, 2 furnaces, capacity 54 pots; or a total of 952 pots made in tank-furnaces. Some idea of the size of these large furnaces at New Kensington can be obtained by considering that previous to 1880 the largest window-glass pots held but 1200 pounds, and a furnace of ten pots 12,000 pounds or six tons, and then comparing these figures with the tank-furnace at New Kensington, holding 1000 tons.

Mr. Weeks gives the value of the product of window-glass in 1893 as $10,500,000. This was a calculation based on the works operating January 1, 1893, before the depression came. The imports of the year ending June 30, 1895, amounted to $837,730, which is the smallest amount imported for many years, and is doubtless caused by the increased facilities and cheapening of the products of our tank-furnaces.

The discovery of natural gas, and its application to the glass-furnaces, has led to a very great increase in the building of flint and green-glass works, and the census of 1890 gives the relative value of the products of each branch of the industry:

	1880.	1890.
Plate-glass	$868,305	$4,869,494
Window-glass	5,047,313	9,058,802
Glassware	9,568,520	18,601,244
Green and black glass	5,670,433	8,521,464
Total	$21,154,571	$41,051,004

From these figures it will be seen that in this period the industry has almost doubled its production, the largest increase being in plate-glass and glassware. Glassware covers all the glass used for lighting purposes, such as lamp-chimneys, gas-globes, and shades, globes and bulbs for electric light, table-glass, both pressed and cut, flint-glass bottles—in fact, everything that is made in crystal or fancy colored glass. In this branch of the industry, in 1880, 73 establishments were reported, with a capital of $6,907,278. In 1890, 125 establishments were reported, with a capital of $15,448,196, an increase of 123.65 per cent. It is impossible to go into detail as to all the works, and I will confine myself to a few of the notable ones in the different lines.

Probably the largest flint-bottle works in the world are those of Messrs. Whitall, Tatum & Company, located at Millville, N. J. They have thirteen flint-furnaces, in addition to five green-glass furnaces and a green-glass tank, and employ from 1500 to 1900 employees, according to the demand for their goods. This business has been principally built up since 1860.

The Rochester Tumbler Company, at Rochester, Pa., was organized in 1872, and commenced making glass in July of the same year. They commenced with one ten-pot furnace and ninety employees, making a specialty of tumblers, and with a capacity of 12,000 dozen per week. At present they operate seven furnaces with eighty-eight pots, with a capacity of 75,000 dozen per week, or 150,000 tumblers each day. The melting capacity of the furnaces is 120 tons of sand per week. The pots are very large, and over 1000 hands are employed. When they first commenced they made only common tumblers, but now they make every kind of tumblers, with a cutting, engraving, and decorating department. The works cover over seven acres of ground. They make their own barrels, boxes, and machinery, and almost everything used for the manufacture of glass. All the fuel used is natural gas. They do some export trade,—probably more than any other concern in this country,—and without question have the largest plant in the world making a specialty of tumblers.

The discovery of natural gas was the means of largely stimulating the erection of flint-glass furnaces, and many small towns offered land and a bonus in money to have a glass-works established in their boundaries. By this means many works were started by parties who had little knowledge of the business, so that the business was largely overdone, and prices in 1891 were such that little or no profit could be made. Labor was high, and, in view of there being so much demand for it, was aggressive and unreasonable in its claims, being backed up by its labor organizations. A number of manufacturers met together and formed a stock company under the name of the United States Glass Company, which company bought up fifteen of the largest and most complete press manufacturers in the country, located in Pennsylvania, Ohio, and West Virginia. The fifteen establishments had a capacity of twenty-nine furnaces. The company afterward erected a plant at Gas City, Ind., with three fifteen-pot furnaces, to get the benefit of the natural-gas fuel. The capital stock of the company is $4,158,100, $640,000 of which is preferred and $3,518,100 common stock.

The first year of its existence as a corporation the sales amounted to very nearly $3,000,000. With a view of consolidating the plants the company bought 500 acres of land on the Monongahela River adjoining McKeesport, Pa., and have erected two fifteen-pot furnaces, and propose, as opportunity offers, to finally move all their plants to this one point. It is without question the largest flint-glass works in the world, and is almost able to supply this country with table-glass, if all the furnaces were in full operation. Quite a number of flint-glass works are operated in the making of glass for lighting purposes—arc-globes, gas-globes, and shades for electric lighting. There are six leading companies making these goods, four of them located in Philadelphia, Pa., one at Monaca, Pa., and one at Brooklyn, N. Y.

Gillinder & Sons, of Philadelphia, were the first of these works established, and operations were commenced in 1861 by William T. Gillinder, the father of the present owners. Their works have two furnaces, with twenty-three pots, and have a capacity of production to the amount of $400,000 per annum. It is impossible to continue further to enumerate special plants, but I think I have established the fact that so far as glass making is concerned we are practically independent. We have sand in almost every State of the Union fit to make glass. The sand of Massachusetts, Pennsylvania, and Missouri is equal to, if not better than, any other sand in the known world. Soda-ash and other chemicals are being made, and when the beet-sugar industry is fully established we shall be able to get pearl-ash from the ashes of the beet, so that it will not be necessary to import our potash from Germany. We have fire-clay for furnaces, which is found in many States of the Union, notably in New Jersey, Ohio, Pennsylvania, and Missouri. The pot-clay found near St. Louis, Mo., has been used for more than forty years. It is a very superior clay, and for the making of glass-house pots is unsurpassed. It is capable of resisting a very high degree of heat, and will stand the changes of temperature much better than the most celebrated clays of Europe.

The census report of 1890 gives number of factories, 294; product, $41,051,004. A carefully prepared statement by Mr. Weeks shows that in 1893 we produced:

GLASS PRODUCTION IN 1893.

Plate-glass to the amount of	$7,600,000
Window " " "	10,500,000
Flint " " "	20,000,000
Green and black glass to the amount of	9,500,000
A total of	$47,600,000

Our imports for the year ending June 30, 1895, amounted to $6,541,661. Owing to the environment of the glass-works abroad there will always be some glass imported, but the time will come when the amount brought over will be very much reduced. Our exports of glass have never been very large.

EXPORTS FROM 1826 TO 1895.

Year.	Exports.	Year.	Exports.
1826	$44,557	1870	$530,654
1832	106,855	1880	749,866
1842	36,718	1890	882,677
1850	136,682	1895	946,381
1860	277,948		

We can get no data that will give the kinds of glass exported. Window-glass is credited with $11,140; all others, $935,241. This shows that we can export but little window-glass under existing conditions. The statistics from the Treasury Department show that in 1894 we exported to British America $345,199, and to Mexico $108,988, making a total for both of $454,187. Thus it appears that these two, our near neighbors, took about one half of our exports. Cuba took $82,931; France, $18,267; England, $44,076; and British Australia, $54,973. The balance was distributed among forty-nine other countries, no one of which took more than $26,576. Our principal export was pressed glass. There is no other glass we can sell cheaply enough to compete with the cheap-glass producers of Europe, and this demonstrates that the markets of the United States are worth more to us, fifty times over, than the markets of the whole world.

In the preparation of this article I have been aided very much in the early records by the "History of Glass Making in the United States," prepared by Mr. Joseph D. Weeks; and for information in regard to the various improvements in furnaces and leers, by H. L. Dixon, of Pittsburg, who for the past fifteen years has been identified with the building of many of the improved furnaces that have taken the place of the old furnaces. What the future one hundred years will produce in the product of our furnaces none can tell. Had any one said one hundred years ago that the United States in 1895 would produce glass to the value of $47,600,000, he would have been deemed insane; or that a furnace would be constructed that would hold 1000 tons of molten glass, and make 900 boxes of window-glass every twenty-four hours; or that a single plant would make 75,000 dozen tumblers per week; but such are the facts. The distribution of this product in the various States of the Union is shown in the subjoined table, taken from the census of 1890:

GLASS PRODUCT BY STATES IN 1890.

Pennsylvania	$17,179,137
Ohio	5,640,182
New Jersey	5,218,152
Indiana	2,995,409
New York	2,723,019
Illinois	2,373,011
Maryland	1,256,797
Missouri	1,215,529
West Virginia	945,234
Massachusetts	431,437
Kentucky, Georgia, Wisconsin, California, Colorado, Delaware, Michigan	1,065,397
	$41,051,004

The uses of this material in new ways have wonderfully increased during the past century. Dr. Muspratt says, that without speaking of the economical uses of this compound, and considering it only with reference to its application in the study of natural phenomena, it is impossible to doubt the singular influence it has exerted on the progress of science. It is chiefly by its aid that astronomy has attained a perfection so wonderful. By it also naturalists have been enabled to study under the microscope a host of phenomena which have before escaped notice. But perhaps of greater importance is the use made by chemists in their experiments. It requires no profound chemical knowledge to recognize the fact that to glass is chiefly owing the present advanced state of the sciences so fruitful in marvelous applications.

With increased capital and the intense competition of the age there must be still greater improvement, and with her many advantages the United States in the future will be the great glass-producing country of the world.

James Gillinder

CHAPTER XLI

AMERICAN POTTERIES

THE potter, with his wheel, is the oldest artisan of whom we have any record. In fact, the potter antedates history. His was one of the arts earliest known to man, and in the face of an inscrutable antiquity the date of its origin can scarcely be established by the evidence of the oldest records, which are those of the Chinese, ascribing the invention of pottery to their Emperor Hoangti, about 2700 B. C. It might be said, that no people known to history have been without evidences that they made, and used, earthen vessels in some form.

The Hindoo and the Hebrew knew the art, and practised it, as did the Egyptian bond-master of the olden times and the Roman conqueror of the later day. When, in its turn, Rome fell, and its civilization sank beneath the barbarian flood which rolled in from the north, the potter disappeared from Europe. With the invading Moors he returned to Spain, however, and during the fourteenth and fifteenth centuries the wonderful art of the Italian Middle Ages had adopted him, and masters such as Raphael were designing the decorations for his wares, and the priceless majolica of the modern collector was being produced. In the latter century, also, potteries for the manufacture of the famous Delft ware were established by the Dutch, at the town of that name in Holland. The Dresden potteries were opened in 1751, those at Sèvres in 1754, and, a little later, Josiah Wedgwood had so mastered the art in England that he was able to produce copies of the famous Portland Vase of such excellence and beauty that very high prices were readily obtained for them.

The Greek potters, also, in early times, produced many beautiful forms in pottery, decorated in refined taste. Many are the rare and beautiful specimens of ancient production that have become historical and are of fabulous value. In early Colonial days small potteries were established from time to time, as needed, in nearly if not all the American colonies, to supply the demand for the commonest kinds of pottery ware. Since the remotest times pottery, or earthenware, has been an American product. The Mound Builders in the prehistoric era, and the Indians before the white man, both made and used it. The first manufactory for white ware in America of which we can find any record was established by Dr. Daniel Coxe, of London, at Burlington, N. J., in 1685. Dr. Coxe was one of the West Jersey proprietors. The extent to which the undertaking had been carried by 1688 is best related in an inventory of that date, offering the works for sale, as follows:

"I have erected a pottery at Burlington for white china ware. A great quantity, to the value of 1200 pounds, has already been made, and vended in the country and neighbouring colonies and ye islands of Barbadoes and Jamaica, where they have been in great request. I have two houses and kilns with all necessary implements, diverse workmen, and servants. Have expended thereon about 2000 pounds."

That the ware turned out from this pottery was china is scarcely to be credited, inasmuch as yellow and cream-colored were the only wares known, even to the English potters, except, of course, porcelain, which came from China, whence the name of "china-ware" was derived.

To Mr. Edwin Atlee Barber the writer is indebted for much information regarding the early pottery attempts in this country. From his recent work on "Pottery and Porcelain of the United States," I make the following interesting abstract:

"A patent was taken out, in 1744, by Edward Heylyn, of the Parish of Bow, in the County of Middlesex, merchant, and Thomas Frye, of the Parish of West Ham, in the County of Essex, painter, for the manufacture of China ware, and the following year they enrolled their specifications, in which they state that the material used in their invention is an earth, the produce of the Cherokee nation in America, called by the nation 'Unaker.' The specification of the patent is of startling interest. Who would have thought, until Mr. Jewett unfolded this document to modern light, that the first English china that we have any knowledge of was made from American china clay? Let our American cousins look out for and treasure up lovingly specimens of the earliest Bow-ware after learning that. This 'Unaker,' the produce of the Cherokee nation in America, is decomposed granite rock, the earth or clay resulting from the washing being the decomposed feldspar of that rock. It is curious that it should have been imported from among the Cherokees, when we have mountains of it so near as Cornwall, unknown, however, to any whom it might concern until Cookworthy discovered it, twenty-four years later than the date of the above patent."

There are records of a pottery enterprise started in South Carolina in 1765, which maintained a very brief existence, and of which but little is known; the results of which, however, seem to have seriously alarmed the greatest of English potters, Josiah Wedgwood, who, writing to a friend, shows his anxiety regarding the establishment of the pottery industry in America. This letter runs as follows:

> The bulk of our particular manufactures are, you know, exported to foreign markets, for our home consumption is very trifling in comparison to what is sent abroad; and the principal of these markets are the continent and islands of North America. To the continent we send an amazing quantity of white stone ware and some of the finer kinds, but for the islands we cannot make anything too rich and costly.
>
> This trade to our Colonies we are apprehensive of losing in a few years, as they have set on foot some Pottworks there already, and have at this time an agent amongst us, hiring a number of our hands for establishing new Pottworks in South Carolina, having one of oui insolvent master Potters there to conduct them. They have every material there equal, if not superior, to our own, for carrying on that manufacture, and as the necessaries of life, and consequently the price of labor amongst us are daily advancing, it is highly probable that more will follow them and join their brother artists and manufacturers of every class, who from all quarters are taking a rapid flight, indeed, the same way. Whether this can be remedied is out of our sphere to know, but we cannot help apprehending such consequences from these emigrations, as make us very uneasy for our Trade and Pottery.

It is said that Wedgwood, for several years, used considerable quantities of these Carolina clays, and also those from Florida.

There is mention of a pottery at Germantown, New Quincy, Mass., as early as 1760. Some samples of its ware were said to be almost vitreous. There is but little information to be found concerning it.

There seems to have been a "China Factory" built on Prince Street, Philadelphia, in 1769, which ended in failure in a very short time, and was abandoned.

There was a serious attempt to establish works about the same time in Philadelphia, as will appear by the following announcement in a newspaper in the year 1769, which I quote from Mr. Barber:

"Notwithstanding the various difficulties and disadvantages, which usually attend the introduction of any important manufacture into a new country, the proprietors of the china works, now erecting in Southwark, have the pleasure to acquaint the public they have proved to a certainty that the clays of America are productive of as good porcelain as any heretofore manufactured at Bow, near London, and imported into the Colonies and plantations, which they will agree to sell upon very reasonable terms, and, as they propose going largely into the manufacture as soon as the works are completed, they request those persons who choose to favor them with commands, to be as early as possible, laying it down as a fixed principle to take all orders in rotation, and execute the earliest first. Dealers will meet the usual encouragement, and may be assured that no goods under thirty pounds worth will be sold to private parties out of factory at a lower advance than that from their shops. All workmen skilled in the different branches, throwing, turning, modeling, moulding, pressing and painting, upon application to the proprietors, may depend upon encouragement suitable to their abilities, and such parents as are inclined to bind their children apprentices to either of these branches, must be early in their application, as only a few of the first offerings will be accepted without a premium. None will be received under twelve years of age, or upwards of fifteen. All orders from the county or other provinces, enclosed in letters, post paid, and directed to the China Proprietors in Philadelphia, will be faithfully executed, and the ware warranted equal to any in goodness and cheapness hitherto manufactured in or imported from England." The proprietors were Gousse Bounin, probably from Bow, and George Anthony Morris, of Philadelphia. In 1771 their financial needs impelled them to seek assistance from the Colonial government, in which they were not successful. Being unable to withstand the competition with the manufacturers in Europe, Mr. Bounin ceased his labors, and the pottery was closed.

The year 1795, with which we begin the discussion proper of the pottery trade in this country, saw a goodly number of potteries in operation, but their output was comparatively small. Everything was made with the hands and feet by the use of the ancient potter's wheel, to which, in those days, the power was applied by the thrower's foot. The thrower's wheel in these early days was called a "kick wheel." The potter's wheel is still used, and nothing new can take its place. Better ware can be made in the ancient manner of throwing and turning than in any other way. The text of Scripture which says that the clay is in the hands of the potter is still as true as when it was first written, for nothing can take the place of the human hand as applied to the clay on the thrower's wheel. The only advancement made in the thrower's wheel, from the most ancient times to the present, is, that the rotary motion is now given to the wheel by steam-power instead of foot-power, thus allowing the operative potter to give his whole attention to the clay on the wheel.

Abraham Miller, for many years, had a pottery in Philadelphia, succeeding his father, who commenced, before 1791, making common earthenware, fire-brick, etc. He seems to have been one of the most intelligent potters of his day. He was one of the earliest to make fine porcelain, and produced some very superior ware; but, for some reason, did not undertake to make it a practical business, probably for the reason that, while there was a profit in making common ware, the disadvantages in making porcelain in competition with foreign goods of the same character were so great, owing to an insufficient tariff, that profit was impossible.

It is known that there was a "china" factory in existence in 1800, in Philadelphia, near Fourth and Chestnut streets, probably making plain white ware, as such ware seems to have been called chinaware at that time, but little is known of it.

The Columbian Pottery in 1808 was making queensware—as crockery ware was then and now is sometimes called. Alexander Trotter was the proprietor, and he continued the business until about 1813. This pottery claimed to produce ware of a quality equal to any made in Staffordshire, England. But little can be learned of it.

The Jersey Porcelain and Earthenware Company of Jersey City was incorporated in 1825, with George Dummer, Timothy Dewey, and others, as incorporators. The next year, the Franklin Institute, of Philadelphia, awarded to its exhibit a silver medal as "the best china from American material." The making of porcelain was, however, of short duration. In 1829 the establishment passed into the hands of Messrs. Henderson, who in a few years organized the American Pottery Manufacturing Company, with a capital of $150,000, and commissioners were appointed by an act of the Assembly to receive subscriptions.

The ware produced by this company was of very good quality, but was confined to special articles, no general line of crockery ware being made. The pottery afterward fell into other hands, and continued making a similar class of goods under the name of the Jersey City Pottery. After various other changes and vicissitudes of fortune, Rouse & Turner became the proprietors, still making druggists' wares and specialties. It existed until after 1861, when it gradually changed its products into a general line of crockery, and continued in existence until a recent date, having maintained a checkered existence of upward of sixty years.

One of the most determined attempts in the first half of this century to establish a pottery enterprise for the manufacture of a full line of goods was commenced in Philadelphia in 1825, by William Ellis Tucker, after experiments made for several years previously with American materials.

The location of the pottery was at the corner of Schuylkill Front—now Twenty-third Street—and Chestnut Streets. From the beginning he seems to have met with serious troubles, as the following extract from a paper read before the Historical Society of Pennsylvania, in 1868, graphically narrates: "We burned kiln after kiln, with very poor success. The glazing would crack, and the body blister, and, besides, we discovered we had a man who placed the ware in the kiln who was employed by some interested parties in England to impede our success. Most of the handles were found in the bottoms of the seggers after the kilns were burned. We could not account for it until a deaf and dumb man in our employment detected him running his knife around each handle, as he placed them in the kiln. At another time, every piece of the china had to be broken before it could be taken out of the segger. We always washed the round O's, the article in which the china was placed in the kiln, with silex; but this man had washed them with feldspar, which, of course, melted and fastened every article to the bottom. But William discharged him, and we got over that difficulty."

The committee of the Franklin Institute on awards, in 1827, when considering pottery wares, made a report from which the following extract is taken: "This is a manufacture of great importance to the country, as most of the capital expended is for labor, the materials being taken out of the soil in great abundance and purity. The highest credit is due to Mr. William E. Tucker for the degree of perfection to which he brought this valuable and difficult art. The body of the ware appeared to be strong, and sufficiently well fired, the glaze, generally, very good, the gilding executed in a neat and workmanlike manner. Some of the cups and other articles bear a fair comparison with those imported." A silver medal was awarded. In 1829, Mr. Thomas Hulme, of Philadelphia, became a partner in the enterprise and put in additional capital, and the firm became Tucker & Hulme. The quality of the goods rapidly improved. The partnership was of short duration, as Mr. Hulme withdrew shortly thereafter. Financial support seems to have been needed; application was made for government aid, and among other public men communicated with on the subject was Andrew Jackson, as the following letter from him indicates:

WASHINGTON, April 3, 1830.

Sir: I have had the honor to receive your letter of the 3rd of March, and since, the porcelain, which it offered to my acceptance. I was not apprised before, of the perfection to which your skill and perseverance had brought this branch of manufacture. It seems to be not inferior to the finest specimens of French porcelain. But whether the facilities for its manufacture bring its cost so nearly to an equality with that of the French as to enable the moderate protection of which you speak to place it beyond the reach of competition in the markets of the world, is a question which I am not prepared to answer.

If Congress could be made acquainted with the experiments on the subject, and they should confirm your favorable anticipation, there would be scarcely a doubt of its willingness to secure the important results of the manufacture. I do not see, however, any mode by which this can be effected on any other principle than that of protection.

You would probably have a right to a patent for the discovery, but this right would have to be determined in the usual way.

Congress has refused to make a donation to the heirs of Robert Fulton for the national benefits resulting from his discovery, upon the principle that the constitution does not provide any other reward for the authors of useful discoveries than that which is contained in the article in relation to patents. The same objection would of course defeat your application for $20,000 as remuneration for this discovery, as a reward for its free communication to the world.

It will give me much pleasure to promote the objects you have in view, so far as they are within my constitutional sphere. There is no subject more interesting to me than that which concerns the domestic economy of our country, and I tender you my sincere thanks for an example of its success so creditable to yourself.

With great respect, believe me,

Yr. Obt. Svt.,

ANDREW JACKSON.

MR. WM. ELLIS TUCKER,
Philadelphia.

Mr. Tucker's scheme for gaining congressional help proved unsuccessful. He continued the business, receiving a silver medal from the American Institute of New York for an exhibit of his wares in 1831.

Judge Joseph Hemphill, of Philadelphia, who had recently become interested in the subject of the manufacture of china while abroad, just before the death of Mr. Tucker, had obtained a pecuniary interest in the pottery, and the firm became Tucker & Hemphill in 1832.

Just previous to the death of Mr. Tucker, another appeal to Congress was made for a tariff of protection to the industry from foreign competition, which brought the following letter from Henry Clay:

WASHINGTON, June 23, 1832.

Gentlemen: I received your favor of the 21st inst. on the subject of your manufacture of porcelain. I had been previously aware of its existence, and had seen some beautiful specimens of its production.

When the Tariff Bill shall be taken up in the Senate, I will take care that its attention shall be called to it. Such is the state of parties here, however, the friends of protection combating against the Treasury bill, sustained by the whole weight of the Administration, that it is extremely difficult to anticipate results on any part of the tariff.

With great respect,

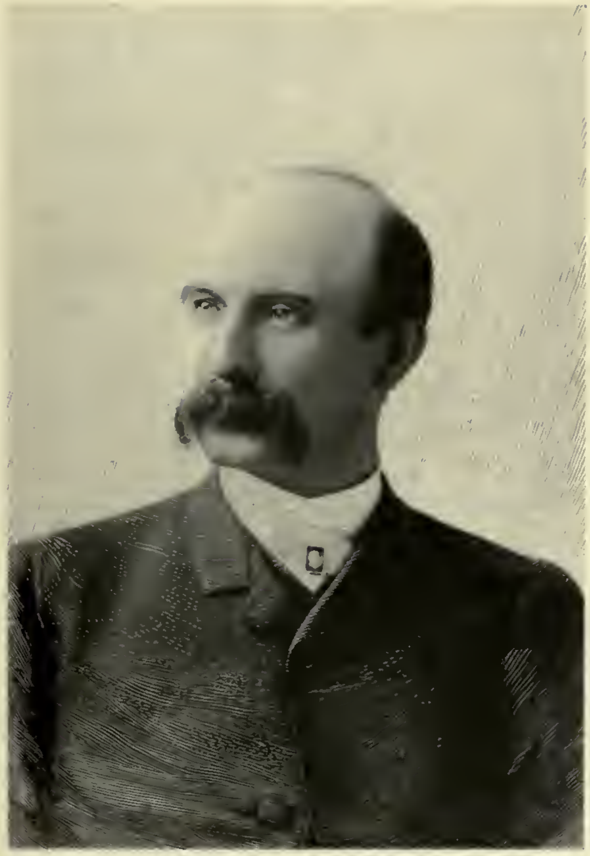
I am your ob. svr.

H. CLAY.

MESS. TUCKER & HEMPHILL,
Porcelain Manufacturers, Philadelphia.

After the death of the founder of this pottery, William Ellis Tucker, his brother, Thomas Tucker, managed the business in the name of Joseph Hemphill, who associated with him his son, the late Mr. Robert Coleman Hemphill, of West Chester, Pa.

Remarking upon the appeal for greater protection to the pottery industry above mentioned, it



John Moses.

may not be out of place to mention the fact that in 1833 a tariff bill was passed decreasing instead of increasing the tariff generally, which no doubt to some extent had its influence on the few years' existence which this pottery still maintained. Under Joseph Hemphill's ownership a more pretentious style of decorations was introduced, and foreign artists were imported for the purpose. The ware was extensively sold to the wealthy classes of Pennsylvania and New Jersey, and many prominent families had dinner sets made to order for their use. Some very interesting pieces are still to be seen in various parts of the country. Several exhibits of the ware were made in Philadelphia and New York, and it was very highly spoken of and admired for its quality and decorations. The business continued until 1835, when the American Porcelain Company was incorporated, but this company amounted to little, and in 1838 it ceased operations altogether. Thus, after an existence of thirteen years of varied experiences, this enterprise went down in the contest with foreign competition, after making the most determined effort to establish the pottery industry ever attempted up to that time in the United States.

The prices asked for china during the days of this early factory were such as the buyer of to-day would scarcely care to pay. Without going into the matter at too great length, it might be interesting to note what was asked at the factory for a few of the more common articles of daily use, in the plain white undecorated wares. Teapots sold at from \$1.00 to \$1.25 each; coffee pots, \$2.00; pitchers, \$1.00 to \$1.50; butter-coolers; \$1.00; fruit-baskets, \$2.00; sugars, \$0.75; creams, \$0.37½; gravy-boats, \$.50; plates, \$2.50 to \$4.00 per doz.; saucers, \$1.50 to \$2.00 per doz.; cups, \$1.50; cake-stands, \$1.00; and salads, \$2.00 each. During the period covered by the operation of the Tucker & Hemphill china factory, and the years immediately succeeding, the trade was growing rapidly in stoneware, yellow and Rockingham, and other colored wares throughout the country at large. Perrine's stoneware works were opened at Baltimore in 1827; Homer & Shirley commenced the making of flintware at New Brunswick, N. J., in 1831; John Hancock started his first yellow-ware factory at South Amboy in 1828; in 1837 Charles Cartlidge began to make porcelain hardware trimmings at Greenpoint, Long Island. During the forties William Bock & Brother established a pottery in the same line of goods. In 1829 the Lewis Pottery was incorporated at Louisville, Ky., for making queensware and china. The owners, at that time, of a small pottery were induced to join the company. The plant was moved from Pittsburg, and they commenced making C. C. ware. The business was continued until 1836, when it was abandoned.

About this time a Mr. Clews, an experienced English potter who had been manufacturing for years large quantities of goods for the American market, appeared. He had been successful in his American trade. His goods had been very popular, and he was known as a successful pottery manufacturer. Among his various decorative designs were American scenery in dark blue, noticeably the views of the Hudson River, the "Landing of Lafayette at Castle Garden" in 1824, etc. He was soon engaged in inaugurating a pottery enterprise at Troy, Ind., situated on the Ohio River. The location was considered favorable as being a good shipping point, and was well situated regarding proximity to suitable materials. In 1837 the Indiana Pottery was incorporated by an act of the Legislature, with James Clews and others as incorporators. The company began business with the brightest anticipations. After a short time considerable money was lost, the company changed its management, and after a checkered career it disappeared in 1846.

Bennington, Vermont, which was one of the towns where the old stone and earthenware pottery was earliest established, came again to the front about 1846, when C. W. Fenton, Henry D. Hall, and Julius Norton commenced making Rockingham, yellow and white wares in the old stoneware pottery of Norton & Fenton. After several changes in the personnel of the firm, the establishment, in 1849, became the "United States Pottery," and for many years afterward ranked as one of the most progressive of American potteries. It produced the first Parian, and also excelled in a peculiar ware, patented by Mr. Fenton, somewhat resembling majolica and called flint enamel. White granite and soft paste porcelain were also turned out by them, and so great was their success, that in 1853 their works were enlarged and six new and improved kilns built. Difficulties arose, however, and the factory closed in 1858. The other potteries of that day, so far as can be recalled, were those of Ralph B. Beach, in Philadelphia; William Wolfe, in Sullivan County, Tenn.; George Walker's Temperance Hill Pottery, at West Troy, N. Y.; Sanford S. Perry's stoneware works at the same place; Moro Phillips's on the James River; James Carr's Swan Hill Pottery, at South Amboy—Mr. Carr is still living, and, I believe, the oldest living potter in America; T. D. Wheeler's, at

South Norwalk; the American Porcelain Manufacturing Company's, at Gloucester, N. J.; Houghwout & Daily's decorating establishment, at 561-563 Broadway, N. Y.; and the Southern Porcelain Company, in Aiken County, S. C., whose kaolin factory was the only one in the South turning out white and porcelain ware during the war. East Liverpool, Ohio, the other great home of the trade, owes the foundation of its prosperity to the discovery of clay in its neighborhood by James Bennett, an English potter, who, in company with Anthony Kearns, erected the first works there in 1839. In 1854 Isaac W. Knowles and Isaac A. Harvey started a one-kiln factory for the manufacture of yellow ware. Earlier than this, also, Salt and Mear were making yellow and Rockingham wares in 1841, and Woodward and Vodrey in 1848. Other cities where pottery interests have had well-known representatives are Cincinnati, Baltimore, Wheeling, Peoria, Pittsburg, Boston, New York, Steubenville, Ohio, Greenpoint, Long Island, and many others.

The foregoing brief review of the personnel of the pottery trade in the earlier days summarizes briefly those beginnings upon which all our later success and artistic excellence have been reared. Trenton, the foremost pottery center of the United States to-day, built its first factory in 1852, Messrs. Taylor, Speeler & Bloor being the proprietors. The following year William Young & Sons erected the second Trenton pottery for the manufacture of common ware and Rockingham. Situated most advantageously as regards transportation, either by rail or water, the Trenton potteries were enabled to extend the previous searches made for material, and, in addition to the native clay deposits, Maryland and Pennsylvania were drawn upon for flint and china-clay, and Maine, Connecticut, and North and South Carolina for feldspar. To-day the ground feldspar or flint can be shipped from much greater distances and still handled profitably, owing to improved methods of running and grinding. Trenton, in common with the rest of the country, scarcely considered her pottery interests as her greatest industry until some time after Messrs. Taylor and Speeler had fired their first kiln. It was not, indeed, until the first real protection by tariff ever accorded the potteries was enacted, as a war measure, that the American maker found himself able to enter the field against the English potter, especially in the two staple lines of white granite and C. C. The premium on gold, doubling, as it did, the increased duty, gave the potters the long-needed opportunity, and new establishments sprang up in Trenton during the decade succeeding the war at a rapid rate. By 1880 the potteries of the country were turning out a product valued at about $9,000,000. Only ten years later, from the 707 establishments of the country, an annual product of no less than $22,057,090 was being turned out, of which Trenton alone produced a little over $5,000,000. From a general production by all makers twenty years ago of a few staple lines, Trenton potteries now turn out a product that ranges from the daintiest of decorated porcelain to the heavy earthenware of the sanitary factories.

For some years previous to 1861 the tariff rate was twenty-four per cent. on white granite, etc. By the tariff legislation of that year the rate was increased to forty per cent. on white. The legislation made the tariff rate on some other articles, needing no more protection than pottery wares, double that amount. This was due to the fact that the large pottery industry, as now known, was not in existence at that time, and had no representatives to fairly and fully urge its needs before the committee who prepared such legislation. In no industry in this country is labor more largely represented in the cost of its production, it being ninety to ninety-five per cent. of the entire cost, the other five per cent. being represented as the value of the mining right on the materials in the ground; the ninety-five per cent. being labor in mining, preparation, grinding, transportation, and the whole amount of wages paid in the potteries. The wages paid by American pottery manufacturers are fully double those paid by English manufacturers, as is so accurately shown on page 14 of the Report of the Tariff Commissioners. It has been claimed by the enemies of the pottery industry that the cost has been largely reduced by the use of improved machinery, as has been the case in other industries. This statement is not true. The only use for improved machinery that yet has been found practical is in the mixing and preparation of the clay, flint, and spar for the use of the workmen, and the substitution of steam for hand-power, for the benefit of but a limited number of men in the pottery. No article can be made fully complete, in the clay state, and no large part of any, can be made by machinery. No machinery has ever been invented to work automatically, and none can work without the guiding hand of the potter. The yielding nature of the clay is such that, now as in the earlier days, it must be formed and molded by the hands of the potter, savage or civilized. A new era opened to the manufacturing industries of the United States by the protective legislation of 1861, the design being to increase the revenue and provide protection to American labor. While the tariff bill of that year was under consideration, the representatives of the established industries appeared before the committee regarding the rate of duty necessary for their respective needs. As before stated, there was no adequate representation of the pottery interest. Instead of receiving a rate of duty as high as any other industry, as its needs required, the tariff rate was made forty per cent. This rate was totally insufficient to encourage its establishment, as I have remarked before. The premium on gold soon began, but not until 1862 did it reach a point that induced the establishment of one pottery for the manufacture of W. G. and C. C., and the change of two or three others from yellow and Rockingham to W. G. and C. C.

During the year 1863 several new potteries were started, and other changes made in the potteries already established for Rockingham, yellow ware, etc. In 1866, eleven potteries were making W. G. and C. C. wares, and one continued making yellow and Rockingham ware. The number has grown from time to time, until they now number twenty-nine, all told, in the city of Trenton, all making decorated wares in addition to white, and some making large quantities of underglaze printed ware as well.

The first pottery was started at East Liverpool, Ohio, in 1839, to make Rockingham and yellow ware, and during the following fifteen years five or six more had been built making the same class of goods. After this a few other potteries were built from time to time, all making the same class of goods. Clay suitable for making this ware having been found in the neighborhood, made East Liverpool a peculiarly fitting place for this branch of the industry, and especially so as they had close at hand coal suitable for their use. Soon after the tariff legislation of 1863, they began, one after another, to change their products to the better class of crockery ware, the W. G. and C. C., and each added a decorating department to its establishment. New potteries also were rapidly built, until the pottery establishments, all told, were twenty or more in number. Trenton and East Liverpool are the principal centers of the pottery industry. There are also scattered about the country a considerable number of potteries, in all making a total of about one hundred in the United States, including those making floor tile, etc., producing white and decorated wares, annually, of the value of from $8,000,000, to $9,000,000, employing nearly an equal amount of capital, and from 9000 to 10,000 operatives. Fortunately for the industry, the gold premium which furnished the additional protection to the tariff continued for several years, and, gradually diminishing, did not disappear until 1879. Thereby a remarkable development had been attained, the difficulties and discouragements incident to most new enterprises had been well overcome, and the consumers of the country had realized the fact that American pottery wares were equal in quality to foreign wares for household use. Thus were the American potters generally able to withstand the strain caused by the entire disappearance of the incidental protection of the gold premium on the resumption of specie payments in 1879.

No one, with any knowledge of the manufacture of fine pottery, can question the fact, when it is asserted that as a branch of industry it is surrounded on all sides by dangers peculiar to itself. Every piece of white goods, from the smallest to the greatest, must pass through the hands of upward of thirty different operatives in its growth from the materials into the finished piece of ware. It will readily be seen, then, that neglect, carelessness, or ignorance on the part of any one individual can only be detected when the piece of ware passes through the two fires at white heat. It is then often found to be absolutely worthless, in spite of the skilled labor of the number of men that has been expended upon it. This is true of all general pottery wares for domestic use, but it is also true in a far greater degree in the manufacture of porcelain, or china, and the still finer Belleek or egg-shell china now being made in this country. We have several factories devoted solely to the production of porcelain goods for table use, and these goods successfully compete with the French and English of the same class. Again, there are a number of factories that produce the finest possible grade of Belleek and egg-shell china, surpassed in quality by none. The extreme delicacy and fragility of these goods multiply the dangers to which they are exposed in the process of manufacture. Notwithstanding the fact that only the most skilfully trained workmen are employed in this branch of the industry, it is yet impossible to prevent great loss by carelessness, accident, etc.

The United States Census reported that "there were four hundred and eighty-four potteries in the United States in 1850." The potteries named were scattered all over the country, making common stoneware, red earthenware, gas-retorts, drain-pipes, terra-cotta ware, fire-brick, etc., to all of which the twenty-four per cent. tariff then existing seems to have been sufficient protection on account of the goods being cheap and bulky, and because they were manufactured where used. With the exception of a few goods of the commonest kind of white ware, known as cream colored, or C. C., no white crockery ware was made in 1850. Between 1850 and 1860 a number of potteries started making yellow and Rockingham ware in Trenton, East Liverpool, Philadelphia, Baltimore, and other places; and even in 1860 the making of white tableware had but barely commenced. Between the years 1860 and 1865, and after the stimulating effects of the rapidly-increasing gold premium had been felt, the substantial growth of the pottery industry began, and at the expiration of this decade in 1870, the annual production of white ware reached $4,000,000. During the succeeding decade the number of potteries decreased, the growth of the industry having been checked by the steady decline in the gold premium and its final disappearance.

The facts regarding the industry as shown by the tariff commissioners' report are as follows:

AMERICAN POTTERIES, 1850–1880.

	Potteries.	Capital.	Production.	Average Capital.	Average Production.
1850..	484	$777,544	$1,466,063	$1,606	$3,028
1860..	660	1,701,774	2,706,681	2,578	4,100
1870..	777	5,249,398	6,045,536	6,813	7,780
1880..	686	6,380,610	7,943,229	9,301	11,578

Thus showing the ratio of increase of capital employed and of production to be as follows (these statistics include all kinds of clay productions, brick, terra-cotta, pipe, tiles, stoneware, flower-pots, red earthenware, etc.):

	Capital per Pottery.	Increase per Pottery.	Production per Pottery.	Increase of Production per Pottery.
1850	$1,606	Increase.	$3,028	Increase.
1860	2,578	over 1850 ... 60 per cent.	4,100	over 1850 ... 36.7 per cent.
1870	6,813	" 1860 .. 164 "	7,780	" 1860 . 89.7 "
1880	9,301	" 1870 ... 37 "	11,578	" 1870 .. 48.8 "

From the above figures it will be seen by the very small amount of capital employed and the production, in 1850, that the potteries were then very insignificant affairs, and that no white ware could have been produced. The small increase in amount of capital and production per pottery in 1860 shows that the status of the potteries had not then materially changed. In 1870, however, the increase is very marked, and in 1880 the figures show the growth to have been greatly retarded by the gradual decline and final disappearance of the gold premium. The last quarter of a century, within which so many advances have been made in the pottery trade proper, has also seen an extension of the industry along lines previously undeveloped. The potter has contributed largely to the accomplishment of many of those latter day conveniences known as "modern improvements." The extensive sanitary and plumber's-ware trade is a branch as important and generally recognized to-day, as the older lines, and it is steadily growing. The porcelain bath-tub is among the latest of the luxuries of American life; but the end is not yet, and the next decade will probably witness many innovations.

Pottery, literally speaking, could scarcely be considered to include brick and tile, and yet both of these, and especially the latter, now approach very closely in the processes employed and the artistic results obtained to the proper craft of the potter. The glazed and ornamental kinds of brick which have become so common during the last decade are all made by machinery, turned out by specially constructed model presses, burnt in continuous kilns, and treated with the utmost care. The enameled brick is ordinary pressed brick treated with a soft glaze and re-fired, or, in some cases, is a fire-brick body on which the enamel is originally placed and the whole burnt at one firing. This is the English process, and while used by a few of our larger manufacturers, the composition of the enamel, or glaze, has been kept a profound secret.

Tiles, and architectural terra-cotta work, are also important branches of the pottery trade. Abraham Miller, mentioned earlier as one of the pioneer potters of the century in Philadelphia, was the first, in 1838, to make tile other than the old terra-cotta roofing tiles, known in 1740. The first tiles for inlaid flooring were turned out by the United States

Pottery at Bennington, Vt., in 1853, and the manufacture, after this factory closed in 1858, was largely of an experimental nature until during the seventies, when the damp-dust process succeeded that of the wet clay, and works sprang up all over the country. The artistic excellence which this branch of the working of clays has now attained is too well known to need description. The modeler with his plastic sketches, reliefs, intaglios, and ambitious panels, has already won a place well up in the ranks of art, and closely akin to that of the sculptor. Through him and his work, supplemented by the cunning of the potter, America has achieved and holds the proud distinction of leading the world in this branch of ceramic production. Of the many processes and effects by which the beauties of the art tile are thrown into fuller relief or accentuation, want of space forbids mention. The mechanical branch of tile-making, however, has kept pace with the increased demands of artistic endeavor, and clays, glazes, and coloring are now handled with a precision and certainty never before known. Terra-cotta, seen to-day in nearly every building of any pretensions to architectural elegance, is, comparatively speaking, an innovation in building materials in this country. The first attempts made to introduce it, about 1853, were completely unsuccessful, and it was not until 1870 that the Chicago Terra-cotta Company, having introduced the English method of manufacture, succeeded in turning out a product that became immediately popular. Apart from the beauty and finish of this material, it is, also, one of the most enduring known, and as it has considerable range in color, its use is steadily increasing. There are many manufacturers of terra-cotta throughout the country today, and at least a score of them are producing work of a highly artistic nature. Roughly speaking, an equal number may be said to be engaged in the manufacture of ornamental art tiles.

The relations borne by the pottery trade to the national commerce have, unfortunately, been altogether one-sided in their character. American goods have never sought a foreign market, but there is scarcely a port of entry along our seaboard where earthen, stone, or chinaware does not figure more or less prominently in the customs returns. Since the old days, when every village that could boast a clay-pit had its own pottery and drew from it the household-supply, the domestic product has never been dominant in the market except during the period of the Civil War and the protection then received, which lasted, although far less effectively, until 1884. In this year European goods were pouring in again, and by the next year, 1885, the total importations of pottery amounted to $4,837,782. Since then, the increasing volume of this trade has continued with scarcely a break until the last year, when it has declined slightly, owing to the depressed business conditions since 1893, together with the impending tariff changes at that time in contemplation.

The figures giving the imports since 1885 are as follows:

IMPORTS.

Year.	Earthen, Stone, and Chinaware.	Year.	Earthen, Stone, and Chinaware.
1885	$4,837,782	1890	$7,030,301
1886	4,947,621	1891	8,381,388
1887	5,716,927	1892	8,708,598
1888	6,410,871	1893	9,529,431
1889	6,476,299	1894	6,879,437

Between these years the exports, of course, fluctuated slightly, but the total variation has been trifling and unimportant. From $135,385 in 1885 the exports by 1894 had fallen to $127,437, a difference inconsequential in itself, but significant by comparison with the greatly increased imports.

The present year has witnessed, so far as the returns up to date can show it, a still further increase of importations. Coincident with this, of course, has been more or less depression of the domestic pottery interests; but that is merely temporary and, in its effects, will operate to force upon those concerned a realization of certain vital principles which are at the base of all American industry. There are too many millions of dollars and thousands of working men bound up in the welfare of the pottery-trade to-day for its interests ever to suffer more than temporary repression. The people of no country in the world has at its very feet a more bountiful supply of the raw material than Nature has given to us. The finest materials for the manufacture of china are found, so far as I know, in every State in the Union.

The native genius and persevering spirit have overcome, so far, every obstacle placed in their path. Recognition is already coming for the prolonged patience of the potter, and whoever shall have to write of pottery in the annals of the coming industrial age will speak of it as one of the greatest of the American trades, and one which has ever been expansive to the increased demands of our modern wants.

In the foregoing account I have endeavored to give, in a condensed form, some account of the early struggles, disappointments, and disasters connected with the history of the pottery business in this country, but who can describe the anxious but disappointed hopes of men such as Bernard Palissy and thousands of others unknown to history, who, like him, ventured their all on the chances of fire — a god or demon, as the result turned for good or evil — lifting them into ecstasies of delight, or plunging them into the depths of despair, want, and misery, broken in fortune, health, and spirit? In America the development of the pottery business for some years was phenomenal; but this growth of late years has been checked, and, I might say, altogether stopped. We do not make quite half of the domestic crockery used in this country, and it can be truthfully said that the American potteries have not been run up to their full capacity for several years. The conditions of the business at the present time and ever since August, 1894, are very discouraging, having been caused by an unintentional and accidental reduction of the tariff to the extent of twenty-five per cent. more than was intended, making the reduction on plain white goods from fifty-five to thirty per cent., and on decorated goods from sixty per cent. to thirty-five per cent.

It may be thought that this statement is out of place in this article, but it is a part of the history of the pottery business, and one of the most trying incidents. In writing this review of the trade I have omitted the names of many prominent potteries because I could not fix the date of their first beginning. Among them is a chinaware factory at Greenpoint, Long Island, which for many years has been successfully run by Messrs. Thos. C. Smith & Son, making china after the French method. There have been several large potteries built in the Ohio Valley, a few of which have had a checkered experience. Some have stopped, others have been in the hands of receivers, been reorganized, and started up again; for the potters, as a rule, are plucky men, not easily discouraged nor driven from their hopes of ultimate success. One great difficulty that the foreign practical potters met with in their early efforts to establish the business in this country arose from the fact that American materials are different from those of England and other European countries, requiring different treatment, different combinations, and a greater amount of heat to produce the same results. I am afraid that already more space has been occupied by the writer than was intended, and will close by expressing the hope that whoever lives to write the history of pottery for the next one hundred years will be able to show as much business success as has been achieved during the past century in artistic development of the potter's art.

John Moses

CHAPTER XLII

AMERICAN GAS INTERESTS

A CENTURY covers, with some margin, the history of gas-lighting, not alone in the United States, but in the world. Late in the eighteenth century, William Murdock of England, and Philippe Lebon of France, investigated the possibilities of the manufacture and distribution of illuminating gas distilled from bituminous coal. To which of these investigators should be accorded the merit of priority in the application of coal-gas to domestic purposes is one of the questions over which English and French authorities are still disputing.

The first recorded instance of the illumination of a house by artificial gas reported in the United States fixes the date at 1806. In that year David Melville, of Newport, R. I., lighted his house, and the street in front of it, with gas manufactured upon his premises. This was one year before the first public gas-lighting in England, but it was four years after a display made at the Soho factory of Boulton & Watt, and nine years after William Murdock lighted his premises in Old Cumnock with gas of his own manufacture. Melville improved his apparatus from time to time, finally patenting it in 1813. He introduced gas for the lighting of a cotton-mill at Watertown, Mass., and of a mill near Providence, and in 1817 employed it in lighthouse illumination. From this small beginning the gas industry in America grew at first slowly, and later, with the development of improved apparatus and the acquirement of more accurate knowledge of the physical laws involved, much more rapidly. In 1816 a company was chartered in Baltimore, Md. In 1822 Boston adopted gas-lighting. In 1823 a company was organized in New York City. In 1825, Brooklyn, New York, and Bristol, R. I., were lighted with the new illuminant. In 1835 the New Orleans Gas-Light Company was chartered. These were the pioneer companies in the United States, and the number grew until in the year 1859 there were, according to tables prepared by the "American Gas-Light Journal," 297 companies, with a capitalization of $42,861,174, supplying a population of 4,857,000 through 227,665 private meters.

From 1860 the growth of the business has been rapid, until in 1895 the capital invested is, approximately, $400,000,000, and the annual output is, approximately, 60,000,000,000 cubic feet, supplying a population of 24,500,000, in 885 towns. The number of plants named by the authority for the above data (Brown's "Directory of American Gas Companies") is 999. Thus in thirty-five years the number of companies has increased almost three and one half times, the population supplied five times, and the capital invested almost ten times. It is probable that the sales of gas have increased twenty times. It has been impossible to obtain a record of the total sales for an earlier date than 1890.

While it is not possible to state the number of premises at present supplied throughout the United States, an idea of the multitude of people who in their homes and places of business enjoy the convenience and security of this modern illuminant may be gathered from the fact that in 1894 there were 134,447 premises supplied in the State of Massachusetts; and in the city of Philadelphia, for the same year, there were 153,546 premises supplied. There can be little doubt that there are in the United States to-day nearly 2,000,000 premises supplied with gas.

The history of the gas-works in Philadelphia may be taken as typical of the history of the earlier plants erected to supply gas; and this plant, being operated by a city, has records which are available for the scrutiny of the historian. Apparently the earliest attempt to secure gas-works in Philadelphia was made in 1815, when it was proposed to manufacture gas from wood. This attempt failed. In the winter of 1826–27 there was a proposition made to erect works and light the city lamps with gas. This plan also failed. There was at this time a strong opposition on the part of certain Philadelphians, many of them men of high standing, to the introduction of gas, it being claimed that there was danger to life, limb, and health from the erection of gas-works and the distribution of gas. It was not until 1835 that an ordinance for the construction and management of gas-works was passed. This ordinance provided for the issuing of stock to the amount of $100,000. It was estimated that the lighting of the entire city would require 20,000 burners, consuming an average of four feet per hour each. The works were completed early in 1836, and in 1837 distributed 17,000,000 cubic feet of gas. The gas was made from bituminous coal, and 6816 private burners and 301 public lamps were supplied. The growth of the business is shown by the following figures:

PRODUCTION OF GAS.

Year.	Gas Made. Feet.	Number of Consumers.	Price per Thousand.
1840......	56,410,000	2,393	$2.25
1850......	182,016,000	9,216	2.25
1860......	639,578,000	41,200	2.25
1870......	1,241,485,000	66,943	$2.55 and $2.30
1880.....	2,173,010,000	99,035	2.00
1890......	3,311,995,000	134,555	1.50
1894......	4,110,401,000	154,743	$1.50 (3 Mos.) and $1.00 (9 Mos.)

In fifty-four years the sales have increased approximately seventy times, the number of consumers about the same, and the number of burners from 6816, as given above, to nearly 2,000,000.

The history of one of the earlier companies, the New Orleans Gas Company, shows a similar growth. In 1836 the output was 7,300,000 cubic feet at $7 per thousand; in 1840 the business had grown to 20,075,000, at $7 per thousand. In 1850 the sales were 53,562,000, at $5; in 1860, 132,418,000, at $4.50; in 1870, 238,468,000, at $4. The panic of 1873 was very severe on general business in New Orleans, and a full recovery was not made until after 1880. The gas sales in that year were 230,296,000, at $2.70. Between 1880 and 1890 the candle-power of the gas, which had, previous to that date, been about 16.5, was raised to thirty-three candles, and the consumption fell away until in 1890 it was 181,497,000 feet. This falling off is due to the great increase in the candle-power of the gas. In total illuminating value the gas sold in 1890 was equal to 363,000,000 cubic feet of the gas sold in 1880. The New Orleans Company is one of the few at present in the enjoyment of a legal monopoly.

The first movement toward furnishing a supply of gas to the city of Cincinnati was based upon a communication written by John Towne, a resident of Pittsburg, Pa., under date of September 7, 1827; but it was nearly ten years later—April 3, 1837—when seven public-spirited citizens procured a charter for the purpose of making and vending gas. Though they made active efforts to induce capitalists to advance the funds, and even secured coöperative pledges from the city, all their efforts were unavailing, and four years were consumed in fruitless endeavor. In the spring of 1841, a young Englishman, John S. Conover, appeared upon the field, and after much earnest effort induced the municipal council to pass an ordinance, on the 16th of June, 1841, granting to him and his associates the exclusive use of the city's streets for the purpose of laying mains, and also granting him certain contract privileges in the way of supplying gas to public lamps. He then purchased the charter of the company previously organized, and proceeded to comply with his contract obligations. While blessed with untiring energy, he possessed but little capital, and had a very hard time getting construction under way and fighting off the ceaseless attacks of councilmen. He finally assigned to John H. Caldwell, a capitalist of New Orleans, a half-interest in the undertaking, and with the capital advanced by Mr. Caldwell was enabled to turn gas into his mains on or about January 1, 1843. Two years later he died at Bedford Springs, Pa. John H. Caldwell then succeeded to the presidency and assumed the management of the company. The capital of the company was nominally $100,000, though probably not half this sum had been expended in building the works and laying about six miles of mains. The price then charged for gas was $3.50 per 1000 cubic feet. December 1, 1846, the price of gas was reduced to $3, and January 1, 1854, to $2.50. The company had, January 1, 1847, 546 meters and 192 public lamps in use, supplied through 32,487 feet of main pipe from two to eight inches in diameter. Dry meters were first introduced in July, 1847. By January 1, 1848, the number of meters was 738, with 289 lamps; and the largest "send-out" in one day, 88,600 cubic feet. Clay retorts, imported from Belgium, were introduced in December, 1861, and exhausters in October, 1863. The following table represents the growth of the enterprise:

EMERSON McMILLIN.

PRODUCTION OF GAS IN CINCINNATI.

Year.	Cubic Feet.	Consumers.	Lamps.
1845	7,947,300	561	181
1850	33,039,900	1,593	486
1855	71,359,200	4,401	1,220
1860	157,216,200	7,560	2,102
1865	245,441,200	9,893	2,780
1870	355,449,000	12,247	3,328
1875	577,244,000	13,000	5,042
1880	518,336,000	13,828	6,957
1885	751,278,000	16,601	7,488
1890	1,076,780,000	20,978	9,676

The capital has been gradually increased, as extensions demanded, to its present requirements of $8,500,000, with market value of $17,000,000. The price of gas has been periodically reduced from the initial price of $3.50 to the present price of $1 per 1000 cubic feet.

Gas-lighting in the city of New York has increased at a rapid rate. Efforts to obtain accurate data from some of the larger companies failed to elicit a response. It is safe to assume, however, that the output for the year 1894 was, in round numbers, 12,000,000,000 cubic feet.

In the first days of gas-lighting in America the material used was almost exclusively soft or bituminous coal. In some Southern cities rosin and pine-wood were used, and during the war these materials were very largely employed in towns which were unable, owing to the blockade, to obtain coal. The gas made from soft coal had an illuminating value of approximately fifteen to seventeen candles, and was considered a brilliant illuminant in the earlier days, when comparison was made with whale-oil lamps and tallow dips. But the advent of kerosene-oil and the improvement in oil-lamps marked the commencement of an era of higher candle-power, and, by creating a new factor in the competition for urban lighting, promised to reduce the rapid growth of the gas business. While its convenience and safety would, in the face of any oil competition, insure gas a large share of the lighting business of cities, the quality of gas supplied in 1870 could not, at 1870 prices, compete on the basis of cost per unit of light with the oil-lamps of that day, and its value as a cooking and apartment-heating fuel had not been demonstrated. Its prospect was somewhat dimmed. At this crisis in its history a Frenchman, Tessie du Motay, and an American, Professor T. S. C. Lowe, of aëronautic fame, were independently experimenting in the manufacture of gas by the dissociation of steam in contact with incandescent carbon. The result of these experiments was the development of the water-gas systems that bear the names of the distinguished inventors—the cupola-retort system of Du Motay, and the generator-superheater system of Lowe, the most important of all inventions affecting the manufacturing of gas. The experiments of Tessie du Motay, as well as of Lowe, were carried on in the United States, and the development of the water-gas system is purely American. The first plant of any magnitude under the Tessie du Motay system was erected for the Municipal Company, of New York City, by the Continental Iron Works, of Brooklyn, N. Y. Under this type may be included the Jerzmanowski and Wilkinson processes. In all processes of this type the non-luminous water-gas is generated in cupolas, carbureted with oil vapor, and passed through retorts externally heated, the gas thereafter being condensed and purified, as in coal-gas and other water-gas systems.

The Lowe process, covered by patents dated 1872 and 1875, may be regarded as the basis of the modern water-gas system. It covers, broadly, the use, in connection with a generator in which non-luminous gas is made, of a superheater, or fixing-chamber, fired by internal combustion, the combustible being the gases which are formed during the process of "blowing up"; that is, during and from the passage of air through the fuel in the generator. This air is blown through the fuel—hard coal or coke—at a high velocity, for the purpose of raising the fuel to a condition of incandescence, fitting it to dissociate the steam admitted during the gas-making period. The Lowe process further covers the introduction of oil or other enriching substances into the non-luminous gas, and the fixing of this oil by passage through the super heater. The first Lowe apparatus was erected at Phenixville, Pa., in 1873. A short time later one was erected by the inventor himself at Conshohocken, Pa., and a third, also by him, at Columbia, Pa.

The modern water-gas apparatus is undoubtedly the double superheater or improved Lowe, a development of the Lowe idea by the United Gas Improvement Company, the owners of the Lowe patents (now lapsed) for the greater part of the United States. Many modifications of each of the two water-gas systems have been made and patented by their inventors, but none of these have been of sufficient importance to command special attention or to overshadow the original inventions. After several years of neglect or bitter antagonism on the part of the coal-gas interests, the water-gas processes obtained a firm footing, and since 1880 the introduction of water-gas has been rapid. In 1880 there were in operation approximately 12 plants of the Tessie du Motay type, and approximately 75 plants of the Lowe type. By 1890 the number of Du Motay plants in operation had grown to 30, and the number of Lowe plants to 260. At this writing it is estimated that there are in operation 40 plants of the Tessie du Motay type and its modifications, and 350 plants of the Lowe type and its modifications. There are about thirty-five companies operating water, oil, and combined plants of various forms, included in the above estimate. Every city in the United States of over 400,000 inhabitants uses water-gas, wholly or in part; and all but six of the cities of over 50,000 population by the 1890 census have water-gas plants.

It is to be noted that among the largest water-gas plants in the country are the Tessie du Motay plants in New York City and Baltimore, and the Lowe plants of Boston, Providence, Chicago, and the Twenty-fifth Ward Works, Philadelphia. It is probable that at this date seventy per cent. of the illuminating gas manufactured in the United States is water-gas, and by far the greater volume of this is made under the Lowe process. Among the modifications of the Lowe apparatus, but covered by the Lowe type, are the Granger-Collins, Hanlon-Leadly, Springer, Flannery, McKay-Critchlow, Martin, Pratt and Ryan. These are all of the generator-superheater type, variously modified according to the ideas of the inventors.

There are several points of advantage in the operation of a water-gas plant, each of which had its weight in the argument that finally persuaded so many coal-gas makers to adopt the water-gas process. In its influence on the extension of the use of gas, the particular point of advantage was the candle-power. Water-gas is sold of candle-powers varying from twenty-two, for a probable minimum, to thirty-five candles in Pensacola, thirty-three in New Orleans, and thirty in New York, with a probable average throughout the country of twenty-five to twenty-seven candles.

Americans are peculiarly fortunate in the quality of gas supplied them. There is probably not five per cent. of the gas manufactured and sold in England that is above seventeen candle-power, and some of the English companies are chartered to supply gas at as low as fourteen candle-power. When we remember that, with few exceptions, the large cities of this country are supplied with gas of above twenty candle-power, and that the far greater part of the gas supplied to them is twenty-five candle-power and above, while, with rare exceptions, the smaller cities (above 25,000 inhabitants) are supplied with gas of twenty to twenty-five candle-power, we can see how much more illumination the American is getting per 1000 cubic feet of gas bought than is his English cousin. In the matter of impurities in the gas the American is equally fortunate. The English law allows twenty grains of sulphur in forms other than sulphureted hydrogen, and three grains of ammonia, per 100 cubic feet of gas. The average of sulphur per 100 cubic feet of gas sold in the United States is certainly not above twelve grains, and the ammonia may be truly said to be a mere trace. A long series of analyses, extending over a period of ten years, in one of the largest cities of the country, has shown the gas to contain, approximately, ten grains of sulphur per 100 cubic feet, with practically no ammonia. The superiority of American coals, and the pride that the American gas-engineer has in the quality of his product, are sufficient explanations of the smaller quantity of impurity in the American gas than in the English gas.

The development of the water-gas process came at a time peculiarly fortunate for the American gas industry, which was just then threatened, as stated above, by cheaper oils and improved lamps. A few years after the invention of the water-gas processes, and during their development, the electrician appeared on the field as a competitor for the business of city illumination. The effect of the appearance of the new light on the value of gas shares was disastrous. The general introduction of water-gas, however, checked the fall in prices and enabled the gas-man to hold his own. The high candle-power of the water-gas made it a cheaper illuminant, unit of light for unit of light, than the incandescent electric lamp; and while the introduction of electricity doubtless retarded the growth of the gas business, it did not succeed in reducing the sales, or even entirely stopping their extension. The fright that the electric light gave gas-men has resulted in good to the companies and to the consumer. Many gas managers believed that their sole refuge from the storm would be in the cultivation of other uses for gas than that of illumination. This idea resulted in the development of the gas-stove for cooking and heating, and of the gas-engine and many other mechanical devices for the utilization of gaseous fuel. This branch of the business has grown enormously within the last ten years, and there are now gas companies supplying, during portions of the year, fifty per cent. of their product for fuel purposes.

This is a field in which electric energy has so far been unable to compete; and the rapidity of its growth, past and present, indicates that it will soon be the larger branch of the gas business. In the field of illumination, electric invention and the improvement of oil-lamps have made great advances in the last decade, and have threatened again to give the gas industry a close fight for supremacy in this branch of its business. In this crisis, invention again helps the industry of which I write, making its method of illumination so much cheaper than the incandescent electric lamp or the kerosene lamp that it is apparently only a question of a brief period until—except for special work—gas will be used almost exclusively for illumination wherever gas mains are laid. This new factor is the Welsbach lamp, the invention of Auer von Welsbach, of Vienna. It develops an illuminating power of twenty candles per cubic foot. This means that five feet of the gas will give a light of 100 candle-power, making the illumination, from a given quantity of gas, from six to seven times greater than could be obtained with the best burners known to the art thirty years ago. The Welsbach invention has so cheapened gas-light that it may be said—on the question of cost per unit of illumination—that it has no competitor but the heavenly bodies.

The convenience with which the electric arc is lighted and extinguished gives it an advantage over gas, even with the Welsbach burner, for the illumination of streets, large railway-stations, etc.; but even in these places the Welsbach light is making progress in competition with electric light. The rapidity with which the use of this burner has grown within the past two years is one of the wonders of the history of gas-lighting. It is estimated that there are now in use, approximately, 1,000,000 Welsbach burners in the United States, and it is believed that the sales for the year ending June 30, 1896, will aggregate 1,500,000 burners.

For many years "gas logs" and gas-heating stoves have been in use in a limited way. Neither have met the popular requirement, either from an effective or an economic view. About 1890 a combination gas-heater and steam-radiator, the invention of Q. S. Backus, of Philadelphia, was brought to the attention of gas companies and the public. For three or four years it met with indifference, and in many instances open hostility, on the part of gas managers. During the past year, however, it has rapidly grown in favor, and at present the demand for these heaters exceeds the supply. It is by far the most economical of any of the inventions for heating by gas that have yet been offered to the public of which the writer has knowledge.

The history of the gas-lighting industry in the United States would not be complete without a reference to the standing of the companies in the communities in which they operate, their relation to the municipalities, and the trend of legislation affecting them. In the early days of gas-lighting monopoly franchises were commonly granted to companies agreeing to stated and generally easy conditions. The industry was regarded as hazardous, and legislators, anxious to secure for their constituents the possible advantages of the modern system of illumination, found that capital could be tempted into the untried field only by the offer of a special concession. This ordinarily took the form of a franchise, exclusive for a term of years estimated to cover the time of development, and a period of profitable operation in which to earn interest on the investment for the life of the franchise. The right to use the streets and continue the business of supplying gas was not ordinarily made to terminate with the exclusive clause of the franchise. A few years of experience demonstrated the safe and profitable character of the business, and capital becoming more willing, legislation became more exacting. Exclusive franchises were less readily granted, and conditions as to price and quality and amount of investment were attached, and the right of municipalities to interfere in the conduct of the business of established companies was asserted. This tendency has grown with the century, until in its closing years exclusive clauses are almost unknown, and many Western cities are attempting to fix the price at which gas shall be sold within their boundaries. Franchises are now commonly granted for a term of years, the right to charter other companies being reserved, and conditions as to price and quality of the gas supplied being attached.

A number of attempts on the part of councils and legislatures to fix prices at which gas and electric light shall be sold and the business of the common carriers conducted have of recent years been the subject of judicial investigation and decision. The tendency of these decisions is to limit the power of regulation to the fixing of a reasonable rate, the adjective "reasonable" being construed to be a rate that should not result in the depreciation of the value of the property of the company affected. There is every reason to believe that gas companies, in common with railroads and other corporations serving the public, will be protected in their right to earn an interest that shall be commensurate with the investment, and with the risks of the business.

Gas companies, because of their commonly enjoyed monopolistic privileges, either actual only, or actual and assured, and because of the fact that their commodity is taken as wanted from a maintained supply, and paid for after use, have been generally subjected to the suspicion of the unthinking, and charges of extortion have been common in the public prints. This feeling on the part of citizens and officials that gas companies were getting more than their deserts, and the belief that there are fabulous profits to be earned in the gas business, have resulted in some instances in the acquisition of gas property by municipalities. The example set by the city of Philadelphia, which in 1841 took over the gas-plant, and has since continued it as a branch of the city government, was followed later by Wheeling, W. Va.; Richmond, Va.; Danville, Va.; Charlottesville, Va.; and Hamilton, O.

The result of municipal ownership and management of gas properties has not encouraged other cities to acquire works. It has been amply demonstrated that it is better for the municipality and better for the citizens that the gas-plant should be conducted by private enterprise. With the single exception of Hamilton, O., there has been no recent instance of the erection or purchase of a gas-plant by a municipality in the United States. The Hamilton works were erected about 1890.

American gas literature contains but few books. The American contributions have consisted principally of papers read at gas association meetings. Many of these papers have been of the highest order, but for our more formal literature we have been dependent upon Europe. There are three periodicals devoted to the gas industry at present published in America. In the order of their age they are the "American Gas-Light Journal," of New York; "Progressive Age," of New York; and "Light, Heat, and Power," of Philadelphia. For the purposes of the American gas-man they are more valuable than the journals published abroad.

The commercial importance of the gas industry is indicated by the amount of money collected from sales of the products of gas-works. While accurate figures are not obtainable, enough information is at hand to indicate that the receipts for gas sold in the United States amounted in 1894 to between $70,000,000 and $75,000,000. It is probable that the receipts for residuals of gas manufacture amounted to an additional $5,000,000, making the total receipts for the products of gas companies $75,000,000 to $80,000,000.

In the first years of gas-lighting—indeed, up to about 1870—lime was the purifying agent of gas manufacture, to the exclusion of every other material. Since 1880, however, the use of oxide of iron as a purifying agent has become popular, and to-day it is probable that more than three fourths of the gas purification in the United States is effected with this material, with a reduction in the cost, and without the nuisance attending the removal of the spent lime.

The American gas business is to-day entirely independent of foreign countries. The New York Gas Company, incorporated in 1823, made its first gas from oil, using rosin later, and in 1860 was distilling English coals for the manufacture of its product. Most of the earlier companies imported the material from which their gas was made from England. Ultimately the opening of American mines furnished them with a bituminous coal that for gas-making purposes has no known superior. In water-gas manufacture America took the lead through invention, and will probably continue to hold it, because of the fact that the materials from which it is manufactured, anthracite and petroleum, found in the United States, are superior in quality to the products of any other country. Meters and clay retorts were originally imported from England and from the continent of Europe. At present American meters and American retorts have no superiors. For many years cannel-coal, for the enrichment of coal-gas, was brought from Scotland and Australia. Beds of cannel equal to any in the world have since been found in the United States, and cannel-coal has been shipped in quantity from America to Europe.

It cannot be said that the business of gas manufacture in America has been made by any man or set of men, or any corporation or set of corporations. Gas is peculiar in that it must be manufactured in the vicinity in which it is used, and, as a rule, local enterprise is responsible for the erection of the local plants. There has been, of late years, a tendency to the formation of what are known as "parent" companies; that is, companies controlling and operating a number of plants, situated in different parts of the country. Of these the best known are the United Gas Improvement Company and the American Gas Company. Such combinations of capital have in them nothing of the objectionable characteristics of the much-abused "trust." Prices cannot be kept up by such combinations. The gas for each city's use must be made in, or close to, that city, and local conditions control the prices. The tendency to-day is toward further concentration in the ownership of gas properties, and there can be no reasonable doubt that such concentration as has taken place up to this date has resulted in good to the investor and to the consumer, chiefly through the introduction of improved processes and apparatus, and the employment of more skilful management.

This is intended to be a history; prophecy is foreign to the purpose of the publishers, and the limit set for the story of the gas business has been passed. Otherwise it would be interesting to speculate on the future of this great industry—the producer and the distributer of the cheapest lighting and heating agent of the present, and possibly of the future. After passing through the recent financial depression with practically no shrinkage in the volume of its business, it finds itself to-day in what promises to be the most prosperous year of its existence, with new and superior appliances for manufacture and utilization to guarantee it a still more prosperous future. "More, better, and cheaper light" will be the demand of the dawning century; and, as in the nineteenth, so we have every reason to believe in the twentieth cycle, gas will fill that demand to the profit alike of its manufacturer and its consumer.

In the preparation of this article the author is indebted for data and assistance to the London "Journal of Gas-Lighting," Brown's "Directory of Gas Companies," the Gas Bureau of Philadelphia, Shelton's "History of Water-Gas," the "American Gas-Light Journal," "Progressive Age," "Light, Heat, and Power," General Andrew Hickenlooper, and above all to Walton Clark, general superintendent of the United Gas Improvement Company, of Philadelphia.

Emerson McMillin

CHAPTER XLIII

AMERICAN PAPER-MILLS

ANTIQUARIAN and philologist, seeking the origin of paper, have always come alike to the same beginning. By the banks of Egypt's great northward-flowing river they have found, green and tall, the papyrus growing. Here the record ends, or rather begins, and with the seventh century before the Christian era the tale of paper making is commenced. Papyrus manuscript has been found, it is true, of a seemingly far earlier date; but the authentic record begins with 670 B.C., in which year a dweller by the Nile, named Numa, is believed to have written several works upon this paper. Later in the same century there were manufactories of paper from this aquatic plant in Memphis, papyrus being for many years one of the products of the land of the Pharaohs, and an important article in the commerce of that ancient day. Both Greece and Rome, despite the fact that parchment from the skins of sheep and goats appeared and went into common use during the second century B.C., used much of the papyrus product every year; and as the supply could never meet the demand, the price was always high.

The papyrus paper was formed from the thin, separated films of the plant, superimposed upon one another crosswise to the desired thickness, made coherent by pressure, and smooth by drying and polishing. Of the paper of to-day, the Chinese, who seem to be credited with every art the beginnings of which are sufficiently remote to be uncertain, are believed to be the originators. A mandarin of the palace in the year 95 A.D. is said to have been the first to make a fibrous pulp from which paper could be produced. In addition to the bark of the mulberry or bamboo this ingenious Oriental used cotton and hempen rags, the paper thus obtained soon demonstrating its superiority over anything then known in the Flowery Kingdom. It is still made there to-day, after much the same primitive methods as were used at that time. From China to Tartary the art of pulp making extended, and there the fiery Arabs, when they humbled the Tartar hordes about 170 A.D., are supposed to have found and borne it home with them to the West.

Paper made from a pulp of linen rags is first known in an Arabic manuscript of the "Aphorisms" of Hippocrates of the date 1100 A.D. Coincident, almost, with the appearance of linen paper was the final disappearance of the papyrus roll from general use. It had been little used for centuries, parchment taking its place. It was not until 1290 that the first paper-mill was established in Germany. Forty years later Italy followed suit, and France and Austria came next after a few years. England was among the last, the first mention of the art of paper making in that country being late in the fifteenth century. During the next three centuries the art became general, and Holland and France took the lead over all other nations. In Holland windmills were used instead of the water-mill elsewhere, and the Dutch were also the first to use machines, called Hollanders, or engines in macerating the rags into pulp.

Colonial enterprise turned to paper making in the New World among the very earliest of its endeavors. The fringe of population from which was to grow one of the mightiest and most numerous nations on earth had scarcely stretched from the mouth of the James River to Massachusetts Bay before the first mill was started. William Rittinghuysen (now Rittenhouse), a native of Broich, Holland, was the first paper maker, and he had associated in partnership with himself that celebrated old printer, William Bradford. By the banks of a little stream known as Paper-Mill Run, flowing into the Wissahickon at Roxborough, near Philadelphia, the old Hollander opened his mill in 1690, grinding up the rags of the home grown and woven flax for pulp. For twenty years this mill represented the American paper trade, a second being established only in 1710 near the first one, by William de Wees, a brother-in-law of the original William Rittenhouse's son.

At this time all paper making was by hand; and until 1750, when the pulp-engine was invented in Holland, and 1756, when it was introduced into America, the rags were beaten into pulp by hand. The pulp-engine accomplished a great saving in time and labor. The effect of its introduction was seen in 1770, when the three colonies of Pennsylvania, New Jersey, and Delaware alone had a total of forty mills, turning out an annual product valued at £100,000. The process of manufacture in these old mills, where everything was done by hand, and still kept up to-day in the making of some special kinds of paper, was very simple. The pulp floating in great vats was dipped out by the workman on his "mold," around the outer edge of which he formed a rim by superimposing a thin frame known as a "deckle." This kept the pulp from running off, as the water drained away through the wire cloth of which the bottom of the mold was made, and allowed it to settle in a thin film or layer over the surface of the mold. It was then passed to another man, known as the "coucher," who dexterously applied the pulp-covered mold to a sheet of felt, where the pulp adhered and the mold was removed. This left a thin sheet of pulp evenly disposed upon the felt. Another piece of felt was placed on the top of this, and another mold applied, the process being continued until the pile reached a certain height, when it was called a "post," and removed to a press where the water was expressed. The sheets were then removed from the felt, pressed, and hung up to dry over "tribbles" or lines in the drying-room. When this was finished, the sheets, which were rough and like blotting-paper, were dipped in size, pressed, and dried again, coming out finally the finished paper. This process, briefly described, is that by which all paper was made prior to the invention and perfection of the Fourdrinier machine, during the first decade of the present century. Neither this machine, nor any other, in fact, was known in this country until several years after their use had become common abroad. Despite this the industry had progressed, and, after a great scarcity of paper during the Revolutionary War, it was beginning in 1795, when the century we are now to consider opened, to make appreciable headway. The first mill in the northern part of New York State had only been erected the preceding year at Troy by Messrs. Websters, Ensign & Seymour. This mill turned out from five to ten reams daily, using rags in making its pulp, as did all the others at that time. The scarcity of rags was one of the great difficulties with which these early manufacturers had to deal. Stirring appeals to the ladies were constantly appearing in the public prints, beseeching them by their patriotism to stand by American industries and save their rags. A further, if less lofty, argument was made to this end in the offer of the manufacturers to pay three pence per pound for white, brown, blue, or checked rags, delivered at the mill. The first mill in the United States to use other than rags for pulp was one which was built this same year by Matthew Lyon at Fairhaven, Vt., and which made use of the bark of the basswood-tree in the manufacture of coarse wrapping-papers. While the exact number of mills in operation in 1795 is nowhere stated, it is known on the authority of Debrett, in his "Bibliotheca Americana," that six years before the United States was producing paper enough for its own consumption.

By the primitive methods of that time the American paper makers continued to abide even so far into the present century as the latter half of the second decade. During this time, in France and England, there was being perfected one of the most wonderful machines which the ingenuity of man has ever devised. This was the so-called Fourdrinier machine; and while it was not an American invention, the history of paper making, whether here or elsewhere, demands its mention. Despite its name, it was originally the invention of one Louis Robert, a workman in the mill of François Didot at Essone, France, who, in 1799, secured a patent for the making of paper by an endless web-machine. The internal troubles of France at this time being highly unfavorable to the development of any great industrial undertaking, Robert sold his patent to Leger Didot, who went to England in 1801, and in association with John Gamble, and later Bryan Donkin, attempted to perfect the invention. Didot's funds were scanty, however, and in 1804, having interested two wealthy London stationers, brothers named Henry and Sealy Fourdrinier, in the matter, he transferred his interests to them. They erected a plant at Boxmoor, and began a series of experiments which, though finally successful in producing a practicable machine, ruined them financially. Their sole reward, for all they did for the paper-making industry, has been that the machine they brought out has been named after them.

The Fourdrinier machine, as it was presented in 1806, revolutionized the making of paper. A seven-vat mill, operated under the old system at an annual expense of about $13,000, could run with a machine for about $3600, an annual saving of $9400. While the form of this machine has changed often and greatly since 1806, the essential principles it then established are the basis of paper making to-day, and its process is the one still in use. It consists of an endless web of revolving wire cloth, upon which flows evenly a stream of liquid pulp. As in the hand process, the water drains away from the pulpy mixture as the whole is borne on and up by the running wire cloth, and the precipitation of the pulp-sheet is completed just as the wire web meets an endless belt of felt, which takes the fresh pulp from the wire and carries it through large metal rolls, where it is pressed and taken from the felt, in the same condition as the hand-made product when the "post" comes out from the presses; then it passes over cylinders heated by steam, which dry the paper, leaving it ready to be polished and cut into sheets. This is substantially the process in use to-day; but the modifications and improvements now employed would render it difficult to recognize the early machine. To-day the pulp goes in at one end of the Fourdrinier machine to come out at the other finished paper, sized, dried, calendered, and cut into sheets, or wound in immense rolls ready for the modern press.

Besides this machine, a second was invented in 1809 by an English paper maker named Dickinson. It was called the "cylinder-machine," and differed from the Fourdrinier in having a hollow, perforated, wire-gauze-covered cylinder placed directly in the vat with the pulp-water. In motion this cylinder drew out the water, leaving the pulp-sheet precipitated on the wire gauze, by which it was carried to the felt, which carried it through the couching-rolls, and on as in the Fourdrinier machine. This machine, or rather an American invention of similar nature, seems to have been the first paper-making machine employed in this country, one having been built and operated by Thomas Gilpin & Company at Wilmington, Del., in 1817. This machine of Gilpin's turned out a sheet wider than any then made in this country, and of any length desired. The introduction of the Fourdrinier or any other machine from Europe did not occur until three years later, and it was ten years after that, again, before they were commonly used or their manufacture begun here.

Meantime the manufacture of paper was steadily increasing. In 1810 there were 185 mills in the country, turning out an annual product valued at $811,000. In that year, owing to the insufficiency of the supply from domestic sources, the importation of rags was commenced. All paper-stock at that time was made from rags, and the trade in them was a large one. Rag-pulp is still used in many of the more expensive grades of paper, and its manufacture is a distinct process in itself. The rags are first cleansed and softened, by boiling in a strong lye of caustic alkali or lime, from which they are transferred to a washing machine or engine, where a heavy cylinder with knives partially macerates them, and everything is removed except the vegetable fiber itself. It is then treated with a solution of bleaching powders; the mass is placed in great stone bleaching vats, and allowed to remain until the bleaching process is complete. The water is then drawn off, and the partially prepared stock, known as "half stuff," is taken to the beating-engine, where it is washed with water to remove the chlorine, and is then reduced to pulp ready for the Fourdrinier machine.

In 1817, the first steam paper-mill in the country was put into operation at Pittsburg, Pa. This mill, which employed forty persons, consumed 120,000 pounds of rags yearly, and turned out a product valued at $20,000. The coal required in generating the steam necessary for running the sixteen horse-power engine of this plant was 10,000 bushels annually. Three years later the Gilpins, on the Brandywine, began the introduction of foreign machinery for making paper. There was at this time an annual output of $3,000,000 from the paper-mills of the United States, and 5000 persons found employment in them. The popularity of the new machines was far from immediate, as they were too expensive. In 1822, John Ames, of Springfield, Mass., produced a new cylinder-machiue. It met with some success; and in 1829, Isaac Saunderson, of Milton, Mass., and Reuben Fairchild, of Trumbull, Conn., patented improvements based on it which did much toward introducing it to general fame. Culver and Cole, of Massachusetts, also participated in the improvements brought out in this year, and the cylinder-machine has been in general and extended use ever since. During that year the paper production of this country reached $7,000,000, and 10,000 men, women, and children earned a livelihood in the mills. The same year (1829) also saw straw and grass first utilized here in the making of paper by machinery. G. A. Shryock, of Philadelphia, was the manufacturer who accomplished this, and he claimed to be the first in the world to do it, inasmuch as the straw paper made in England by Matthias Koop, in 1801, had been hand-made. The manufacture of Fourdrinier machines in this country was begun in the next year (1830)

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by Messrs. Phelps & Spofford, of Connecticut. They succeeded in turning out good machines, which were capable of very fair work. The introduction, in 1831, of chlorine as a bleaching agent, to whiten and cleanse the pulp-fiber, helped in the advance which the increasing use of machinery had brought about. As an almost universal bleacher the new chemical permitted the use for paper-stock, of colored and dirty rags, hemp, tow, and many other previously unavailable fibers. This of itself was a great benefit to the paper trade, for the scarcity of material for paper-stock was already causing serious inconvenience, and many were the experiments made, in the attempt to find new and more plentiful substances.

The history of the paper trade for the next three decades is mainly a history of research and experiment. All the expedients of ingenuity were employed to continue along on the old lines, and all the invention of that same ingenuity was being exhausted in the attempt to discover new lines, at once more practicable and more profitable. Nearly every substance known or believed to have the fibrous qualities needed was experimented with more or less successfully.

The first real and practical advance along the lines indicated by these experiments was not made until 1854. Many inventions were recorded, in the mean time, for improving, simplifying, and expediting the processes of manufacture; but until that date the main object was still as far from being attained as ever. The business had extended, though, very greatly, and by 1842 it was estimated that $15,000,000 represented the value of the annual production. The capital invested in paper-mills was placed at $16,000,000, and nearly 50,000 people were dependent upon the employment it afforded for a living. The consumption still kept ahead of the domestic supply, and the paper exports for that year were valued at only $69,862, as against imports amounting to $92,771. The importation of rags had increased during the thirty years it had been going on, until in this year it amounted to nearly $500,000. By 1850 these figures had still further increased. A total capitalization, for 500 mills, of $18,000,000 was turning out an annual product of $17,000,000. The importations of rags had increased to $750,000, and the imports of paper itself amounted to $496,563. There were at this time only five mills in the country still turning out exclusively hand-made paper, and the paper-machine had been improved the previous year to the point where laid paper was being produced with it. A. H. Laflin, of Herkimer, N. Y., was the manufacturer to introduce this improvement, although the machine-papers had long had the water-mark, a small cylinder with the desired impression nearest the couching-rolls having been invented for this purpose many years earlier.

A new era began for the paper makers in 1854. In that year, A. C. Mellier, a Frenchman, discovered the process that has since borne his name, and which consisted in the conversion of certain vegetable fibers, notably straw, into pulp. The process consisted in boiling the soaked and cleaned straw in a solution of about four per cent. of caustic soda, and at a temperature not less than 310° Fahrenheit. The paper produced from pulp thus made was claimed to be superior to anything ever yet brought out for newspaper. The process was patented in 1857, and the same year, J. B. Palser, an Englishman, of the firm of Howland & Palser, began the manufacture of straw paper at Fort Edward, N. Y., and in 1859 secured patents for improvements on the process that came later to be universally adopted. From this time on, during the war, and for a few years after, straw paper made by this process was the staple of the market, and nearly all newspapers were printed on it. The farmers of the country appreciated their rye straw in those days, when the price jumped almost at a bound from $6 to $20 per ton. There were many objections to the straw paper, however, and experiment was by no means ended in the matter of pulp ingredients. The silicious nature of the straw gave the paper a glassy, brittle surface that wore out type at a rate direful for the newspaper proprietor to contemplate. A dress of type that on other paper would have worn a year, was used up in three months. Furthermore, straw paper would have been useless on the fast presses of to-day, because it was neither soft nor absorptive, nor could it, owing to its brittle surface, be printed from the roll. Such as it was, however, the newspapers were glad to get it; and from twelve to twenty-six cents per pound was the price they paid for it during the war, an amount which to-day would make a modern paper manufacturer a millionaire, and beggar the newspaper publisher in a few months. We find the 555 paper-mills of the country, in 1860, turning out an annual product valued at $21,000,000, which exceeded that of either Great Britain or France. During the next few years, while the Civil War was raging, the demand for paper increased to a very great extent, and new methods were demanded. These were discovered, and have accomplished one of the greatest results of the century; for they have, by the introduction of wood-pulp, made possible a cheap and excellent paper, which gives to the American people cheap newspapers, periodicals, and books. Thirty years ago newspapers such as we have in New York to-day, with paper at twenty cents per pound, would have cost the publishers for paper alone no less than four cents apiece, where to-day the cost is scarcely half a cent.

Wood-pulp and the changes it has brought, not only to the paper trade, but to the world at large, form the final chapter in the story of American paper. Excellent and inexpensive paper has done more than any one thing to develop the American press, and the publishing business. No better evidence of this could be desired than was given last year, at Cornell, in an address delivered by a certain far-famed New York editor, of the school which produced Raymond, Greeley, and the elder Bennett. In discussing the wonderful advance made by newspapers in late years, Mr. Charles A. Dana concludes: "But the great revolutionary agent is the cheapness we have reached in the cost of paper." With this high testimony regarding its importance, we may proceed to a more detailed consideration of wood-pulp.

Many attempts to produce a pulp out of the softer kinds of wood had been made, and many patents had been issued for such processes both here and abroad, prior to 1854. This year, the same one which brought out the Mellier process, also saw the first patent for a chemical wood-pulp that was practicable, secured by Watt & Burgess, of London. This process, in a crude form, was the soda-pulp that is still in extended use. It began by boiling the wood in caustic soda lye, after which it was subjected to the action of chlorine. Both this, and the later and much-improved sulphite process, produce in effect a more fibrous pulp than that to which the name wood-pulp is more commonly and properly applied.

The patent of Watt & Burgess was assigned by them to Ladd & Keane, who secured a reissue in 1858. In the mean time, however, in 1855, Hugh Burgess, of Roger's Ford on the Schuylkill, brought out a similar process in this country, using the wood of the poplar. His patent and that of Mellier were later purchased and continued, in 1865, by the American Wood-Paper Company, of Manayunk, Pa., and a considerable quantity of poplar-pulp turned out by it.

While the manufacturer of the chemical pulp, or wood-fiber, was thus slowly working here, the ground wood-pulp was being developed abroad. A German named Keller patented a wood-pulp grinding-machine in 1844. He figures as the originator of the process, but having no money he sold his invention to Voelter, who developed the grinding of the wood by stones, and is usually credited with being the discoverer. The ground wood-pulp was used by Voelter in Germany, in large quantities, for the manufacture of newspaper as early as 1847, and two years later the process was introduced into France, at Souche. In America the ground wood or wood-pulp was first successfully made by Alberto Pagenstecher, at Stockbridge, Mass., and put into printing-paper, in 1867, by Wellington Smith, William A. Russell, and myself.

The prominence that the paper industry has achieved since the introduction of wood-pulp, and the extent of the trade relations arising therefrom, are the best and most direct evidences possible of the usefulness of the product. To-day paper figures, either wholly or in part, in more diverse and numerous articles than any other one substance known. It is manufactured into boards, roofing, boxes, barrels, pails, furniture, buttons, collars, tapestry, belting, car-wheels, carpets, canoes, and even at one time, some few years ago, into coffins, which were declared more enduring than those of lead, steel, or wood. All these, and many more uses, seemingly outside its ordinary and proper sphere, make paper an article of the greatest demand. The great metropolitan newspaper, consuming many tons a day, needs a mill to feed it alone. The consumption is something enormous, and will always be an increasing one. When modern paper making from wood-pulp was in its infancy, about 1869, and rags were still largely used, the dimensions to which the paper-manufacturing trade had grown were indicated by the fact that, at New York alone, the importation of rags amounted to $2,149,202. Besides this the entire domestic rag product, as well as thousands of tons of wood and straw, was being put into paper; and yet not only was it all consumed at home, but a considerable quantity was imported in order to supply the demand. The figures of exports and imports of paper for this year (1869) are perhaps the best indication of the condition of the trade at that time. The imports amounted to a total of $355,511, of which $96,158 were credited to newspapers, and $259,353 to fine writing-papers. Contrasted with these figures were the exports, which for paper manufacturers of all sorts amounted to less than $20,000.

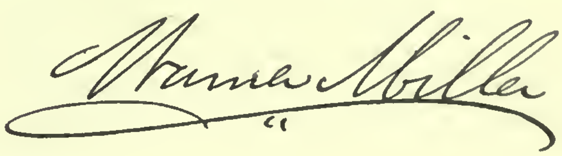
The growth that has come in this trade, during the quarter of a century that has elapsed since then, has been remarkable. The following year (1870) the mills engaged in the manufacture of paper in this country were estimated to number 669, with an annual production of $48,436,935. Six years later, despite the depressed condition of affairs resultant upon the financial troubles of 1873, the number of mills had increased by nearly 200, and their production was sufficient not only to supply the home market, but, still further, to lay the foundations for a decidedly profitable export trade, which has remained ours ever since. The paper exports for 1876 amounted to $96,138, while the imports, on the other hand, had increased, although in less proportion, to $1,218,159.

The year 1880 saw a still further addition to the paper-manufacturing interests. Of paper-mills proper there were 692, with a combined capital of $46,241,202, and an annual output of $55,109,914. Besides these, the manufacturing interests in the coördinate branches of the paper industry, such as paper bags and boxes, envelopes, wood-pulp, and cardboard, included 543 mills, with an aggregate capital of $7,922,646, and a production of $18,684,127, making the totals for the paper industry of the United States for this year (1880) as follows: mills in operation, 1235; total capital invested, $54,163,848; aggregate product, $73,794,041.

In 1886 the import and export trade showed an increase for the ten years, particularly noticeable in its exports. This tendency to a more equable adjustment of the balance of trade indicates the healthful condition of the industry. The exports had made the extraordinary jump from $96,138 to $1,106,616, while the imports had increased by only about $600,000, their total value being given as $1,838,822. In addition to this, the enormous amount of $5,194,951 was represented in the importation of rags and crude paper-stock, which were admitted free of duty, and swelled the total of importations due to the paper industry to $7,033,773.

The number of mills in the country had increased by 1890 to 1086, operated exclusively for the manufacture of paper or pulp. Of their product an amount valued at $1,226,686 was consumed in the export trade, while of rags and crude paper-stock from foreign countries the mills imported to the value of $5,261,448. The general consumption of the country further demanded imports of manufactured paper aggregating $2,816,860, which, added to the paper-stock importations, gave a total for this year of $8,078,308.

In 1892–93, the mills of the country were turning out annually considerably over 3,000,000 tons. Of this enormous amount the news and book prints consumed between 750,000 and 800,000 tons, which was a third more than went into wrapping-paper. The writing-paper consumed was estimated to be in the neighborhood of 150,000 tons. At the present time the available figures place the total number of mills in the country at 1101, with a daily production averaging about 10,000 tons, in round numbers. For the supply of these mills there was imported in 1894, crude paper-stock to the value of $3,048,094. Imports in addition to this amounting to $2,628,351 were received during the same period, credited to paper and its manufactures, making the total importations of the paper trade for that year $5,676,445. The export trade also has increased, and so large has it become with England, that that country has recently ordered that in all reports of imports, rendered by the customs officials, the paper and manufactures of paper coming from the United States shall be so specified and made a separate item; whereas they have always previously been included in the lump sum given under the classification "From all other countries." Last year, the total of the paper exports from this country was $1,906,634. The dimensions to which the domestic trade had grown meantime are shown in the fact that the production of news and book paper alone was more than $45,000,000, or nearly as much as the total production of the country for all grades, twenty-five years ago. With this still so recent advance, achieved in the last quarter of a century of endeavor, it is perhaps a little improbable that the near future will see any such pronounced changes as those which have brought things to the present point. It is rather more reasonable to expect that for some time to come the progress of the paper industry will be along the lines of a natural and healthy growth of the present establishments. That this growth will come is certain, as it is also that developments will follow as fast as they are needed to keep the paper-mills of America in the place they have won in the front rank of the world's industries.



CHAPTER XLIV

AMERICAN PUBLISHING

WHAT is understood by a "publisher," in the generally accepted meaning, is defined as "one who, as the first source of supply, issues books and other literary works, maps, engravings, musical compositions, or the like, for sale; one who prints and offers books, pamphlets, engravings, etc., for sale to dealers or the public." This definition—a comprehensive one—includes the publishers of newspapers; but the business of journalism, being distinct from that of book publishing, need not be further referred to, save incidentally.

One of the differences which exists between the book publication of the past and that of to-day is in the primal source of derivation of the matter printed. This change is due to the immensely greater distribution of newspapers and magazines, and the improved methods of intercommunication. Half a century ago literary matter was usually issued or published for the first time in book form, and with few exceptions the text had never been read before; whereas it is a common practice to-day for an author to supply a magazine or a newspaper with his writings, which, widely read in daily, weekly, or monthly issues, are afterward put in book form. As a volume it is then, however, only a "first source of supply" when considered in a material sense. Generally the text collated in this way is republished in book form by the firm in whose journal or magazine the text originally appeared; but sometimes, by prior arrangement with the author, this is not the case, for in its book form the work may be published by another house.

There have always been reprints of particular books. A popular work of a past century, in the one hundredth year after its first publication, is often found to have been reprinted twenty times by as many different publishers. Of the world's great standards, hundreds, and in some cases thousands, of editions have appeared. Old lamps are made as good as new, and if they have served as shining lights in the past, it is to the advantage of mankind that they should be kept constantly luminous to-day. There is, nevertheless, a distinction to be made—but not in the least of a disparaging character—between the manufacturer of books who takes old works and reprints them, and the publisher who, selecting entirely fresh and original matter, issues this in book form and for the first time.

"Robinson Crusoe," or some other standard book, may appear as a two-cent pamphlet, mutilated by abridgment, on wretched paper, and with blurry type; or as an *édition de luxe*, a masterpiece of typography and binding, with illustrations for which the artist alone has been paid $10,000. Both works are, in a sense, manufactured. In the cheap book to be sold for two cents there is the minimum of risk; in the costly *édition de luxe* perhaps the maximum of risk. But, as to risk, there never was an original work published wherein the element of uncertainty as to the pecuniary result did not exist for the publisher.

The people of the United States are the greatest readers and book-buyers in the world. By means of inexpensive books there is presented the amplest opportunity for instruction and recreation, and when the text of these books is carefully selected, their publishers, in no small measure, cater to the general education of our people. There are, of course, exceptions. In some cases there are, unfortunately, reprints made of vile and vulgar books, and these are issued in all parts of the country. It is not within the province of this article to indicate the methods of suppression.

The origin of the publishing business of the United States may be thus briefly described: In the year 1640 the first book, the "Bay Psalm-book," was printed by Steven Daye at Cambridge, Mass. After its publication in the colony it was reprinted in England, where it went through seventeen editions, the last one bearing the date of 1754.

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It was also a highly popular work in Scotland, twenty-two editions having been printed there, the last dated 1759. It is somewhat remarkable that the first colonial book written and the first book printed were both in verse. Sandys's translation of Ovid's "Metamorphoses" was the first true "copy" written here, although issued in Great Britain; but the "Bay Psalm-book" was the first book put into type in this country. The first original American book printed here was Mrs. Anne Bradstreet's "Poems," and this volume, issued in Cambridge, Mass., in 1640, was republished in London in 1650. Cambridge remained the only publishing town for a long time, and for twenty-one consecutive years issued about one volume per annum. In 1653 Samuel Green published John Eliot's famous Catechism in the Indian language, followed in 1659 by the Psalms in Indian, in 1661 by the Indian New Testament, and in 1663 by the whole Bible in the Indian tongue. This was the first Bible printed in America.

William Bradford, who moved to New York from Philadelphia in 1693, was the originator of the publishing business in that city. To Christopher Sauer, of Germantown, Pa., the United States is indebted for the first Bible printed in a civilized tongue, his German Bible having been issued in 1743. Benjamin Franklin, in the first half of the last century, stood at the case, worked the press with his own hands, first in Boston, then in Philadelphia; and he left an indelible impress on this country, his "Autobiography" being the first book of real importance in American literature.

It is interesting to note that the business of publishing has been identified generation after generation with certain families. Many of the best-known firms of publishers in the United States to-day have carried on their calling for over sixty years—in some cases quite one hundred—through three or four generations. The most notable instance is that one of the direct descendants of Christopher Sauer (established 1738), the publisher of the German Bible in 1743, is still in the business of book publication in Philadelphia. It would be impossible, within the limits of this article, to give any complete list of publishing firms which are carried on to-day by the descendants of those who established the business several generations ago, but a few may be named. For instance, in New York City: Harper & Brothers, 1817; Baker, Voorhis & Company, 1820; D. Appleton & Company, 1825; David G. Francis, 1826; D. Van Nostrand, 1830; Ivison & Company, 1831; John Wiley & Sons, 1832; John F. Trow, 1835; A. S. Barnes & Company, 1838.

In Philadelphia: Lea Brothers & Company, 1785; Henry Carey Baird, 1785; J. B. Lippincott Company, 1835; Butler & Company, 1837.

In Boston: William Ware & Company, 1792; Ticknor & Company, 1832; Little, Brown & Company, 1837.

In other cities: Northampton, Mass., S. E. Bridgman & Company, 1785; Cincinnati, O., U. P. James, 1831; Springfield, Mass., G. & C. Merriam, 1831; Louisville, Ky., John P. Morton, 1825; Richmond, Va., J. W. Randolph Company, 1831; Mobile, Ala., G. H. Randall, 1831; Montgomery, Ala., Joel White & Company, 1833; Lancaster, Pa., John Baer's Sons, 1817.

Above the fireplace in the private office of one of the publishers in New York are the following lines by George William Curtis. They exemplify not only the facts in that particular instance, but seem further to apply to many firms of book publishers.

> "My flame expires; but let true hands pass on
> An unextinguished torch from sire to son."

With the great massing of the population of the country in certain cities, the character of the publishing business has become more general, and the convenience of the purchaser now presents itself as a constant factor. If New York City is to-day the largest book mart and the producer of the greatest number of books, Philadelphia and Boston still hold their own. With new centers of population arising in the West, also, other elements are being introduced, and to-day Chicago is fast becoming an important publishing center. Examining the list, which includes 617 American publishers who issued books in 1894, New York is found to have 187, Philadelphia 60, Boston 52, Chicago 51, San Francisco 12, and Baltimore 9, the remainder being scattered over almost every State in the Union.

The great bulk of the books are published by less than one hundred firms in the four chief cities. The conservatism of the trade is shown in this. Before there were easy means of transportation, as in the first third of this century, a newspaper office in a small town would publish a book, and this business has been retained in a lesser proportion until to-day. In examining the number of books published by the 617 firms it is found that a large proportion of these houses issue only one or two books a year. These publishers of one or two books, however, are not all to be classed as among minor producers of books. In many cases a publisher may turn out but one book in a year, but that single book may be of paramount importance and may cost a very large amount of money to produce.

In tracing briefly the history of book publishing in the United States during the last one hundred years various periods may be indicated. At the conclusion of the War of Independence, with the severance of the bonds which united us with England, there sprang up a demand for books, principally of a religious and educational character. During this early period literary reputation was in a measure dependent on the politician, and many pamphlets on state and international topics were published; but books of theology were in the lead.

The second period of publishing owes its progress in some degree to improved mechanical devices. Stereotyping, first used in the United States in 1813, soon became of universal application, and very much cheapened the price of books, though it led to the persistency of typographical errors, and prevented revision and enlargement when a new edition was called for. The prime material—paper—was, however, costly. The raw material—rags—was not readily obtainable in sufficient quantity at home or abroad, and to furnish the necessary paper for new publications old books and papers were regularly collected and sent to the paper-mills.

The third period is one of marked improvement, and dates from about 1843. It was not alone an awakening on the part of the publisher as to the better manufacture of books, but he called in the artist for illustrative aid. Harper's Bible, with 1400 illustrations, Verplanck's Shakespeare, with 1100 illustrations, and many other works, with and without illustrations, were published in parts during the period from 1843 to 1850 inclusive. They found their way into almost every family in the United States. The many thousands of illustrations made during that period gave employment to artists, especially to wood-engravers, and laid the foundations for that school of American wood-engraving which soon took its place in the first rank, and which, within a generation, was acknowledged to be without an equal.

From 1850 to 1855 the demand for books increased rapidly. The estimated output in 1850 was $10,500,000, and in 1855, $16,000,000, being an increase of over fifty per cent., whereas the population had not increased more than twenty per cent. during the same period. The panic of 1857, the Civil War from 1861 to 1865, and the disturbed state of the country during the reconstruction period did not prevent a steady growth of the publishing interest.

About the year 1872 the publication of standard works in pamphlet form at cheap prices was begun. Within a very few years everything that had ever appeared worthy of note in English fiction, together with books in every other branch of literature, was issued in enormous numbers. Millions of books were put on the market at nominal prices, and the supply exceeded the demand. As a result a change was made in the form of these cheap editions, from a quarto to a handy 16mo or 12mo form; and, in addition, these same books were then bound up in cloth, and offered to the trade at a very slight advance over the cost of paper, printing, and binding. There was a perfect flood of books. Whenever a new book by a popular English author appeared it was seized upon by publishers in every portion of the country, and reprints were thrown on the market. This very excess of books in time brought about its own cure, however. Many of the publishers of these very cheap books went out of business. Others joined together in one gigantic company; and this company, in turn, disappeared. A demand arose for an International copyright law, and resulted in the passage of the law in 1891. This copyright law, during the four years of its existence, has proved to be equally advantageous to the public, the author, and the publisher.

It is needless to state that on the intelligence of a people depends the prosperity of the book publishers. It would be trite to remark that where there are illiteracy and ignorance there can be no demand for books. It is the mental activity existing in the United States which has had all to do with the business of the publisher. There must be interdependence between the author and his readers. Literature belongs to the civilized world, and authors are of all nationalities. Our own writers have achieved signal success, and we may be said in a measure to be freeing ourselves from foreign influence; but yet no one would insist, from patriotic motives, that publishers should confine their issues of books to those of an American origin. It is worthy, then, of mention that the American reader, through the medium of the American publisher, has had brought to his notice on many occasions the works of foreign authors whose powers had been overlooked in their own country. In this way the excellence of many foreign authors, by their popularity in the United States, has been revealed to European readers, and finally their reputation at home has been fully established.

A selective power on the part of the American publisher is one of the elements of his success. Though the publisher must always strive toward the production of the best books, he must bear in mind how different are the ages of his readers and the variety of tastes. Nevertheless the imprimatur on a title-page must be regarded as the flag covering the merchandise. A discerning public at a glance determines for the most part from the name of the publisher the quality of the wares purchased.

To estimate the value of the total output of the book publishing business in the United States is a very difficult matter. There are in the United States over 70,000 post-offices, and this gives some idea of the vast field for the distribution of literary matter in book form. According to a careful estimate made six years ago there were engaged in the publishing, subscription, and retailing of books, periodicals, and stationery, in the United States, not less than 40,000 concerns. Their number has not diminished during the last six years, but has increased, and it is estimated that there are in the United States at least 50,000 firms which make the selling of books the whole or a part of their business. The major part sell the cheapest kinds of paper-bound books only, their main business being the sale of periodicals or stationery.

Studying the output in books of the year 1894, and counting the retail price of one copy of each book published during that year, the total value amounted to $11,000. As a great number of these books cost less than fifty cents, an idea of the quantity may be, in a measure, understood. Eleven thousand dollars representing, then, the price of one copy of each book, the number of these same books constituting what is known as an edition must be borne in mind. Sometimes very expensive books are limited to an edition of 100 copies. On the other hand, there are works of fiction of which from 20,000 to over 100,000 copies are sold within the year. Of school-books, editions of 50,000 to 500,000 copies, intended for one year's consumption, are not an unusual event. Messrs. D. Appleton & Company for many years sold over 1,000,000 copies of Webster's "Speller" every year; and a Western house, W. B. Smith & Company, of Cincinnati, O., was believed to have sold over 1,000,000 copies of the Eclectic Series during each year. If an edition of 1000 copies only be taken as an average of the books published during the year 1894, their value would be $11,000,000. This, of course, can be but a small proportion of the total sales of books during the year. The electrotype plates of school-books, Bibles, prayer-books, hymn-books, and other books of that nature, are very rarely changed, and enormous quantities are sold every year.

Making the proper deductions for ages, the child in the United States is a large consumer of books, due to the public-school system. One other factor often overlooked must be added, and it is that the preparation of a large and increasing class of young men and women for the higher professions is much more extended as to time to-day than in the past, and additional books have to be supplied.

Such books as the "Encyclopædia Britannica" (of which there are several editions in the market), the "Century Dictionary," "Standard Dictionary," etc., are sold by subscription; and the initial expense of such books being enormous, before a single copy of the book is made, the sales must be enormous also. Then there are many "books which are not books"—such as city directories, which are usually published by a company devoted exclusively to the publication of this one book; State directories, lists of dealers in each business, and commercial agency reports (each of these agencies makes four revised editions of their book each year, each book measuring about eleven by thirteen inches, and containing about 2500 pages of matter in close print). There are innumerable genealogies, indexes, catalogues, together with many other productions which are truly books, but which cannot be called literature.

The records of American publications for the twelve years ending in 1841 show an aggregate of 1115 works. Of these, 623 were original and 492 were reprints from foreign works. It is believed, however, that the list of reprints is incomplete, owing to the difficulty of obtaining complete data. Possibly twenty-five per cent. should be added to the number given. The population of the United States in that year was about 17,000,000. In 1853, 733 new works were published in the United States, of which 278 were reprints of English works, 35 were translations of foreign authors, and the remainder were original American works. The population of the United States had reached about 25,000,000, an increase of fifty per cent. compared with 1841. The original American works published in 1853, compared with the twelve years ending in 1841, show an increase of about 800 per cent. in less than twenty years. In other words, the publications of the book trade seem to have advanced about fifteen times as fast as the population.

In 1880, with a population of 50,000,000, the new books published during that year amounted to about 2000—nearly three times more than in 1853, whereas the population had only doubled. The total number of new books published in each year, according to the records of the "Publishers' Weekly," from 1881 to 1894 inclusive, were as follows:

NEW BOOKS PUBLISHED.

1881	2,991	1888	4,631
1882	3,472	1889	4,014
1883	3,481	1890	4,559
1884	4,088	1891	4,665
1885	4,030	1892	4,862
1886	4,776	1893	5,134
1887	4,437	1894	4,484

These figures, of course, include the different editions of the same book issued by different publishers. During the period from 1872 to 1890 inclusive it was no unusual thing for six or seven editions to be made of the same book by different publishers, most of them being in the cheap pamphlet form or in the cheapest cloth binding.

Below is a table of the publications for the year 1894, classified according to subjects and the source of origin. The variety of books by foreign authors (chiefly English) imported bound or in sheets is very large, but the number of copies of each book thus imported is usually small.

PUBLICATIONS FOR 1894.

Classifications.	Books by American Authors, incl. New Eds. Manuf. in U. S.	Books by English and Other Foreign Authors, incl. New Eds. Manuf. in U.S.	Books by Foreign Authors Imported Bound or in Sheets into U. S.
Fiction	370	297	62
Law	474	1	10
Theology and Religion	184	22	262
Education and Language	330	22	90
Juvenile	261	22	61
Poetry and the Drama	107	82	77
Political and Social Science	174	8	72
Literary History and Miscellany	152	35	50
History	125	14	48
Physical and Mathemat'l Science	76	11	78
Biography, Memoirs	50	32	79
Medical Science, Hygiene	145	1	14
Description, Travel	83	17	44
Fine Art and Illustrated Books	93	7	38
Useful Arts	92	..	46
Sports and Amusements	33	..	23
Domestic and Rural	35	2	14
Mental and Moral Philosophy	28	4	17
Humor and Satire	9	..	1
	2821	577	1086

Several methods of estimating the yearly output of books have been attempted. One of these was to take the capital employed in every firm which published books during the year 1894—in the case of firms not exclusively devoted to publishing, subtracting from their known capital a definite proportion, so as to allow for that part of the business not connected with books. In the case of several incorporated companies, their capital and their output are known, thus giving a basis for calculation. The same proportion of output to capital was observed in the case of all the publishing-houses given on the list. A second method was to estimate the output by classes; for instance, the amount of books used in schools and colleges, the amount bought by free and subscription libraries, the amount sold by subscription only, the amount bought by lawyers, doctors, and other professional men, etc. A third method was to take the reported total value of books made in 1820, 1830, 1840, 1850, and 1855, and to carry forward the same progression to date. Still another method tried was by taking the retail prices of the books published during 1894 as a basis. Estimating that each book sold an edition of 1000 copies, which is probably well within the limits, the result was multiplied by the proportion estimated as sold of those books printed previous to 1894.

These four methods were suggested to a number of booksellers, with a request for their estimate of the total amount paid by the public during the year 1894 for all classes of books. The results obtained varied greatly, not only as to individuals, but in several cases where persons made the estimate according to each of the four methods suggested above, their four estimates did not correspond in any appreciable degree. After a careful comparison of all the estimates it seems a fair conclusion that the public pays at least $25,000,000 per year for what may be called "general literature," and probably an equal amount is paid each year for school and college text-books, for books sold by subscription only, for directories and other similar works, and by the public and subscription libraries.

For many years there has been a gradual increase of American books in all departments of literature, with the exception of fiction. The English novel, owing to lack of international copyright, could be printed and published at low prices; but since 1891 the tendency has been altogether in favor of American novelists. In 1893, 263 American novels and 834 English or foreign novels were published in the United States; but in 1894 there were 370 novels by American authors and 297 by English and other foreign authors.

The study of the export of books for the last year shows that we sent books or other printed matter to all parts of the civilized world to the amount of $2,147,391. British North America was the largest receiver, taking something over a half-million of dollars ($581,066); and the United Kingdom was the next, taking $548,358. The book business with South America and the West Indies is an important one, having amounted in 1894 to about $579,000.

Australia uses $50,780 of our books. In estimating this total of exports of books to be $2,147,391, some natural speculations arise as to what must be the home consumption of books, since the exports can express only a small proportion of the total output.

As to the life of the average book in the United States during various periods, it has been estimated as follows: During the first half of the century probably three fourths of the books published at any time during that period could be found on sale in the book-stores at the end of it. During the next twenty-five years the average life of a book was from five to twenty years. In 1872 began the publication of the cheap "libraries." These "libraries" tended to materially reduce the life of the average book printed after that date. It is probable that one third of the books published in any calendar year will be out of date, and only asked for occasionally, within one year of publication. Another third of the books published during the same year will probably have a life of about two or three years. Of the remaining third practically all but ten per cent. will be "dead stock" within seven or eight years of their publication. This arises from the fact that such an enormous number of books are published to-day. Prior to 1870 the publication of any book, and the necessary machinery of distribution, required an outlay of capital which very few firms possessed.

One large and increasing demand for books is that arising from the many public libraries in the United States, which, according to the last enumeration, in 1891, numbered nearly 4000, having an average of about 9000 volumes each. Some of the most important libraries take copies of all the works published. When a book is popular—not necessarily fiction, but historical, biographical, philosophical, etc.—many copies may be taken by a single library.

The increase of the legitimate business of book publishing in the United States is a healthy and perfectly natural one. The demand for books must increase with the growth of the country. The publisher and the book distributer are at once in touch with the new sections of the country that are being opened constantly. The need of general instruction is the predominant idea in the American mind, and it is for that reason that the Americans are the most universal of book-buyers and of book-readers.

This sketch of book publishing in the United States was prepared by Mr. Barnet Phillips and Mr. Frederick A. Nast, under my supervision.

John W. Harper

CHAPTER XLV

AMERICAN PRINTING

WHEN the Revolutionary War closed, the printing trade in America was almost exclusively confined to the tide-water towns. Except in two or three instances in Pennsylvania and Massachusetts, the art had not penetrated inland, and the total number of places where it was practised before 1775 was only twenty-nine, aggregating about 100 offices. In most of these establishments printing and the publication of newspapers were carried on concurrently, the latter being esteemed an integral portion of the printer's art. This continued to be the rule for a long time after, and until within the memory of some living men; and that extension of the calling which began immediately after the struggle for freedom was through newspapers. The first ones established beyond the coast settlements were those at Lexington, in Kentucky, and Pittsburg, in Pennsylvania. They were soon followed by another in Cincinnati; and by 1810 there were thirteen newspapers in Kentucky, fourteen in Ohio, six in Tennessee, and one each in Indiana and Michigan. Each of these offices did whatever job-printing was offered to it, and also printed and bound books on occasion.

The chief centers of the printing trade, however, have always been the three great cities on the Atlantic coast. Baltimore has never executed much printing in proportion to her size, and Charleston, Savannah, and Norfolk did little except that which was purely local in its character. Those towns which first developed a comparatively large trade in printing, not above mentioned, were Albany, Hartford, and Worcester. The leading printer in the latter place, Isaiah Thomas, was denominated by a French traveler as the Didot of America. Of the three great cities, Philadelphia was, for the first fifty years after the conclusion of the War of Independence, unquestionably the first in this line. There the earliest daily paper was begun; there bookbinding and bookselling were most vigorously carried on; there the greatest publisher of the United States, Mathew Carey, was established; and there Congress sat most of the time after the adoption of the Federal Constitution, before a permanent seat of government was established at Washington. Philadelphia was, too, the largest city in the United States. So great was this industry there shortly after the beginning of this century that 110 presses were kept at work. They were wooden presses, it is true, and their performance was small, measured by the standards of to-day; but the number surpassed that of any other English-speaking city on the globe except London. New York and Boston were alike much smaller in the quantity of the work they did, although the latter had been on a parity with Philadelphia until about 1760.

There was no job-printing to speak of in the year that Jay's treaty was ratified. Probably one man could have set up all the jobs that were executed in Philadelphia in 1795. An important city of that size would now require perhaps sixty men to do the small work offered to its printers. In these offices books and pamphlets took nearly the entire force. Newspapers were little read, and there was in them very little discussion of important matters. They were repertories of dry American facts and summaries of foreign news. Condensation and re-writing were little practised, and there were no editorials. Very little local news was given. Whenever a politician wished to address the public in a forcible way, he wrote a pamphlet. The books were very largely pirated from English publishers. Next followed religious works, books upon law and medicine, and school-books. A few original works were issued each year, but the departments just mentioned comprised the great bulk of all those printed. There were no authors who lived by their calling, and wood-engraving was commenced only in 1793, any one who had natural skill in this line being considered qualified to pursue it.

The printing art in both England and America in 1795 was substantially that which existed two hundred years before. Type-founding was better executed in England in the second quarter of the eighteenth century than at any time before, and there had necessarily been some development occasioned by the greater wealth of the English printers and the greater number of men they employed. But with the single exception that the press had been slightly altered, no new inventions had been made. It was soon to improve, however, and marvelous changes were to originate in the mother-land of the race, and be carried still farther both there and here. The shape in which progress was to appear in this country was chiefly, for a series of years, in the enlargement of printing-offices, the multiplication of places in which the art was carried on, and the introduction of minor industries which had not hitherto been known in America. The first of these was the establishment of a permanent type-foundry. Some foundries had been started by self-instructed workmen, and had attained a certain measure of success, but none of them had been of long continuance. Even a Scotch type-foundry which had been begun in Philadelphia about 1785 had ceased operations, the senior member of the firm having died in 1790. The first permanent establishment was also in Philadelphia, and began casting in 1796. It is still in existence and doing good work, and until lately was known as the foundry of the MacKellar, Smiths & Jordan Company. Those who began it were two Scotchmen, who formed the firm of Binny & Ronaldson. They had no competitors till 1805, when ingenious mechanics in Hartford started another foundry, but with very indifferent success, until Elihu White, one of them, brought the tools to New York in 1810. Here he did very well. A firm of printers in New York, David & George Bruce, desired to enter the field of stereotyping, and applied to the two existing foundries to accommodate them by the casting of types suited to their special needs. This was refused, and the Bruces began making their own type, and soon became successful. Other foundries began in Boston in 1816, and in Baltimore in 1817; in 1830 there were a dozen in the country.

Stereotyping by the plaster process was practised in the city of New York by David & George Bruce in 1813. David Bruce had been to England to learn the particulars of a process invented there, but was able to do no more than to approximate to the thorough knowledge requisite. Facts were held back. When he returned he found that some processes must be reinvented, and that Lord Stanhope had not attained complete success. His diligence and mechanical skill finally enabled him to make a plate which was perfectly level on both sides, and of exactly the same thickness in every part. This made the work far more perfect than that done abroad, and an Englishman in New York named Watts, who had succeeded in making stereotype plates here by another process in the same year with Bruce, left this city, with Bruce's improvements, and went to Vienna and other cities in Europe, where he taught master printers the art of making stereotypes "in the American way." Through him Germany acquired the art. His sojourn in Vienna was in 1819. In that year an Englishman then traveling through the United States declared that stereotyping was more largely employed in America than in England, and that the results were excellent. It reached its acme of development here by 1865, forty or fifty firms carrying on the business, and 1000 workmen being employed in it. The plaster process was finally superseded by the introduction of electrotyping for book work, and the papier-mâché process for news work, which had been used concurrently with it for some time. The facility with which, when types had been composed, a cast could be taken of them through the agency of plaster of Paris, that replica then remaining useful for a lifetime, induced Americans to stereotype almost all books that were likely to sell for longer than a year. This proved a very great economy. In England, and upon the Continent, where labor was less high-priced and where stereotyping did not meet with so much favor, the types were recomposed for each new edition.

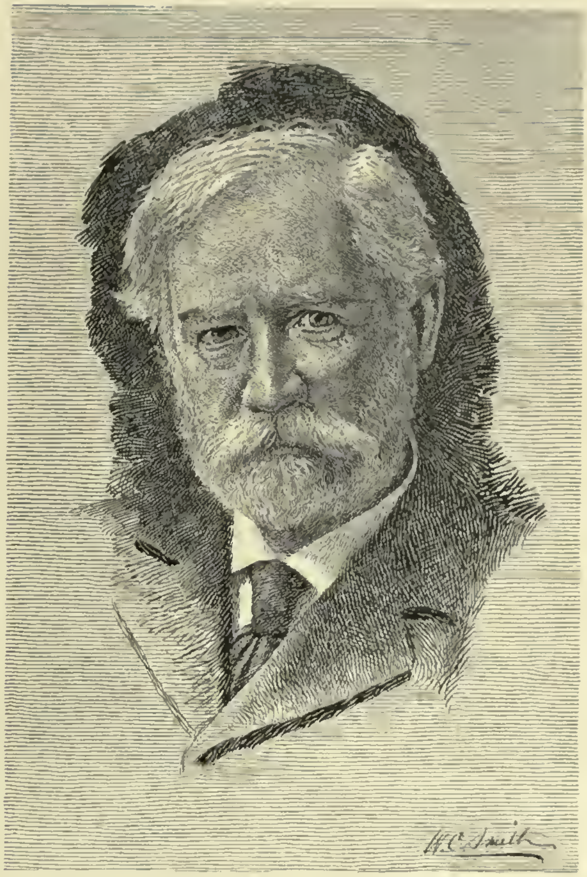
Ink, during the colonial period, was made by most of our printers. Few attained the skill that would enable them to manufacture a good article. The theory is very simple. It is to mix soot or lampblack with a boiled oil that is transparent and sticky, remaining fluid when in mass, but rapidly drying and adhesive even when laid in a very thin coating upon a sheet of paper. But practice was difficult. Most printers bought their good inks in England and made their poor inks. About 1805 one firm in Philadelphia and another in Cambridgeport began the manufacture of printers' ink. Shortly after another was begun in New York, and in 1816 a fourth one. After this date enough was made and demanded to increase materially the standard of excellence. Competition has been active among these houses, and as a result inks are now cheap and good. There are perhaps thirty firms engaged in preparing this article. Until 1850 no systematic attempt was made to supply colored inks. Before that time almost the only color used other than black was vermilion, which each printer mixed as he needed for use. Ten years after aniline colors appeared and became very popular. Their use is still increasing. A curious thing about bright-colored inks is that many of them are made as near to the desired tints as possible by the use of mineral and vegetable substances, each variety then having brilliance added to it by the employment of an aniline mixture which differs very little from it in hue. Thus a very bright effect is produced at the moment, but afterward vanishes, although the substratum remains, and gives an indication of what the color originally was. The whole amount manufactured does not reach a value of $1,000,000.

Another step in the progress of the printer's art was the introduction of elastic rollers for inking the types. In Washington's day ink was applied to the face of types with balls of pelt in a slow and laborious way. An ingenious compositor in England found an elastic substance, formed from glue and molasses, used in the potteries of England, and fancied it might work well if employed on presses. He tried the experiment, which was successful; and shortly after, when machine presses went into use in England, composition rollers were found to be indispensable. Their first employment in America, it is believed, was in New York in 1826, but their use soon rapidly spread throughout the whole country. Printing-machines could not be used to profit without cylindrical inking rollers. More than a dozen establishments are constantly engaged in making rollers for printers.

Another great change was that which came between 1819 and 1830, when wooden hand-presses were driven out and iron ones came in. To-day this seems unimportant, but it was the greatest change that had taken place in the printer's art since the time of Gutenberg. The wooden press was weak and wheezy; it creaked with every pull; the sheets printed were no larger than about a page of the ordinary daily, and each press required two expert men to keep it going. It was very slow. A year's work by four men would produce no more than a man and two boys can now accomplish in a single month with modern machines. The change from wood to iron did not begin in the United States until about 1820, although several presses had been imported before that time, the invention being an English one. Nor was the change a rapid one. Eight years later the majority of the presses employed in New York were still of wood, and many were used up to as late a date as 1840. The iron press was very much stronger in all its parts than its predecessor; it took no more muscle, and it printed a sheet three times the size of the former one. Among the first manufacturers were Turney, Worrall, Wells, and Smith; but in a few years nearly all presses were manufactured by Hoe in New York and Ramage and Bronstrup in Philadelphia.

It is to be noted throughout all the earlier history of printing in the United States that our country followed Great Britain. There the improvements originated, after a time being taken up by us. This continued to be the case till half a century ago, since which time the lead has been on this side. Among the inventions which were perfected to a great extent in England before they came here was the new method of paper manufacture introduced by the Fourdrinier machine, which was brought to America in 1825. The result of the change was that paper immediately became lower in price, and larger sheets were made. Only one further advance was now necessary for the production of cheap newspapers and books—the construction of rapid presses.

In the third half-decade of the century a German named König, who lived in England, succeeded in producing a cylinder-machine upon which the London "Times" was printed with great speed. After constructing several, he returned to Germany, and there began again the manufacture of presses. In England engineers took up the problem of improving the machine as he left it, and succeeded in doing so in many important respects. But in America no presses like König's were made which were successful in practice until about 1829. Platen printing-machines were made by Treadwell and Tufts, which answered a useful purpose, but these could not print as swiftly as those in England. About 1826 an English machine was imported, and it was while repairing this that Colonel Richard M. Hoe gained his first knowledge of power-presses. Shortly afterward Colonel Hoe's father began the manufacture of presses on substantially the same plan as the one imported, although certain improvements were added. They were made strong where there was much wear, and light where no wear was expected. The very best material was used, and the most thorough workmanship demanded. This thoroughness has always been kept up. As a result, although English presses have always been cheaper than ours, it has never been found expedient to import them. The high pitch set by Hoe has since been followed by all the manufacturers, and no more trustworthy



THEODORE L. DE VINNE.

ironwork is executed anywhere than by our press builders. Hoe improved all machines that he constructed, brought out new patterns, and added new devices. The other early power-press makers were Adams and Taylor.

The early stage of American printing ended in 1833. For some years after the productions of the art were not altogether pleasing, and some of them were offensive to a cultivated taste. But all the requisites for rapid development were at hand. Paper, ink, type, and presses were made here; money which could be invested in new enterprises had accumulated, and the people were anxious to get cheap reading and better printing. By the invention of cloth bookbinding, which began to be used here two or three years before, the production of bound books had become much less costly. What had before cost fifty cents or more a copy to bind could then be bound for ten cents. Schools were formed everywhere, mechanics earned good wages, and roads had been much improved. At about this time railroads first went into use, enabling newspapers printed at one city in the morning to reach another 150 miles distant by nightfall, which could not have been done by any method of riding express previously known. On the 3d of September, 1833, the New York "Sun," the forerunner of a new class of newspapers, appeared. At that time nearly all dailies were slow and dull, having little in them but political argument and foreign news. After the power-press came in they began to enlarge, and increased their sheets as they could, until finally some of them had an area of two thousand square inches. They printed few copies. The blanket-sheets, however, had to wait for the general employment of the Fourdrinier paper-making machine, and those with larger circulations required the double-cylinder printing-machines. The New York "Courier" and the New York "Daily Advertiser" were compelled to buy their first paper in England after power was applied, for the product of the American mills was too flimsy. On the small papers there was a continual struggle against time. The "Sun" was printed on a sheet eleven and one half by seventeen inches, a hand-press being used. Two persons, working at their utmost speed, relieving each other every twenty minutes, were able to produce about 400 copies an hour; but this performance did not supply the demand for the papers. In 1834 a cylinder-press was used, propelled by the arm of a laboring man at the crank of a balance-wheel. This was followed, in 1835, by a double cylinder driven by steam-power. Such, with a change of names and places, was the experience of all other cheap dailies of that time, including the Baltimore "Sun," the Philadelphia "Ledger," and the New York "Herald." The amount of printing increased rapidly. In 1808 the combined circulation of all the New York dailies was estimated at less than 9000; in 1840 ten dailies had a circulation of about 87,000, of which 70,000 was attributed to the penny papers. The population had increased a little more than threefold; the circulation had increased more than ninefold.

The changes in the decade from 1840 to 1850 were in the introduction of the lightning press, the institution of news agencies, the testing of power-presses in job-work and upon books, and the multiplication of shops and mills subsidiary to the art. The double-cylinder press in general use by newspapers in 1845 was ultimately found to be too slow for the requirements of a large circulation. R. Hoe & Company in 1847 invented the type-revolving rotary printing-machine, on the cylinder of which the type was fastened, and successively presented to the four, six, or ten impression cylinders placed around it. For twenty years this form of cylinder was approved as fast enough. After that time it was adjudged too slow. In 1869 the same house introduced the web printing-machine, which printed continuously from stereotypes on a cylinder against an endless roll of paper, with a speed that then seemed incredible. This machine was made in many forms: to print four, eight, twelve, or more pages; to fold, count, and paste them, and to add covers or insetted sheets; or to print illustrations in two, four, or six colors. All this can be done at speeds varying from 6000 to 70,000 an hour. Large as this performance is, one machine is not enough for the needs of a paper of large circulation. From two to twelve are used in the more prosperous dailies. Fast newspaper machines are made in Europe, but few of them are sold in America, although the machines constructed here are used in England and the English colonies. It is admitted that the largest printing-press manufactory in the world is that of R. Hoe & Company. The efficiency of the fast machine presses is largely aided by improvements in stereotyping. Instead of printing the type on one press, two or more stereotypes of a page can be made for use on as many different presses. This would have been impossible with the liquid plaster method, but the use of paper pulp enables it to be successfully accomplished. Moist papier-mâché is driven into the interstices of the type, dried, and laid in a concave mold, so that when metal is poured upon it it will make a convex plate. The stereotyping of curved surfaces was successfully done, for the first time in America, by Charles Craske, of this city, in 1854, and plates were made regularly in 1861.

Job-offices, as distinct from book-offices, first began to be numerous about 1850, and book printers added to their facilities those of the job trade. Before 1830 printers had no opportunity to develop their art. There were more printers than work, and the abler men had to seek other trades for the exercise of their ability. Jonathan Seymour, for many years the leading printer of New York, became a paper dealer. Others in New York also made a change. Alderman Clayton gave up printing and bestowed exclusive attention to the sale of paper and stationery; Mather undertook the manufacture of ink; Darius Wells began the making of wood-type; David & George Bruce, at first printers and afterward stereotypers, became type-founders. All these, and many others that could be named, both here and elsewhere, achieved distinction in their newly selected callings. Harper & Brothers, then J. & J. Harper, became publishers by necessity. Failing to get from established publishers work enough to keep their presses busy, they selected and printed at their own risk books which they sold in small quantities to leading booksellers in every part of the country, adding the purchaser's name to the regular imprint.

The decade before the war was one of great advancement in every department of the art. New press builders came in, and this branch, which had been carried on almost entirely by Hoe, Adams, and Taylor, was henceforth to be practised by many. Among them were Cottrell, Babcock, Campbell, Potter, and Huber, each making some new improvement. The introduction of the power-press into book and job offices was very slow. All the work of Harper & Brothers in 1835 was done on hand-presses. The first power-press used by this house was introduced the next year. The first power platen printing-machine was made in this country by Daniel Treadwell, of Massachusetts. Although bulky and inconvenient, it proved of so much advantage to Daniel Fanshaw, of New York, then the printer of the Bible Society, that in 1829 he mortgaged his establishment to that corporation, so that he might put in nine more. It was superseded in a few years by the Adams press. In 1845 this latter machine was the favorite in every office in the great cities. Publishers of books would not allow their plates to be printed upon a cylinder even as late as 1860. The use of cylinder-machines was confined to newspapers, posters, and coarse job-work. Francis Hart was the first New York printer, and probably the first in the country, to prove that the cylinder could be successfully used on fine book and job work, but for a long time his demonstration was received incredulously by other printers.

In this branch of printing improvements in machinery began with the small presses used by job-printers. The Yankee card-press and the Gilman card-press, introduced in the decade between 1840 and 1850, took card-printing away from the hand-press. Soon followed the Ruggles printing-engine and the Gordon press, equally efficient for the printing of circulars and hand-bills. These little machines not only did the work quicker, but better. They made a revolution in the methods of printing. It was found that on these machines wet or damp paper was not necessary; a stronger and clearer impression could be had on dry paper when the type was resisted by the hard packing of glazed mill-boards. This method of printing on dry paper was afterward utilized on cylinder-presses, and applied with great success to fine woodcuts. The success of American magazines is largely due to the dry-paper method of printing illustrations. The old "Scribner's Magazine," now the "Century," was the first magazine to develop dry-paper printing. Its example has been ably followed by "Harper's," the "Cosmopolitan," and others.

The American method of making-ready woodcuts was first shown in "Harper's Pictorial Bible," by Joseph A. Adams, who made the engravings, also made ready the forms, and developed the system of overlaying that is now adopted in all printing-houses of this country. The type-casting machine, that rapidly reduced the price of printing-types, was invented by David Bruce, Jr., of New York, in 1838. For many years it was the only effective machine, and as such was adopted in every type-making country. About 1848, Lovejoy, from Boston, introduced in New York the art of electrotyping. The feasibility of the new process had been demonstrated in this city by Joseph A. Adams in 1839, who made electrotype plates in 1841 for "Mapes's Magazine." On books the new art supplanted plaster and papier-mâché stereotyping, which could not properly reproduce engravings on wood.

There are several claimants for the honor of introducing and developing the art of photo-engraving in America, but it is generally admitted that John C. Moss was one of the earliest and most efficient workmen in this field. This new process has practically destroyed the art of engraving on wood. Illustrations that once cost $100, and that required a month of time, can be had for a tenth of the price, and sometimes in one day. The success of the cheaper illustrated magazines is based on the low cost of ordinary illustration. When engraving on wood was in fashion, there were here engravers of marked eminence, and their work was admired abroad. Adams, Linton, Juengling, Nichols, Howland, Filmer, are but a few of the many able men of that period. The high reputation of New York engravers is now worthily sustained by Cole, Muller, Whitney, and King. Closson and Anthony of Boston are equally famous.

The progress made in the United States has been in many directions, and leaders in the art have been found in many places. More printing has been done in New England than elsewhere, in proportion to the population. The two principal colleges of the United States are located there, and the general standard of education is high. Much book-printing was executed in early years in Hartford, Boston, New Haven, and Worcester, and each of these cities is still steadily increasing in its production. The chief center of the printing business is in New York; Philadelphia and Chicago coming next, and Boston, Washington, St. Louis, and Cincinnati following. The bulk of the work done in Washington is for the government. There are at least ten other cities where the amount executed is great, and where large establishments can be found. The amount of capital required has greatly increased since the beginning of the century, although each tool or appliance is lower in price. Fifty years ago an expenditure of $200 in types and materials was enough to keep a man at work; but now the material required per hand in cities will cost at least $1000. The growth of printing has been very rapid. It is not probable that the total number of workmen of full age in this art in the United States reached beyond 500 at the beginning of the century; it must at present exceed 100,000. The product is in the neighborhood of $150,000,000.

Type-founding is another branch of the business that has increased greatly. The amount manufactured in 1890 was supposed to be about $3,000,000 worth. Since then many of these establishments, of which there were about thirty, were consolidated, and the price of type has been lowered. Recent improvements in the art have enabled type-founders to cast type which is perfect, or nearly so, not requiring much subsequent finish. A very great change has been made in the composition of newspapers, and to some extent in books. Matrices are assembled upon a machine, and a whole line is cast at once. Nearly all large daily papers employ this apparatus, which saves a very large proportion of the cost of composition. Type-setting machines, handling separate types, are also in use, and promise to be equally efficient.

Lithography, or printing upon stone, was employed in 1819 in the United States, but not commercially. Since 1825, however, it has thus been used, and it has made wonderful progress since the Civil War. Three or four years after that closed this kind of printing was executed successfully on a power-press. In 1890 the amount of work done was about $20,000,000 a year, and 8000 persons were employed.

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Theo. L. De Vinne

CHAPTER XLVI

THE IRON AND STEEL INDUSTRY

THE probable period at which iron was first adapted to the use of man is a disputed subject among antiquaries. For a long time the claim was generally conceded that the use of copper and bronze by primitive man preceded that of iron; this assumption, however, appears to be based almost entirely upon the fact that few or no traces of iron implements have been found in the prehistoric remains of man. This absence of iron implements may readily be accounted for by the very perishable nature of iron, and the comparative rapidity with which it oxidizes or rusts away when in damp places. The tendency of recent antiquarian investigations is to place the use of iron by man contemporaneously with, if not antedating, that of copper and bronze. It has been contended by some authorities that the difficulty with which iron is smelted from its ores would cause it to be one of the very last metals used by a primitive race. This claim, however, cannot be entirely substantiated, from the fact that iron is not a difficult metal to reduce from its ores, particularly if they are rich, as is abundantly illustrated by the methods of making iron still in use among the savage and half-civilized tribes of Asia and Africa. It is certain that both the Assyrians and the Egyptians used implements of iron many centuries before the Christian era. Iron and furnaces in which it was made are mentioned in the Pentateuch. The Greeks obtained their iron from the Chalybes, a nation that dwelt on the south coast of the Black Sea, from whom it was also obtained by the Asiatic nations. The Romans not only procured their iron from this district, but also from Spain, Elba, and Noricum. The iron-mines of Elba, which to the present day yield a large amount of ore, were worked by the Etruscans, and the method employed by them for extracting the iron from its ores was probably very similar to that now known as the Catalan forge process.

It may be safely assumed that the aboriginal inhabitants of North America were unacquainted with the use of iron in any of its forms. At the time of the first visits of the Europeans to these shores the few metallic implements in the possession of the natives were probably made of copper. In order properly to comprehend the development of the iron industry in any country it is essential at the outset that the distinctive characteristics of the three great groups under which the iron of commerce is classified should be understood. Though the terms "wrought-iron," "steel," and "cast" or "pig iron" are not scientific and are incapable of technical distinction one from the other, they are by virtue of long usage essentially broad, hence convenient for use. When a lump of pure and easily reducible iron ore is heated on a bed of ignited charcoal in a smelting-fire or forge it is readily reduced to a lump of metallic iron similar in shape to the mass of ore treated. If the lump be sufficiently large one end may be hammered and drawn out into a bar or rod, while the other end remains in the fire as a mass of reduced or partly reduced ore. Such an operation represents the essential features of the primitive methods of iron smelting practised in the early colonial days of this country; the product thus obtained is known as wrought or malleable iron, whether it is made in the rude manner described or by the improved bloomeries which later replaced the rude old forge. From the bloomery, producing its soft malleable bar or bloom, the blast-furnace was gradually evolved, new metallurgical reactions were effected, and the product obtained in a fluid condition, in which it could be run into simple sand receptacles, forming pig-iron, or into specially constructed molds to produce castings for practical use. The metal thus obtained was hard, brittle, and possessed distinct physical characteristics not found in malleable iron. Since by the use of improved methods it became possible to obtain the product of the blast-furnace readily and with vastly greater economy, pig-iron soon became, as it is at present, what the Germans call raw iron (*Roheisen*), from which practically every other variety of finished iron or steel is obtained. The ton of pig-iron is therefore very properly taken as the rough standard by which the world's production of iron is now measured.

Prior to the year 1795 the iron industry in the United States was not only of a primitive character, but was essentially feeble. The British government had for years been systematically discouraging the efforts of the American colonists to produce iron, in order to avoid competition with the home industries; these repressive measures continued until the Revolutionary War. Forges or bloomeries were to be found in nearly all the colonies from the times of earliest settlement, and as the population increased in districts more or less remote from the seaboard the difficulties of transportation were sufficient to stimulate the colonists at such localities to manufacture iron for their own consumption. Unlimited supplies of fuel being always at hand in the vast forests which covered the country, it became only necessary to find ore and obtain persons sufficiently skilled to construct the smelting appliances. The rude forges of earlier days were gradually, as the demand for iron increased, superseded by simple forms of blast-furnaces, producing, as a rule, a strong and excellent quality of charcoal-iron; indeed, the earlier blast-furnaces in the United States were practically foundries manufacturing all the hollow ware and iron castings required for domestic consumption in the rural communities in which they were established. The iron required for structural purposes, such as bars, straps, nails, sheets, etc., was obtained in the early days either by hammering the bloom from the forge or bloomery, or by shaping by means of rolls propelled by water-power. In fact, before the invention of the puddling process in England by Cort, in 1784, a large proportion of all forms of wrought-iron were derived in this manner. The old so-called "Walloon" process of refining pig-iron into the malleable or wrought form or into a crude mild steel was introduced into the colonies at an early date in their history. We have, however, no means of knowing to what extent it was used; but as it required skilled workmen specially trained in its operations, it would seem probable that the colonists, who were generally their own iron makers, did not take kindly to its adoption. By the puddling process malleable iron is not directly produced from the ore, as in the older methods of manufacture, but indirectly from pig-iron. The introduction of the puddling process was second in importance to no other invention in the history of the iron industry of this country; it has, moreover, held its own with the greatest tenacity wherever established, and may, in fact, be considered to have held the same relation to the iron industry of forty years ago that the Bessemer process bears to that of the present day. The Revolutionary War, though causing the ruin of many colonial industries, had the effect of stimulating the iron industry to some extent, by reason of the unusual demand for cannon, projectiles, and other war material, which could not be obtained abroad.

For a number of years after the Revolution the iron industry developed steadily but slowly, probably owing to the fact that, as in colonial days, much, if not most, of the iron used along the seaboard was imported. As the more remote communities in the interior, however, increased in wealth and population, the demand for iron grew apace, and the product not only increased in quantity, but also in quality. According to Mr. James M. Swank, who is undoubtedly the best authority upon the history of the iron industry in the United States, no statistics of the production of iron were collected before the year 1810. The production of pig and cast iron in that year was 53,908 tons; wrought and malleable iron of all kinds, 27,105 tons; having a total value of $6,081,374, of which amount Pennsylvania produced $2,473,748. The product of the steel furnaces of Massachusetts, Rhode Island, New Jersey, Pennsylvania, Virginia, and South Carolina in 1810 was 917 tons, valued at $144,736; of the whole number of steel furnaces Pennsylvania contained five, producing 531 tons, valued at $81,147. An analysis of these figures gives us some idea of the state of the industry at the beginning of the century. The product of the blast-furnaces—pig, or, as it was at that time termed, cast iron—was made or run directly into small castings then in demand for commercial purposes; the malleable iron was probably all derived directly from the ore in forges or bloomeries, whence it was taken to the rolling or slitting mills to be made into rods, bars, plates, nails, etc. The steel made at this period in the United States was probably all produced by the cementation or blister process, and was all of the grade now known as high-carbon or tool steel. Although Huntsman's improvement of this process, by which the steel bars thus made were fused in crucibles and subsequently cast into ingots, had been in operation in Sheffield, England, a number of years prior to 1810, it is doubtful if his invention had been adopted in the United States at this early date. In the census of 1820 the quantities of iron made are not given; their value, however, is stated as follows:

pig or cast iron, $2,230,275; wrought-iron, $4,640,669; total, $6,870,944. If these figures be correct either the value per ton had decreased since 1810 or else the quantity produced failed to increase in a ratio corresponding to the general growth and development of the country. The census statistics of 1830, however, show a decided improvement as to values, although no estimate of the quantity is quoted. The returns for the year 1830 were: pig-iron and castings, $4,757,403; wrought-iron, $16,737,251; total, $21,494,654. As the puddling process had probably not been used at this period to any extent, the disproportion between the production of cast or pig iron and that of wrought-iron is marked. This condition could not be due to the difference in value of the two products ton for ton, since in those early days the blast-furnaces were small and crude, and consumed what would now be considered an enormous proportion of expensive (charcoal) fuel. As a consequence the ton of pig-iron cost from $35 to $40, and the ton of wrought-iron perhaps one third as much more.

In the decade between 1830 and 1840 few changes or innovations were introduced having much influence upon the character of the industry in the United States. New inventions and improvements devised and operated in Europe did not then, as they do now, make their appearance here almost simultaneously with their practical application in the countries where they had their inception. During this period the production of iron steadily increased, but upon much the same lines as heretofore. Primitive and insignificant as compared with those of to-day, the capacity of the blast-furnaces of that period may be judged from the fact that it required, in the year 1840, 804 of them to produce 286,903 tons of iron. The number of tons of malleable (bar) iron produced for this year were 197,233, by 795 bloomeries, forges, and rolling-mills. It will be noted from this statement that for the first time in the history of the industry the production of cast or pig iron exceeded that from the bloomeries and forges; this was possibly owing to the fact that the puddling process and other methods of refining from the pig-iron instead of the ore, as in the case of forges and bloomeries, were gradually being introduced. The establishment of the puddling process as an adjunct to the industry was of the very greatest importance, as this method of refining iron was destined to supplant all others and to continue in existence until in turn replaced by newer methods of making mild steel for structural purposes. No figures are published for the monetary value of the product in 1840, but if we assume the ton of pig-iron to have cost $30, and the ton of hammered bar-iron $90, we obtain $8,607,090, or nearly double the value of pig and cast iron produced in 1830. The total value of the bar-iron at this estimate would be $17,750,970. It will be observed from these figures that the value of the bar-iron increased since 1830 in a ratio greatly less than that of the blast-furnace product, although up to 1840 little or no iron was made in blast-furnaces using any other fuel than charcoal. In 1840 we arrive at a stage in the history of the American iron industry when great changes were to be effected. Notwithstanding the great supplies of timber still available in even the more settled parts of the country, the relatively high cost of manufacturing charcoal, and its enormous consumption in the furnace per ton of iron produced, were serious obstacles to the growth of the industry, even where a good supply of ore was well assured. The discovery a few years previous of great deposits of anthracite coal in northeastern Pennsylvania directed attention to the utilization of this fuel in the manufacture of iron. As early as 1835 the adaptation of anthracite to the manufacture of iron began to attract attention. In that year the Franklin Institute offered a gold medal "to the person who shall manufacture in the United States the greatest quantity of iron from ore during the year, using no other fuel than anthracite coal, the quantity to be not less than twenty tons." Mr. William F. Durfee, in his "History of the Iron and Steel Industry of the United States," states the medal was never awarded, and that it is fair to assume that the required quantity of iron was not manufactured in this manner. He further remarks that there is abundant evidence to prove that from 1830 to 1840 a number of attempts to use mineral fuel in smelting iron ores were made. The first practically successful attempt to produce pig-iron by the use of anthracite was made by Mr. David Thomas at Catasauqua, Pa. The furnace which he erected there for this purpose was blown in on July 3, 1840, and the first "cast" made on July 4th. This furnace was equipped with a "hot blast" operated by water-power, thus inaugurating in the United States, simultaneously and at the same locality, two of the greatest innovations in blast-furnace practice. This furnace, producing from the original start fifty tons of iron per week, continued in profitable operation until the year 1879, when it was dismantled. The earlier forms of hot-blast apparatus consisted essentially of a series of nests of iron pipes heated externally by separate fires, the object being, in passing the air from the blowing or blast engine through these pipes, thereby greatly augmenting its temperature, not only to increase the heat in the furnace, but to decrease the consumption of fuel per ton of ore smelted. The invention of the hot blast was patented by James B. Neilson, of Glasgow, in 1828, and subsequently improved upon from time to time, notably by Cowper and Whitwell, until at the present time the increased heat of the blast is not only obtained by the combustion of the waste gases from the top of the furnace without the expenditure of additional fuel, but the temperature obtained in the modern regenerative fire-brick hot-blast stove has been increased to 1200° Fahrenheit, whereas in the older type of stove the temperature of the blast probably seldom exceeded 600° Fahrenheit. The use of the hot blast is perhaps the most important improvement ever made in blast-furnace practice, for without it the production of pig-iron as cheaply and in such enormous quantities as at present would have been impossible. Notwithstanding that the success in smelting iron in blast-furnaces with anthracite had been practically demonstrated in 1840, the general use of this fuel appears to have grown slowly; it was ten or more years before the use of coal (either anthracite, coke, or a mixture of the two) became general, and the broad river valleys were illuminated by the flames of the furnaces which produced for Pennsylvania the wealth of an empire. In 1846 the first furnace constructed with the intention of using raw bituminous coal as fuel was successfully placed in operation at Lowell, Mahoning County, O. Although coke had been in general use in England for a number of years, it was not, according to Overman, until 1837 that it was successfully used in the United States in the blast-furnace at Lonaconing, Alleghany County, Md. The manufacture of Connellsville coke was commenced in 1841, but, according to Weeks, it was not until a number of years later, when railroad transportation had become more fully developed, that its value as a furnace fuel became thoroughly demonstrated. The period between the years 1840 and 1850 was a most eventful one in the history of the American iron industry. The introduction of the improvements in smelting already indicated, together with the use of steam-power for propelling the blast and in performing other varieties of work about the furnaces, its replacement of water-power in operating rolling-mills and hammers, in mining coal and ore, and the rapid growth of the railroads, produced a stimulating effect probably never before experienced in a similar degree by any American industry. The railroads contributed largely to the development of the iron industry in two ways: directly, by rendering transportation comparatively cheap, thereby enlarging the iron market and increasing the demand; and indirectly, by creating in their construction a new and unprecedentedly large consumption of iron. The railroads, in fact, have perhaps had more influence in shaping the character of American industry than any one other factor. As the production of iron increased in later years, the older iron-ore deposits became exhausted, or else proved inferior to the newly discovered ore-beds of the Lake Superior region. The problem of suitably locating a modern blast-furnace producing from 9000 to 10,000 tons of pig-iron per month became a serious one, and its solution has had the effect of moving the geographical center of the iron industry west of the Alleghany Mountains, nearer a new and larger ore supply, yet handy to the coke of Connellsville. It is a curious fact of economic geology that the best iron-ore deposits in any part of the world are seldom found in the vicinity of large coal-fields. As it is essentially cheaper, considered bulk for bulk, to transport the ore than the fuel a long distance, we find to-day most of the larger iron-producing establishments clustered in the immediate vicinity of the coal-mines, where they will doubtless remain until the supply of fuel is exhausted or until radically different methods of obtaining the iron from the ore are devised. In 1850 there were produced in the United States 563,755 tons of pig-iron by 377 establishments, and wrought-iron to the value of $22,629,271 in 552 establishments. Swank gives no estimate of the amount of steel produced, but as it is probable that most of the steel consumed in the United States in this year was imported, the domestic product must have been necessarily small.

The evolution of iron and steel plate making, particularly boiler-plates, which are of immense commercial and industrial importance, forms an interesting chapter in the growth of our great industry. As I have stated, the pig-iron made early in the century was either used for foundry purposes or was taken to a Catalan forge, where it was reworked and brought to the condition of wrought-iron. It was then made into bar-iron or sheet-iron for commercial use. About the year 1815, when steam began to be used, Dr. Charles Lukens remodeled his mill to produce a thicker plate for that purpose. The bloom, as it was called, was reheated at the forge and hammered as thin as possible, usually about one and one half inches thick. It then went to the rolling-mill, where it was laid on a bed of coal in what was called a grate-furnace. After heating, it was rolled into plates one quarter and three sixteenths of an inch thick and sent to the boiler maker. He, however, soon tired of shearing and having such a quantity of scrap on his hands. The mill then sheared the product into the regular commercial sizes: forty-eight and forty-nine by twenty-six by one quarter or three sixteenths; or, if large enough, it was sheared into plates sixty-eight and sixty-nine by twenty-six, the scrap being cut into nails. Very soon, however, the reverberatory furnace was introduced, the scrap being arranged into piles of such size as was necessary to produce the required plate, heated to a welding heat, and rolled in the mill. This state of things continued until the introduction of the puddling furnace. In 1852 Congress passed a law requiring all makers of boiler-plate to stamp their names, place of business, and letter to indicate whether charcoal or puddled, upon the goods produced. This led to a great amount of deception, as there was no penalty; and very soon the reputation of the maker was the only safeguard. In 1872 Congress passed another law requiring the maker of boiler-iron for marine boilers to stamp his name and place of business upon it, with the tensile strength which he would guarantee, under a penalty of $2000 fine and imprisonment of two years for fraudulent stamping, and making it obligatory for the inspector to see that the law was complied with. This also proved a dead letter until the present supervising inspector-general, James A. Dumont, was appointed in 1877, as appears by the report of the Board of Inspectors to the Secretary of the Treasury in January, 1878, and subsequent years. He at once went to work and placed a testing-machine in each of the ten districts, allowing no plate subject to tensile strain to be used until after it had been tested and approved. Feeling the necessity of a better knowledge, I began, as soon as the law was passed, to test my own manufacture, and when General Dumont came into office he requested the makers of boiler-plate to appoint a committee to come to Washington and appear before the full Board of Inspectors to devise "a set of rules which would protect the public without unnecessary hardship to the manufacturer." I was appointed chairman of that committee, and after several consultations the rules at present in use were adopted, very little alteration having been found necessary since their adoption. In connection with this subject I published in the "Franklin Institute Journal" for February, 1878, an article upon "The Strength and Ductility of Iron and Steel Boiler-Plate at Different Temperatures," and another in January, 1879, upon "The Effect of Continued and Progressively Increasing Strain upon Iron." The Hartford Steam-Boiler Insurance Company about this time wrote to me for a standard for steel, which was given to them, and still forms their standard. It places the tensile strength of boiler-steel at 55,000 to 60,000 pounds to the square inch, with an elongation of twenty-five per cent. in eight inches. In reference to this rule, I have recently written to Mr. J. M. Allen, president of the Hartford Steam-Boiler Insurance Company, who has had eighteen years' testing practice, and quote from his letter in reply:

"You told me at that time that you thought it would be from 55,000 to 60,000 tensile strength on the specimen tested, with an elongation of twenty-five per cent. in eight inches. We had various tests made about the same time, and have since had them made on other machines, more particularly at Watertown Arsenal, Massachusetts, and we have found that your opinion in regard to this matter has been carried out in every instance, and we now vary but little from it in our requirements, except in some cases where the steel is to be used for special purposes, where we have gone a little over 60,000 tensile strength; but our standard rule does not exceed 60,000, and as to the elongation of twenty-five per cent. in eight inches, we have never changed that. We have found the ductility ample in most cases in connection with the thousands of boilers which we have insured."

It has now become the practice in all engineering work to fix some standard, and there is hardly a day that we do not have one or more inspectors in our mill; so that what a very few years ago was merely a rule of thumb is now reduced to a rule by which the quality of all iron or steel is weighed and measured.

The period in the development of the iron industry between the years 1850 and 1860 was not characterized by the introduction of any such changes or innovations as in the preceding decade. The most important changes appear to have been in increasing the efficiency of the rolling-mill machinery and appliances then in use, as, for example, the invention of the "three-high" roll-train; the introduction of mills for rolling beams, by Cooper & Hewitt, at Trenton, N. J.; and the invention in 1848 of the "universal mill," by Daelin, a German engineer, which invention found its way to America some twelve years later. Between the years 1850 and 1860 the production increased steadily, if slowly, foreign competition being at this time a particularly serious obstacle to overcome. In fact, in the manufacture of the finer qualities of steel, no progress was made up to the year 1860. The first edition of "Appleton's

Charles Huston.

Cyclopedia," printed that year, states that "American cast-steel is hardly known in the markets." According to the census of 1860, 97 establishments in the United States produced 51,290 tons of blooms, valued at $2,623,178; 286 establishments produced 987,559 tons of pig-iron, worth $20,870,120; 256 establishments produced 513,213 tons of rolled iron, worth $31,888,705; 13 establishments produced 11,838 tons of steel, worth $1,778,240. These last figures probably refer to the crude or cheaper grades of steel, if the statement in "Appleton's Cyclopedia" be correct. Such was the condition of the American iron industry at the beginning of the decade which saw the country in the throes of the most dreadful war of modern times. During the years 1861–65 the resources of the iron industry in the Northern States were taxed to their utmost to provide the Federal armies with war material and the navy with guns and projectiles. The industry in the South, strained at an early day beyond its feeble capacity, soon broke down, and most of the requirements of the Confederate armies were supplied from abroad. In the train of dire disaster wrought by the Civil War some good to the iron industry may be found; for not only did iron ships make their appearance in the navy, but the application of iron plates or "armor" to their sides had its inception. The American iron-clad monitors which made their appearance at this period were not, as has been popularly supposed, the first armor-clad vessels ever constructed, since in 1859 the French built the frigate *Gloire*, which was armored with iron plates five inches in thickness. The British, not to be outdone by their ancient naval foes, constructed in 1861 the magnificent frigate *Warrior*, which was protected on its sides by solid iron plates four and one half inches in thickness. As regards armor, either of these vessels was much better protected than any of our monitors constructed during the Civil War. It appears doubtful if we possessed any rolling-mills at this period capable of producing as heavy iron armor-plate as was then made abroad, for we find the first monitor was protected by armor consisting of from six to eight thicknesses of one-inch iron plates bolted one on the other with overlapping joints. The later vessels were probably protected in much the same way by armor made up of a greater number of similar one-inch plates. One of the marked incidences in the history of the iron industry between the years 1860 and 1870 was the gradual abandonment of the production of iron in districts remote from the coal-fields, charcoal-iron continuing, as at present, to be made in large quantities, its superior qualities for certain purposes rendering the demand fairly uniform.

In the New England States, containing no coal deposits, but some fairly good iron ores, all the iron smelted in the earlier days was by use of charcoal. As the timber supply decreased and the competition from furnaces more favorably located became greater, the industry began to wane, and gradually, one after the other, the old furnaces were abandoned and dismantled, until to-day scarcely any remain. In 1855 and 1856, Henry Bessemer, of London, obtained patents for a process of converting molten pig-iron into steel by forcing small jets of cold air through the molten iron; but he did not achieve success with his invention until a modification of the process was patented by Robert F. Mushet. Mushet's improvement consisted in adding to the molten steel, after the blast had been stopped, a sufficient quantity of spiegeleisen (an alloy of iron and manganese) to neutralize the oxide of iron caused by blowing and to give the steel the proper degree of hardness and fluidity. In 1856 Bessemer obtained two United States patents for his invention, but was immediately confronted by a claim of priority of invention preferred by William Kelly, a native of Pittsburg, Pa. The result of this incident was that Kelly obtained a patent, but did not appear to avail himself of his success, and the introduction of the pneumatic or, as it is now universally termed, Bessemer process was delayed several years. Since neither Bessemer's nor Kelly's United States patents could be made of much practical value without the control of those of Mushet, it became necessary, in order to create the Bessemer-steel industry in this country, to consolidate all the conflicting interests, which was done in 1866; and the first plant to produce the steel as a commercial article was put in successful operation by the Pennsylvania Steel Company at Steelton, near Harrisburg, Pa., June, 1867. The first steel rails ever rolled in the United States upon order in the way of regular business were rolled by the Cambria Iron Company, Johnstown, Pa., August, 1867, from ingots made by the Pennsylvania Steel Company. The production of Bessemer steel in the year 1867 was 3000 tons, the industry continuing to grow with rapid strides. In 1890, 4,131,535 tons were produced. Of these amounts, 2550 tons were made into rails in 1867, and 2,091,978 tons in 1890. In the year 1891 3,247,417 tons and in 1892 4,168,435 tons of ingots were produced. The output of 1892 was the largest in our history, but in 1893 and 1894 it decreased about eighteen and twelve per cent. respectively. The importance of the invention of the

Bessemer process to the world in general and the United States in particular cannot be overestimated, since it has reached a development with us greater than in any other country in the world. In 1890 the total amount of all varieties of steel made in the United States was 35.2 per cent. of the entire world's product. The rapid and enormous development of the Bessemer-steel industry in the United States is attributable to the great extension of our railroads, as nearly all the steel rails used in their construction were made of this material. Within recent years Bessemer-steel ingots are becoming largely used in the manufacture of black and tinned plates.

The open-hearth steel process had its inception in the year 1856, when the Siemens Brothers, who were natives of Germany, but then residents in London, perfected what is now generally known as the Siemens regenerative gas-furnace, without which no open-hearth steel can be made. In 1864, Messrs. Émile and Pierre Martin, of the Sireuil works in France, erected, with the assistance of Dr. Siemens, one of the regenerative gas-furnaces to convert steel in an open-hearth or reverberatory furnace of their own construction. This scheme was a success from the start, and by a subsequent consolidation of the Siemens and Martin inventions a steel-making apparatus was devised, known as the Siemens-Martin or open-hearth process. The first open-hearth furnace introduced into this country for the manufacture of steel by the Siemens-Martin process was built in 1868 by F. J. Slade for Cooper, Hewitt & Company, at the works of the New Jersey Steel and Iron Company, at Trenton, N. J. The building of this furnace was commenced in the spring of 1868, and in December of the same year it was successfully put in operation. In 1870 the production of open-hearth steel in the United States was 1500 tons, and in 1890 574,820 tons, the industry showing a rapid development during the intervening twenty years. Great Britain is at present the largest producer of open-hearth steel in the world, and in this branch of the iron industry the United States is still somewhat behind its great rival. In 1890 Great Britain produced 1,564,200 tons, as against 574,820 tons in the United States. In 1894 the production in the United States amounted to 784,936 tons, and in Great Britain 1,575,318 tons, of which 104,531 tons were made by the basic process. From the present indications it seems probable that the production of open-hearth steel in the United States for the year 1895 will reach nearly 1,000,000 tons, and that it will not be many years before it equals that of Great Britain. The so-called "basic" open-hearth process, although having been in successful operation in Europe for a number of years, did not have its inception in the United States until the year 1888, when a number of such furnaces were constructed at the works of Carnegie, Phipps & Company, at Homestead, near Pittsburg, Pa. The manufacture of the basic open-hearth steel has developed slowly in the United States, and it does not seem likely to increase with great rapidity as long as the supply of cheap and excellent iron ore from the Lake Superior region continues undiminished. During the remarkable boom in the iron industry of the Southern States a few years ago we heard much about the possibilities of making steel by the basic process in this part of the United States, the cheaply available iron ores of this section being assumed to be particularly suitable to the production of steel in this manner. These expectations, however, appear to have failed to be realized. Without going into technicalities, the basic open-hearth process may be briefly defined as an ordinary open-hearth plant whose furnace lining is made of a basic material, such as dolomitic limestone or the mineral magnesite. When pig-iron containing a sufficiently great quantity of phosphorus to render it unfit for conversion into steel by any other method is melted in a furnace thus constructed, the basic lining, together with a basic flux which is added, removes the objectionable phosphorus and renders (other conditions being normal), in most cases, the resulting steel equal to that prepared in the open-hearth furnace in the old and usual manner. The purposes for which open-hearth steel is ordinarily adapted are quite different from those for which the Bessemer steel is most suitable; but the converse of this fact, however, is not true, since open-hearth steel may be and frequently is used to an equal, if not greater, advantage wherever Bessemer steel is employed. In this country, at least, all high-grade structural material, such as boiler and ship plate, bridge and building members, high-grade castings, etc., is almost invariably of open-hearth steel, which is generally considered, and doubtless is, more uniform in quality than soft steel made by the Bessemer method.

One of the most curious phases in the history of the American iron industry is the fact that although the United States at one time consumed nearly sixty per cent. of the world's entire production of tinned plates, with the exception of a few sporadic attempts in 1873 and 1875, no tin or terne plates were made in the United States until the year 1891. This phenomenon cannot be explained by the fact that this country mines or produces no tin, because Great Britain, since the practical exhaustion of her Cornish deposits, has been similarly situated, and is obliged to import over two thirds of the tin consumed from the East Indies, whence comes, also, most of the tin used in the United States. According to the report of Colonel Ira Ayer, special agent of the Treasury Department, the total amount of tin and terne plate produced in the United States in the year ending June 30, 1892, was 13,646,719 pounds or 6092 gross tons; for the year ending June 30, 1893,—which was a very bad year for the iron trade,—99,819,202 pounds or 44,563 gross tons; the year ending June 30, 1894, 139,223,467 pounds or 62,153 gross tons; and, finally, the year ending June 30, 1895, 193,801,073 pounds or 86,518 gross tons. In 1889 the imports of tin and terne plate from Great Britain into the United States were 331,311 gross tons, having a foreign value of $21,726,707. Great Britain furnished virtually all the tin-plate used in the United States during the twenty years ending 1890. No better evidence of the success of our domestic tin-plate industry could be afforded than the fact that our imports have steadily decreased since 1889, those for the year 1894 being 215,068 gross tons, having a foreign value of $12,053,167. It will be observed from the figures given for the American production that the industry has increased more than fourteenfold in four years. Verily this industry is here to stay, and it is not too much to expect that within a very few years we will be able to supply our entire domestic demand, and importations will practically cease.

If the history of the development of the American blast-furnace practice were written it would form a large book of itself, and it is therefore only possible in this sketch to mention very briefly some of the most important factors which influenced it. I have already intimated how the introduction of the hot blast, coke-fuel, and the use of steam-power increased the efficiency of many of the furnaces. In 1870 most of the blast-furnaces in operation were still very primitive, and although no statistics for that year are given, it is probable that the best of them did not produce as an average over fifty tons of pig-iron per day, whereas in 1895 the production of 300 tons per day is a common occurrence, and in exceptional cases 350 to 400 tons per day have been made by some of our best furnaces. The following table from the United States census reports exhibits the rate of production of pig-iron in the different sections of the United States during the twenty years ending in 1890:

PRODUCTION OF PIG-IRON.

District.	Tons of 2000 Pounds.		
	Year ending May 31, 1870.	Year ending May 31, 1880.	Year ending June 30, 1890.
New England States	34,471	30,957	33,781
Middle States	1,311,649	2,401,093	5,216,591
Southern States	184,540	350,436	1,780,909
Western States	522,161	995,335	2,522,351
Far Western States	....	3,200	26,147
Totals	2,052,821	3,781,021	9,579,779

From the above figures it will be noted that the manufacture of pig-iron in New England was practically stationary for the period of twenty years ending in 1890. Between this date and 1895 it has steadily decreased, the total amount produced in 1894 being 7572 tons. During the twenty years between 1870 and 1890 production in the Middle States had nearly quadrupled, in the Western States increased nearly five times, and in the Southern States nearly ten times. The production of pig-iron in the United States for the census year 1890 was 9,202,703 gross tons, the largest in the history of the country; in fact, larger than that of any other nation in the world, being 616,023 tons in excess of the production of Great Britain in 1882—the greatest on record. In 1870 Great Britain produced 5,963,515 tons of pig-iron; in 1880, 7,749,233; in 1890, 7,904,214; in 1894, 7,364,745. The United States produced in 1891 8,279,870 tons of pig-iron; in 1892, 9,157,000; in 1893, 7,124,502; in 1894, 6,657,388. It will thus be observed that, owing to the general depression in the iron business during these latter years, the production has gradually decreased and fallen considerably short of that in Great Britain during the same period. The production in 1895, however, will probably show a great increase, although it is not likely to equal that of the phenomenal year 1890.

A sketch of the American iron industry in the past hundred years would be incomplete without some reference to the introduction of the manufacture of armor-plate into the United States. This class of material not only has a peculiar and limited demand, but its manufacture requires the highest degree of metallurgical and mechanical skill, together with an exceptionally expensive plant. When the reconstruction of the United States navy was begun, some ten years ago, we had absolutely no facilities for making the simplest kind of armor-plate, although possessing some of the largest steel-works in the world.

One of the first of the new armored vessels completed (the monitor *Miantonomoh*) was protected by "compound" plates imported from England. All the large forgings for the guns and shafts of the earlier ships were likewise imported. Owing to the wise and liberal policy of Congress, the Bethlehem Iron Company and Carnegie, Phipps & Company, of Pittsburg, were induced to erect expensive plants necessary for making not only the heavy gun-forgings required, but also for all the different grades and thicknesses of armor-plate. In 1891 these firms began to supply armor for the ships in course of construction, although at first their output of finished armor was extremely slow. The delays have now been slowly overcome, and at the present time there is little doubt that these great steel-works will be able to supply the armor as fast as new ships are constructed. How successful these works have been in furnishing our government with the best grades of armor-plate could have no better illustration than the fact that the Bethlehem Iron Company is now supplying foreign governments with armor for their ships. The only two important iron and steel commodities which the iron industry of the United States did not supply in 1890 (tin-plate and armor-plate) are at present being made in large quantities, and the year 1895 sees this country for the first time in its history absolutely independent as regards the production of every important variety of iron and steel.

Vast improvement has been made in the machinery necessary to manipulate iron and steel. The Bethlehem Iron Company has, I believe, the largest hammer in the world, of 125 tons' capacity. This hammer was built by Mr. John Fritz and put into successful operation in 1891. The Bethlehem Iron Company and Carnegie, Phipps & Company are now prepared to make the heaviest forgings required for armor-plate, heavy shaftings, etc., up to forty to fifty tons in weight. Long previous to this, however, Mr. Fritz, while at Cambria, put into successful operation the three-high roll-train invented by him (and afterward adapted to plate-mills by Mr. Lauth); and his brother, Mr. George Fritz, invented what is known as the "automatic tables," all of which improvements enable the manufacturer to successfully handle almost any weight of ingot. I well remember when a 500-pound mass of iron was thought to be so heavy that the whole neighborhood gathered in to see it rolled. The necessity of handling such very heavy weights as could be made from ingots cast in large masses brought into play the invention of hydraulic machinery, so that we now have pumps to produce any required pressure in a series of pipes which deliver the water to the hydraulic engines in any part of the works. By simply turning a valve now a boy will pick up a heavy ingot (say of 10,000-pound weight) with his hydraulic crane and deliver it anywhere within reach of the crane. If on a car, it may then be taken by a small locomotive to the rolling-mill, where another crane picks it up and puts it into the furnace, and, after heating to the required degree, takes it out and delivers it to the machinery at the rolls; then the automatic tables push it back and forth through the rolls until it is reduced to the required dimensions. The same tables now take it to the shears, which are also operated by hydraulic power, and the plate, sometimes two inches thick, is sheared ready for shipment. All this is done with more ease than was possible a few years ago. Within the last few years electricity has been brought into play to do some of the heavy work, being for some things even more available than hydraulics.

In this brief account of the evolution of this great industry I have been much indebted for information to Mr. James M. Swank, secretary and general manager of the American Iron and Steel Association, and author of the elaborate work, "Iron in All Ages." My space has been too limited to more than outline the vast subject, but I have endeavored to give a slight idea of the giant in iron production our country has become in so short a space of time.

Chas Huston

CHAPTER XLVII

COPPER AND BRASS

THE Naugatuck River has its sources in the hills of northwestern Connecticut, and flows southward for about forty miles to its junction with the Housatonic River at Derby, taking its course through a narrow, winding valley, between steep, well-wooded hills, that rise directly from the river-bank to a considerable height. From Torrington, at the head of the valley, to Derby, there is a fall of about 600 feet. Four times, within six miles from its mouth, the water is diverted from its channel by dams, and held in large reservoirs to furnish water-power. Further up the valley, wherever it broadens to give room for a village or a city, there are water privileges, and the power is utilized for manufacturing purposes.

In this narrow valley, which contains a population of more than 80,000 people, evidence of thrift and prosperity is everywhere seen in the neat, comfortable homes of the workingmen, and the fine houses of their employers. This is the seat of the brass-rolling industry of America. Ten great corporations are here directly engaged in this business, producing about three fourths of the total quantity of rolled brass manufactured in the United States, giving direct employment to 8200 persons, and indirectly to many thousands more. Nearly 100,000,000 pounds of copper, or about one half the total quantity of this metal consumed in the United States, are conveyed annually to the Naugatuck Valley for use in these manufacturing establishments.

The Naugatuck is a capricious stream. It is subject to freshets in the early spring months, while in the summer there is often a scarcity of water. The valley of the Housatonic River, running parallel with the Naugatuck through Connecticut, furnishes better water privileges, and broader plains for laying out towns and cities; but in the Naugatuck Valley were found the men of foresight, energy, and activity who could originate great enterprises and carry them to completion. They began the brass-rolling industry sixty-five years ago. Its development and progress with the growth of the country are due to the energy and ability of those who have conducted the business and furnished the necessary capital for its enlargement. The causes that have led to the concentration of so large a proportion of this industry in the Naugatuck Valley are more complex. The cheap power afforded by the water privileges in the valley undoubtedly led to the establishment there of the first rolling-mills, which, as they increased in size and capacity, finally outgrew the water-power, and are at the present day operated by steam, or by steam and water-power together. An abundant supply of pure water is always necessary in a brass-mill for washing the metal, for fire protection, and for use in condensers in connection with steam-power; and the water-supply from the Naugatuck River is very useful for such purposes, as well as for power.

The mills originally established in the valley have enlarged and extended from time to time to keep pace with the growing demand for brass. According to the general law governing the concentration of kindred industries and trades in particular localities, new mills were started there, even after the water-power had ceased to be a determining factor in the problem of location. Other advantages, such as the cheapness and accessibility of wood of the variety best suited for annealing purposes, were among the causes that held the trade in the valley. Then, too, there arose a race of workmen skilled from generation to generation in the mixing, rolling, and manipulation of brass; and as time went on and competition increased, the production of rolled metal becoming less profitable, many of the rolling-mills began remanufacturing their own metal. Other corporations were formed, some being direct offshoots from the brass-mills, until the location became what it is to-day; a great center for the reworking and consumption of metal. There are many reasons why it is desirable that a brass-mill should not be too far from the place where its product is chiefly consumed, and thus it happens that, while a few brass manufactories are operated in other parts of the country, the Naugatuck Valley still is and probably will remain the seat of the brass-rolling industry in America. Other enterprises, such as the rolling of iron and steel, thrive best where their raw material, their fuel and labor, are cheapest and most accessible, transportation, labor, and fuel being great factors in the cost of the product; but the brass manufacturer, working a high-priced raw material, and bringing his finished product to the point of nicety in gauge and quality, finds the cost of labor, fuel, and transportation factors of far less importance relatively, and he is governed largely by other considerations in his choice of locality. Therefore, while the shifting centers of the manufacture of iron and steel are marked throughout the country by abandoned furnaces, the seat of the brass-rolling industry remains to-day where it was established sixty-five years ago, it being a noteworthy fact that, with hardly an exception, all of the brass-mills which are operated outside of the State of Connecticut were constructed and are carried on by Connecticut men.

Israel Coe, a farmer of Connecticut, John Hungerford, of Connecticut, and Anson G. Phelps, a capitalist of New York and founder of the house of Phelps, Dodge & Company, were pioneers in brass-manufacturing in this country, and in 1834 they built a brass-mill at Wolcottville, now Torrington, Conn. Previous to 1830, brass was imported, or manufactured here in a very primitive way. As early as 1811, James G. Moffett, of New York, rolled brass in small quantities, using for power a sweep actuated by oxen. In 1802, the manufacture of gilt buttons was begun in Connecticut by Abel Porter & Company. At that time these buttons were articles of fashionable use. To obtain brass for this purpose, the mixture was cast in ingots at Waterbury, and taken to Bradleyville, near Litchfield, Conn., where there was an iron-mill driven by water-power; here it was broken down and rolled into strips, and returned in a rough state to the button factory in Waterbury, where it was rolled thinner by being passed between two rolls two inches in diameter, driven by horse-power. The copper for brass-making was obtained from old boilers which had been used in distilleries and in sugar-making. This copper was cast into ingots and mixed with spelter, which was obtained from abroad. In 1808, Abel Porter & Company purchased the water-power now owned by the Scovill Manufacturing Company at Waterbury, and soon afterward put in rolls suitable for breaking down and finishing brass. For a period of about twenty years they rolled brass, but it does not appear that their production was any more than enough to supply their own requirements. In 1830, the firm of Holmes, Hotchkiss, Brown & Elton established a mill and engaged in the manufacture of sheet brass at Waterbury. This was substantially the beginning of the sheet-brass business in America, although the metal, in small quantities, may have been occasionally supplied to consumers before that time by the firm of J. M. L. & W. H. Scovill, and by Benedict & Coe, of Waterbury.

There was at that time also a demand for brass kettles, which were manufactured in England by a process known as the "battery" process: that is, they were hammered into shape from metal blanks. The establishment of the mill at Torrington, at the head of the Naugatuck Valley, in 1834, was for the purpose of rolling brass for use in manufacturing these kettles, and to supply the growing demand of the button factories. A small rolling-mill was built, with machinery imported from England, and Israel Holmes, of Waterbury, was engaged as manager of the mill. There was great difficulty in securing workmen competent to carry on the business. Mr. Holmes was sent to England, and succeeded in procuring a few experienced men. He afterward made another trip abroad for the same purpose, but the English manufacturers, fearful of losing their American trade, endeavored to prevent him from hiring their men, and it was with great difficulty and some danger to himself that he succeeded in embarking a colony of workmen and their families, about thirty persons in all. These were landed at Philadelphia, taken in a schooner from there to Hartford, Conn., from which place they proceeded on foot through the woods, a distance of twenty-five miles, to Torrington.

From this small beginning, and with no end of difficulty and discouragement, the enterprise continued to grow. Local competition arose, and in 1840, Edwin Hodges, of West Torrington, started a mill for the purpose of making brass kettles, and also for drawing brass wire. This seems to have been the first brass-wire-drawing establishment in this country. It was located in Cotton Hollow, in the town of Torrington. The enterprise was unsuccessful, and the mill was soon closed, with the loss of all the capital invested. In 1841, the original enterprise at Torrington was made into a stock company, with a capital of $56,000. It was named The Wolcottville Brass Company, and the incorporators were John Hungerford, Anson G. Phelps, and Israel Coe. The records of this company for the first few years of its existence contain some interesting details. The copper used was imported from Chile, or was obtained in the form of old copper, which was collected from different places throughout the country. The price of copper was then eighteen and three fourth cents per pound. Spelter, which was imported, cost eight and three eighth cents per pound. The fuel used was mainly wood, but some Lehigh coal was procured, which cost, at Hartford, $8.43 per ton, to which was to be added the cost of transportation by teams from Hartford to Wolcottville. Fire-brick for the furnaces cost $60 per 1000. The manufactured product, in the form of rolled and sheet brass, was valued at twenty-six to thirty cents per pound. It was taken by teams either to Waterbury, or twenty-five miles across a hilly country to Hartford, and from there shipped on sloops to New York. Upon the site of the works occupied by the Wolcottville Brass Company are to-day the great factories of the Coe Brass Manufacturing Company. The name of Anson G. Phelps is perpetuated by the city of Ansonia the Ansonia Brass and Copper Company, and the Ansonia Clock Company, as well as by the firm of Phelps, Dodge & Company, which he founded; and the name of Israel Holmes appears in the title of the corporation of Holmes, Booth & Haydens, of Waterbury.

The decade from 1840 to 1850 saw the birth of many of the prominent brass-manufacturing corporations of the present day. In 1843 a joint-stock company, at Waterbury, was organized under the title of the Benedict & Burnham Manufacturing Company, with a paid-up capital of $100,000. Aaron Benedict was president and treasurer, and John S. Mitchell secretary. Mr. Aaron Benedict continued at the head of the company until his death in 1873. This company now operates extensive works, and gives employment to 967 persons, manufacturing brass, German silver, etc., and remanufacturing metal.

The Waterbury Brass Company began business in 1845 with a capital of $40,000. Among the incorporators were John P. Elton, Lyman W. Coe, Israel Holmes, and Hobart V. Welton. They now give employment to 525 persons, and manufacture brass, brass wire, etc., and also remanufacture.

In 1849 the Naugatuck Railroad was completed, and the product of the valley mills was thereafter shipped by rail to tidewater at Bridgeport.

In 1848 Thomas Wallace and his sons, John, William, and Thomas, began the business of wire-drawing at Birmingham, Conn. Their cash capital was $500. Their knowledge of their trade enabled them to increase their business, and in a few years they built a factory at Ansonia, which has since been greatly enlarged. At present it is conducted under the name of Wallace & Sons, and gives employment to 646 persons, in manufacturing brass and copper wire, and remanufacturing.

The Scovill Manufacturing Company, of Waterbury, succeeded the firm of J. M. L. & W. H. Scovill, and was incorporated in 1850, with a capital of $200,000, which has since been increased. They now manufacture brass, German silver, etc., employing 1650 persons, and are extensive remanufacturers of metal.

The Coe Brass Manufacturing Company, of Torrington, Conn., was founded by Lyman W. Coe in 1863, and succeeded the Wolcottville Brass Company. Lyman W. Coe, the son of Israel Coe, was the president of the corporation, which began business with a capital of $100,000. Their capital has been increased from time to time, and they now employ 650 persons, manufacturing brass, German silver, tubes, wire, etc. They do not remanufacture.

In 1844 Anson G. Phelps purchased extensive lands in the vicinity of what is now the city of Ansonia, which was founded by him, and named in his honor. He constructed a dam across the Naugatuck River, a canal, large reservoirs for water-power, and built a mill for rolling copper. The firm of Phelps, Dodge & Co. had for some years prior to 1844 operated a copper rolling-mill at Birmingham, Conn. The water privilege at Ansonia is now owned and operated by the Ansonia Land and Water-Power Company, and is the source of water-power for the city of Ansonia. Mr. Phelps brought from the Wolcottville works J. H. Bartholomew and George P. Cowles, who managed the business at Ansonia under the name of the Ansonia Brass and Battery Company, the term "battery" being indicative of the process by which brass kettles were hammered from metal blanks. This method of making kettles was in use until 1851, when it gave place to a patented process for spinning kettles from circular blanks of metal. The business of the Ansonia Brass and Battery Company was conducted by the firm of Phelps, Dodge & Company of New York. A brass-mill was built, and later a wire-mill. The company afterward engaged in the manufacture of clocks. In 1869 this manufacturing enterprise was incorporated under the name of The Ansonia Brass and Copper Company. In 1877 the manufacture and sale of clocks had increased to such an extent that it was decided to form a new joint-stock corporation under the name of The Ansonia Clock Company, which began business on January 1, 1878. The location of this part of the company's business was transferred to Brooklyn, N. Y., where large factories were erected and are now in operation. The ownership and management of the two companies are practically the same. They operate at Ansonia four factories, where they give employment to 1125 persons, and in the factories in Brooklyn 1000 persons are employed. They manufacture at Ansonia sheet brass, sheet copper, wire, tubing, etc. They also remanufacture their metal, making brass bedsteads and other articles.

During many years brass manufacturing was conducted on what would now be regarded as a very small scale, and, although the methods pursued at the present day are substantially the same as at the beginning, wonderful progress has been made in cheapening these methods, and improving the quality of the articles manufactured. It is stated that in the early forties it was customary for the manufacturers at Waterbury annually to appoint a committee to make the long journey to Baltimore for the purpose of purchasing copper for the season's supply. At that time the purchase of 500,000 pounds of copper was sufficient for a year's supply for these manufacturers. At present that quantity would not supply the demand of the Naugatuck Valley for two days.

Copper and spelter being the metals from which brass is made, a brief account of the sources of supply from which these materials are obtained will throw some light upon the development of the business of brass and copper rolling. The first copper-mine worked in the United States was the Simsbury Mine, at Granby, in Connecticut. The record of this mine extends back to the year 1705. It was worked until 1770, but was not profitable, and only a small quantity of ore was taken out. During the War of the Revolution it was used as a prison, and to-day it is an object of interest to those who are curiously inclined. About the year 1719, the Schuyler Mine, near Belleville, N. J., was opened and became one of a number of small mines which were worked in that section of the country for a series of years following. The Gap Mine, in Lancaster, Pa., was started in 1732. The production of copper from all these openings, however, was of very little commercial importance, and until the Lake Superior region became a source of supply, the consumers of copper in the United States had to procure their raw material in Chile. It was brought to this country in the form of pigs, and refined near Boston, at Baltimore, and at other points along the coast. In 1844, the Cliff Mine, near Eagle River, Lake Superior, was opened, and in 1845 regular records of production were begun. The great development of the copper-mining industry at Lake Superior soon placed the United States in the front ranks of the copper-producing countries of the world, and the product of these mines, being of a quality much finer than the copper produced abroad, naturally took the place of the foreign product for home consumption. Copper production in the United States from 1845 to 1880 kept pace with home consumption, a comparatively small quantity being exported up to the last-named period, so that the record of the copper produced in the United States between the periods named will indicate the progress made in manufactures of brass and copper. Beginning in 1845 with a product of 100 tons (which was much less than the quantity required for home consumption), the record as shown by periods of ten years is as follows: 1850, 650 tons; 1860, 7200 tons; 1870, 12,600 tons; 1880, 27,000 tons.

Very little copper was imported to the United States after 1860. In 1879 the Lake Superior region furnished about eighty-three per cent. of the total quantity of copper produced in the United States, but after 1880 the opening of the copper-mining regions of Arizona and Montana increased the output largely beyond the quantity required for use here. A heavy exportation at once followed, and this country became one of the world's great sources of supply of copper. The quantity of copper produced in the United States in 1894 was 157,814 long tons, of which there were consumed here 78,687 tons, and the quantity exported was 75,737 tons.

A fair estimate of the average price of copper in the United States from 1845 to 1859 is twenty cents per pound. From 1859 to 1876 the yearly average price of copper varied from twenty and a half cents to thirty-two cents per pound, with the exception that in the years 1864 and 1865 the price was advanced, so that in 1864 the average price of Lake Superior copper was forty-six and one fourth cents per pound, and in 1865 thirty-six and one fourth cents. Since 1876 there has been a gradual decline in the yearly average price, which was eighteen and five eighth cents in 1877, and eleven

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and one fourth cents in 1887. In 1894 the price touched nine cents per pound, which is the lowest point recorded. The price at present is twelve cents per pound. Since we became great exporters of copper, the price of this metal in the United States has been nearly at a parity with the price in Europe. With increased production the cost of mining has been greatly reduced, while improvements in metallurgy, and methods of electrolytic extraction, have brought into the market great quantities of copper suitable for the finest work from sources which formerly furnished only coarse and ordinary grades of material. In former years the tariff upon copper had affected the price of the raw material in this country, often enabling the mining companies to obtain from the consumer at home a higher rate than that which ruled abroad. The price of copper in this country was sometimes sustained by arrangement between the mining companies, who would market the copper here at a fixed price, and ship their surplus product abroad at a considerably lower rate. The American brass manufacturer was, therefore, usually confined to a home market for his product, and the statement that, in certain cases, he succeeded in taking large foreign contracts for brass, with the disadvantage of having to pay a higher price than his competitor abroad, not only for his raw material but for his labor and supplies, is the best possible tribute to the excellent quality of his work. Ingot copper was admitted to this country, duty-free, until the Act of July 30, 1846, when a duty of five per cent. was imposed. The Act of March 3, 1857, restored copper to the free list. Subsequent duties were imposed upon copper: in 1861 of two cents per pound, and after that period of from two and a half to five cents per pound. The McKinley Bill made the duty one and a quarter cents per pound, and at present ingot copper is on the free list.

The first refined spelter produced in this country was made in the year 1856, at Bethlehem, Pa., from ores mined there, and it was sent to the government arsenal at Washington. Up to 1865 or 1866, the spelter used by brass manufacturers was imported from Germany and Belgium. In 1867 the Missouri Zinc Company, at Carondelet, Mo., began to make spelter from Wisconsin ores. The first year they made about 1800 tons; the next year about 2500 tons. This was used in the United States. In 1869 the first zinc ores were discovered in southwestern Missouri, and since then the development of the zinc industry has been constantly increasing. The output of the present year will probably be between 80,000 and 90,000 tons. The American brass manufacturers have used domestic spelter almost exclusively for the past twenty-five years, the quality of the American spelter being superior to that of the foreign article. One of the finest grades of spelter is produced in New Jersey, and is sold at a high price, but the greater part of the spelter produced at present in this country comes from southwestern Missouri and Kansas. At no time within the past twenty-five years has spelter been admitted to the United States free of duty. The duty under the McKinley Bill was one and one half cents per pound. Under the present tariff the duty is one cent per pound.

On January 13, 1801, Paul Revere, of Revolutionary fame, wrote to a friend in London, requesting him to go down to Maidenhead, where rolling machinery was manufactured, and ascertain the price of a pair of rolls nine inches in diameter and twenty inches long, for making sheet copper. Colonel Revere was a silversmith, and had previously corresponded with Benjamin Stoddard, Secretary of the Navy, upon the subject of copper rolling. It is not known whether or not these rolls were procured at that time, but in January, 1801, Colonel Revere purchased an old powder-mill at Canton, Mass., where he began the production of sheet copper. The business has been carried on continuously since that time, and is now incorporated under the name of the Revere Copper Company. Among the names of those originally connected with this enterprise are Joseph A. Revere, James Davis, John Revere, and S. T. Snow. This company now manufactures sheet copper and yellow metal, giving employment to 125 men.

In 1812 the Soho Copper Company was established in Belleville, N. J., where there is a good water-power, and water transportation by canal and by the Passaic River. The originator of this enterprise was Harmon Hendricks, the son of Uriah Hendricks, who was an importer of copper and metals. Some of the buildings were of brick, roofed with tiles imported from Europe. The rolling-mill was of wood, and contained one pair of breaking-down rolls, one pair of sheet rolls, and one pair of bolt rolls, all of which were imported from England. The plant and machinery cost $50,000, and were intended for the purpose of furnishing the United States government with heavy copper sheets for boilers, and bolts for ship-building, during the War of 1812. This business has descended from father to son in a direct line, until it is now in the hands of the fourth and fifth generations, and is known as the "Belleville Copper Rolling Mills," operated by Hendricks Brothers, and employing 100 men. In the year 1815, ingot copper sold for eighteen and one half cents per pound, and the price of copper sheets was thirty-nine cents per pound.

The Gunpowder Copper Works were built in 1817, on the Gunpowder River, ten miles from Baltimore, by Levi Hollingsworth. Water power was used in manufacturing. In 1866 the rolling-mill was transferred to Canton. It is now operated by the Baltimore Copper Smelting & Rolling Co., who are engaged in smelting, and in the manufacture of blue vitriol and sulphuric acid. They employ in all about 500 operatives, of whom fifty are employed in the rolling-mill.

The manufacture of yellow metal for sheathing vessels was the subject of a patent by H. F. Muntz, of Birmingham, England, about the year 1840. This mixture, which contains a large percentage of spelter and can be rolled while hot, being cheaper than copper, naturally came largely into use for ship-sheathing. It was first made in this country by the Revere Copper Company, within a year or two after its production in England. Later, it was made by the Taunton Copper Manufacturing Company, the New Bedford Copper Company, and the Bridgewater Iron Company. The decline of American ship-building, and legislation permitting American vessels engaged in foreign trade to use the foreign metal without payment of duty, have greatly decreased the demand for yellow metal in the United States.

The causes that have tended to localize the manufacture of sheet brass do not affect the rolling of copper. There is no mixing to be done, and less skill is required in rolling copper than is needful in rolling brass. The makers of sheet copper do not remanufacture their product. So that, while out of a total of nineteen brass-mills fourteen are located in Connecticut, the copper-mills are distributed throughout the country: in Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Michigan, and Illinois. The following is a list of the brass and copper rolling-mills in this country at the present time:

BRASS AND COPPER ROLLING-MILLS, 1895.

Name.	Location.	Year Established.	Number Persons Employed.	Principal Products.
Ansonia Brass & Copper Co.	Ansonia, Conn.	1845	1,135	Rolled brass, sheet copper, wire, etc. Remanufacture.
American Electrical Works	Providence, R. I.	1882	698	Wire.
Benedict & Burnham Mfg. Co.	Waterbury, Conn.	1843	967	Rolled brass, German silver, wire, etc. Remanufacture.
Baltimore Copper Smelting & Rolling Co.	Baltimore, Md.	1887	50	Sheet copper.
Brooklyn Brass & Copper Co.	Brooklyn, N. Y.			Rolled brass, copper, etc.
Birmingham Brass Co.	Birmingham, Conn.	1892	206	Rolled brass, wire, etc. Remanufacture.
Bristol Brass & Clock Co.	Bristol, Conn.		455	Rolled brass, etc. Remanufacture.
Bridgeport Brass Co.	Bridgeport, Conn.	1865	750	Rolled brass, German silver, wire, etc. Remanufacture.
Coe Brass Mfg. Co.	Torrington, Conn.	1863	650	Rolled brass, German silver, wire, etc.
Chicago Brass Co.	Kenosha, Wis.	1886	144	Rolled brass and copper.
Detroit Copper & Brass Rolling-Mills	Detroit, Mich.	1881	275	Rolled brass, sheet copper, wire, etc.
Holmes, Booth & Haydens	Waterbury, Conn.	1853	1,012	Rolled brass, wire, etc. Remanufactnre.
Hendricks Bros	Belleville, N. J.	1812	100	Sheet copper, etc.
C. G. Hussey & Co.	Pittsburgh, Pa.	1848	90	Sheet copper, etc.
Manhattan Brass Co.	New York.	1865	575	Rolled brass, etc. Remanufacture.
Edward Miller & Co.	Meriden, Conn.			
New Haven Copper Co.	Seymour, Conn.			Sheet copper, etc.
New Bedford Copper Co.	New Bedford, Mass.	1860	100	Sheet copper, yellow metal, etc.
Plume & Atwood Mfg. Co.	Waterbury, Conn.	1869	791	Rolled brass, wire, etc. Remannfacture.
Park, Bro. & Co., Ltd.	Pittsburgh, Pa.			Sheet copper.
Parsons Manganese Bronze & Copper Co.	Philadelphia, Pa.	1894	50	Sheet copper, etc.
Randolph & Clowes	Waterbury, Conn.	1886	550	Rolled brass, sheet copper, etc. Remanufacture.
Rome Brass & Copper Co.	Rome, N. Y.	1879	397	Rolled brass, copper, etc.
Revere Copper Co.	Boston, Mass.	1828	125	Sheet copper and yellow metal.
Scovill Mfg. Co.	Waterbury, Conn.	1850	1,600	Rolled brass, German silver, etc. Remanufacture.
Seymour Mfg. Co.	Seymour, Conn.	1878	220	Rolled brass, German silver, etc.
Taunton Copper Mfg. Co.	Taunton, Mass.	1831	150	Sheet copper, yellow metal, etc.
Tamarack Osceola Copper Mfg. Co.	Dollar Bay, Mich.	1888	90	Sheet copper, wire, etc.
Wallace & Sons	Ansonia, Conn.	1848	646	Rolled brass, sheet copper, wire, etc. Remanufacture.
Waterbury Brass Co.	Waterbury, Conn.	1845	525	Rolled brass, wire, etc. Remanufacture.

In addition to these, there are two manufacturers of iron wire, who are extensive manufacturers of copper wire also. They are the Washburn and Moen Manufacturing Company, of Worcester, Mass., and the John A. Roebling's Sons' Company, of Trenton, N. J.

Brass founders or manufacturers of articles of cast brass are not included in the foregoing list. This is a separate branch of business, and it is carried on by a great number of foundries in the United States, some of the most prominent of these being:

The Eaton, Cole and Burnham Company, of Bridgeport, Conn. The Crane Company, of Chicago. The Buckeye Brass and Iron Works, of Dayton, O. The Wm. Powell Company, of Cincinnati. Henry M'Shane Manufacturing Company, of Baltimore. M'Nab and Harlin Manufacturing Company, of New York. Jarecki Manufacturing Company, of Erie, Pa. Walworth Manufacturing Company, of Boston.

It is estimated that these eight companies consume about ten million pounds of ingot copper annually, and that the total consumption of ingot copper by all the foundries is from eighteen to twenty-five million pounds. In addition to this there is a large quantity of old metal annually converted into brass castings by these foundries.

Many manufacturing concerns, also, have their own foundries, where metal is cast, to be used in their various departments. These foundries are not included in the foregoing estimate.

Seamless Brass and Copper tubes are made by a number of the brass-mills in Connecticut, by the American Seamless Tube Company, near Boston, and by the Bloomsburg Brass and Copper Company, in Pennsylvania. Early in 1848, Joseph Cotton, Joseph H. Cotton, William E. Coffin, Holmes Hinckley, and Daniel F. Child, all of Boston, despatched to England an engineer, Joseph Fox, to learn how to make seamless brass tubes, paying a large sum to Messrs. Green and Alston, the English patentees, for the instruction of Mr. Fox, and the right to make tubes by their process in the United States. Previous to that time all copper and brass tubes for use in locomotive and marine boilers and for the hundreds of other uses to which tubes were put, were brazed; that is, made of strips of metal put in a rounded form, and their edges brazed together. In 1850, the gentlemen before-named organized a corporation called the American Tube Works, of Boston, and began the manufacture of seamless drawn brass tubes. These tubes have taken the place of the brazed tubes in all cases where steam or other high pressures are involved, and they are made by seven or eight manufacturers in the United States.

There are no public records showing the present condition of the brass and copper industry in America. Figures can only be obtained by personal application to the manufacturers themselves. The following details, showing the state of the business at present and covering the year ending July 1, 1895, are taken from information furnished by twenty-seven corporations, and include the entire business of the country in rolled brass, copper, and wire. In a few instances, where information could not be obtained, an estimate of the business has been made.

The nominal capital invested is $12,137,000, but the amount of the actual investment is about $28,000,000.

The number of persons employed is 14,350.

The annual consumption of copper is 191,000,000 pounds.

The annual consumption of spelter is 31,500,000 pounds.

The value of the annual product is $36,400,000, of which the metal is valued at $29,700,000, and the remanufactured products at $6,700,000. This includes only remanufacturing by brass rolling mills.

Any one of the principal establishments in Connecticut will serve as a type of the modern brass and copper rolling-mill. The buildings are usually of brick, roofed with iron, and contained in an inclosure of from twelve to twenty acres. They are generally one story high, and are light and well ventilated. An air of neatness and order prevails. The machinery is of modern construction and the best that can be made. The motive power is steam. In the remanufacturing departments automatic machinery takes the place of hand labor. In the rolling-mill, metal of the finest finish is produced, and brought to a degree of accuracy in gage which is not usually found in other countries. Eyelet metal, for example, is required to be rolled to a width of six inches, and not to vary more than one two-thousandth of an inch in gage; that is, it must not vary in thickness more than one-fifth of the breadth of a human hair. A skillful rollerman will produce metal within these requirements. It is well understood by those who are familiar with the methods employed abroad, that nearly all the improved processes of brass rolling have originated in this country; that we have taken the lead in this branch of business from the beginning, and that our products at present, in point of accuracy of gauge and fineness of quality and finish, are far in advance of similar articles produced in other countries. This has been brought about indirectly by the fine quality of our copper and spelter, which has enabled our manufacturers to produce brass of a kind readily adapted to mechanical manipulation, while Yankee ingenuity has taught our mechanics to invent machinery for metal rolling and metal working, which in its turn has created a demand for metal of the utmost nicety in gauge; so that a very large proportion of the brass produced in this country to-day is gauged by the micrometer, which registers fractions of the thousandth part of an inch.

Many of these brass manufacturing corporations have a nominal capital, which represents only a small part of the real sum invested. They have from year to year enlarged their plants, using their surplus earnings, and increasing their outlay without increasing their capital, so that often the real investment is three or four times the amount of the capital stock. Seven of the principal brass rolling-mills, with a nominal capital amounting to $2,419,000, claim an actual investment of $12,000,000; nearly five times the amount of their capital stock. Brass rolling is now carried on upon a very narrow margin of profit, so that what would appear to be a fair dividend upon the nominal capital is a very small return for the actual investment. As a natural result, in some cases new plants, that have been erected with modern machinery, have had to close their doors, being unable to compete with those already established. Laborers employed in brass-works are well paid, and, as a rule, are thrifty, often owning their houses. Difficulty with workmen is of very rare occurrence, and no serious labor troubles are recorded in the history of the business.

That the present low price of copper, the revival of business, the natural increase in consumption following the growth of the country, and the extension of electric lighting and telegraph lines, all using a great quantity of metal, will lead to increased production of every form of manufactured brass and copper, is already shown by figures indicating that the domestic consumption of copper for 1895 will be at least twenty per cent. in excess of the quantity consumed in 1894.

The writer is indebted to the courtesy of the manufacturers of brass and copper for such information concerning their business as was necessary to enable him to compile the statistics contained in this article, and he desires also to acknowledge his obligation to Messrs. S. T. Snow, of Boston, Edmund Hendricks, of New York, F. J. Kingsbury, of Waterbury, and Charles F. Brooker, of Torrington, Conn., for facts relating to the early history of the manufacture of brass, copper, and yellow metal; to Mr. E. H. Cole, of New York, for a list of brass foundries, and to Messrs. John Stanton and Edward F. Byrne, of New York, for information touching the history of copper-mining and the production of spelter.

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CHAPTER XLVIII

LOCOMOTIVE AND ENGINE WORKS

ALTHOUGH transportation for self or chattels has long been known to man, improvement in its various methods was so slow as to be almost imperceptible until the introduction of steam gave it an impetus on land and water. This powerful agent has been adapted to transportation within the past one hundred years, and the event has been followed by the decline and fall of the stage-coach and the canal-boat, and the rise and development of the locomotive and the steamship. These two have constituted the most important factors of transportation, which is itself one of the most important elements of the civilization of the present century. On sea and land rapid transportation was impossible without steam. This was applied first to power transmission, as in pumping and the movement of machinery; then to navigation, where the conditions correspond most nearly to those of stationary practice, and last to the propulsion of vehicles on land. The factor by which its power is utilized for the latter purpose is the locomotive. There are no branches of the mechanic arts which possess greater fascination for the general public than the building of steamships and locomotives. Properly directed, they struggle, they accomplish, they excel; and all are interested in their achievements. This interest is not new. It attached no less to the transportation of bygone generations. The rivalry of competing stage-coaches and the popularity of the favorite whips are traditional. To-day the master of the speediest steamship and the driver of the fastest locomotive have inherited the same popular regard.

As the entire development of locomotive engineering in the United States has taken place within the past century, it is not difficult to trace its inception and progress. Although other lines of rails had previously been laid for special purposes, the Baltimore and Ohio and the South Carolina railroads — both begun in 1828 — were the first American railways constructed to carry passengers and freight. Upon the first mentioned of these lines was run the first American-built locomotive,— that of Peter Cooper, which was constructed in 1829. This was, however, a mere working model, not intended for permanent service, but to demonstrate the practicability of operating the line by locomotive power. It did this successfully, and led to the completion of the road, which otherwise might have been abandoned. This little machine, with a single cylinder three and a half inches in diameter, a boiler no larger than that of an ordinary kitchen-range, and tubes improvised from gun barrels, on its trial run attained a speed of eighteen miles an hour, and hauled forty passengers besides the driver, who was Peter Cooper himself. The first locomotive for real service used in the United States was the "Stourbridge Lion," built at Stourbridge, England, and imported by Horatio Allen, in 1829, for the Delaware and Hudson Canal Company. It was of a primitive type, quickly abandoned both in England and the United States, but forms one of the interesting steps by which a uniform pattern was subsequently reached. In 1830, the first locomotive constructed in the United States for actual work — the "Best Friend" — was built by the West Point Foundry, for the South Carolina Railroad. In 1831 Matthias W. Baldwin, a manufacturer of bookbinders' tools, of Philadelphia, was engaged by the proprietors of Peale's Museum, of Philadelphia, to construct a model locomotive to operate on a circular track, to satisfy the public curiosity growing out of the Rainhill contest, in England, which had resulted in a victory for Robert Stephenson's "Rocket," and which was then attracting widespread attention. In September, 1832, there were built at York, Pa., by Davis & Gartner, three locomotives of the "grasshopper" pattern, for the Baltimore and Ohio Railroad, from designs of Phineas

Davis and Ross Winans. Some of these locomotives continued in service about sixty years, and until recently were still in use at Mount Clare, in Baltimore.

The success of the Peale Museum model was such that Mr. Baldwin was employed by the Philadelphia, Germantown and Norristown Railroad Company, in 1831, to construct a locomotive for their line. This locomotive — "Old Ironsides"— was completed in November, 1832. It was a four-wheel engine, similar to the English design of the day, and weighed in running order something over five tons. The rear, or driving wheels, were fifty-four inches in diameter, placed on a crank axle. The cylinders were nine and one half inches in diameter, by eighteen inches stroke, and were attached horizontally to the smoke-box. The frame was of wood. The wheels were made with heavy cast-iron hubs, wooden spokes and rims, and wrought-iron tires. There was no cab. The tender was four-wheeled, with wooden sides and back for holding the wood used for fuel, and with an iron box used as a water-tank. This locomotive attained a speed of thirty miles an hour, with its train attached, and upon a special occasion it is said to have attained a speed of sixty miles per hour. Locomotive engine building may be said to have become fairly established by 1834; but in those early days, when there was no practice to guide, when skilled workmen were few, and but little in the way of shop facilities existed, the difficulties surrounding the locomotive builder were extraordinary, and only the most indomitable perseverance attained success. Civilization owes a debt of gratitude to those pioneers of railway mechanics —Cooper, Allen, Baldwin, Rogers, Norris, Winans, Campbell, and their co-workers, and later to William Mason, Cooke, McQueen, Millholland, Hudson, and others.

The early American locomotives were similar in all essential features to the English engines of the day, being constructed largely either from published descriptions or from actual observation of those imported. The importation of locomotives did not long continue, however, as the mechanics of the country soon proved their ability to supply the demands of the growing railroads. The many bright minds engaged upon the subject, together with active competition among the early builders, soon resulted in radical departures from the English types. Developing independently, under various conditions, the differentiation soon became marked, and resulted in features which still distinguish the American from the English locomotive, in whatsoever country they may be found. The steps by which these differences were reached may be briefly touched upon as follows: the substitution of a four-wheel swiveling truck or bogie for the pair of fixed carrying-wheels (1832); the use of the cross-head pump for supplying feed-water to the boiler (1833); the use of the half-crank driving-axle in place of the crank-axle (1834); the use of outside connections to the driving-wheels (1835); the coupling together of two pairs of driving-wheels, patented by H. R. Campbell (1836); the use of counterbalance weights to balance the revolving and reciprocating parts (1837); the use of lap-welded wrought-iron boiler tubes (1838); the use of bar-frames of forged iron with forged pedestals (1840); the use of wooden cabs with glass windows, to afford ample protection for the enginemen, which originated about 1840 in New England, where such protection was necessary on account of the severity of the winters; the introduction of Baldwin's flexible-beam truck (1842); the use of equalizing beams connecting the driving-wheels, invented by Eastwick and Harrison (1845); the use of the "ten-wheel" locomotive, with six coupled wheels and a leading four-wheel truck (1846); the use of the Mogul locomotive with six coupled wheels and a leading two-wheel truck (1861), and of the Consolidation type, with eight coupled wheels and a leading two-wheel truck, designed by Alexander Mitchell of the Lehigh Valley Railroad, and built at the Baldwin Locomotive Works in 1866. The Mogul type took its name from the first engine of this class; the Consolidation type likewise took its name from Mitchell's "Consolidation," but the latter was named not because of any peculiarity of design, but because of the then recent consolidation of a number of smaller lines now joined in the Lehigh Valley system.

Other features of the American locomotive appear to the foreigner to be peculiar, such as the pilot or "cowcatcher," the bell, the boiler covering of planished or Russia iron, the large headlight, and the directness and visibility of the pipes and other appurtenances. The aim of American locomotive designers has been to produce a machine having the maximum flexibility of wheel-base to enable it to pass sharp curvature and adapt itself to the unevenness of track subject to the action of severe frosts; and to provide for repairs by making every part accessible and removable without affecting other parts. Prior to the Centennial Exhibition of 1876, it was frequently customary to use gaudy painting and forms of unessential parts supposed to be ornamental; but during the period of business depression and retrenchment in which the Centennial occurred, the railroads learned to dispense with this source of expense. This cause, together with the improvement in the public taste which was coincident with, or the result of, the Centennial, led to the abandonment of fancy painting and molded or beaded ornamentation, and the substitution of smooth, appropriate forms, painted in plain dark colors, with little or no striping.

In the early fifties the "American" type, with four coupled wheels and four-wheeled truck, patented by Campbell in 1836, became the most generally adopted class of locomotive, and was for many years thereafter used for general service — passenger, freight, and switching. The growing traffic of the railways, however, created the need for more powerful locomotives constructed especially for freight service, as well as for engines better adapted for switching than old road locomotives. Therefore, in the sixties, the Mogul and ten-wheel types were widely adopted, and between 1870 and 1880 the Consolidation type became the recognized standard for the heaviest freight service. Prior to 1880, the general use of iron tires and iron rails of light section, usually not exceeding fifty to sixty pounds per yard, limited the weight per axle to about twelve tons as a maximum. About that year the general substitution of steel tires and the growing use of steel and the introduction of the heavier rails possible in steel, together with an awakening to the advantages of larger heating surfaces in locomotive boilers, led to the acceptance of greatly increased weights. This tendency has since grown constantly. The use of heavier, more powerful locomotives made practicable economies in transportation by the use of cars of larger carrying capacity, which in turn required still heavier locomotives to move them. Like the perpetual contest between the impenetrable armorplate and the irresistible projectile, it is difficult to predict the conclusion of the struggle. It appears, however, that the present car loads of 60,000 to 80,000 pounds are about as large as will serve the convenience of shippers. It is safe to predict that rails of 100 pounds per yard, which have already been adopted by a number of the most important lines, must shortly come into general use. The heaviest locomotives of 1895 have as much as twenty-four tons' weight per axle.

Among the locomotive-building establishments which have contributed a share to the motive-power of the past, and have either disappeared altogether or have discontinued the manufacture of locomotives for other lines of business in which competition is less intense, may be mentioned the works of Norris Brothers, of Philadelphia, which in early days were active competitors of Baldwin and Rogers, but which, after many vicissitudes, went out of existence in 1865. These works in part are now included in the plant of the Baldwin Locomotive Works. Baltimore had the works of Ross Winans and the Denmeads. Boston has had the works of Seth Wilmarth, the Globe Works of John Souther, and the works of McKay & Aldus at East Boston, whilst the Hinckley Locomotive & Machine Works, one of the oldest, occupied an honorable position in the business until within ten years. New England has been an active locomotive-building section. In addition to the works mentioned may be noted those of Ballard Vail, Andover, near Boston, Mass.; Corliss & Nighttingale, Providence, Geo. H. Corliss, the great engine-builder, proving less successful in the manufacture of locomotives; A. Latham & Company, White River Junction; the Amoskeag Locomotive Works at Manchester, N. H.; the Locks and Canals Works at Lowell, Mass.; a works at Lawrence; and in later days the Taunton Locomotive Works, the Mason Machine Works, and the Portland Locomotive and Car Company, three concerns of enviable reputation, which have recently found other lines of business more profitable. New Jersey also has been a prolific field of locomotive-manufacture. An offshoot from the Rogers Works was that of William Swinburne, of Paterson, which was subsequently called the New Jersey Locomotive Works, and finally the Grant Locomotive Works. Finding their shops antiquated and their appliances inadequate to modern requirements, the Grant Works ceased business at Paterson in 1885, and reorganized with new capital and new shops at Chicago. This plant succumbed to the financial storm of 1893, and was sold to the Siemens & Halske Electric Company, which now operates it under its own name for the manufacture of electrical equipment and locomotives. For many years Breese, Kneeland & Company operated the Jersey City Locomotive Works at Jersey City, and Van Cleeve, McKean & Dripps had shops at Trenton. Eastwick & Harrison were builders of locomotives at Newcastle, Delaware, but, failing in 1840, were succeeded by the Newcastle Manufacturing Company. The partners subsequently gained fame and wealth in railway operations in Russia. In the West were the Cuyahoga Works of Cleveland, those of Scovill at Chicago, Booth & Company at San Francisco, and others at Detroit and Milwaukee. Later the Rome Locomotive Works, at Rome, New

York, entered the field, but had only a few years of disastrous existence, which ended in 1891. The list might perhaps be extended further, but it is a more agreeable task to record the works which are, in this year 1895, engaged in keen but friendly rivalry to contribute to the progress of transportation and to supply the motive power for 180,000 miles of railways in the United States and a considerable number abroad.

The Baldwin Locomotive Works of Philadelphia were established in 1831 by Matthias W. Baldwin, as has before been mentioned. These works are now the property of George Burnham, Edward H. Williams, William P. Henszey, John H. Converse, and William L. Austin, partners, constituting the firm of Burnham, Williams & Company. The annual capacity is 1000 locomotives, and 947 have actually been constructed in a single year, during all of which, however, the demand for locomotives was not sufficient to keep the works running continuously to their maximum capacity. The works occupy sixteen acres in the center of the city. A number of the buildings of later construction are from four to six stories in height and of the most substantial character. Employment is given to about 5100 men.

The Rogers Locomotive Works, of Paterson, N. J., were founded in 1836 by the firm of Rogers, Ketchum & Grosvenor. The mechanical head and dominating spirit was Thomas Rogers. Upon his death in 1856 the business was incorporated under the title of The Rogers Locomotive and Machine Works, of which Jacob S. Rogers was president and William S. Hudson was superintendent. Mr. Hudson exercised an important influence upon the development of American locomotive manufacture. Owing to Mr. J. S. Rogers' increasing age, the company was reorganized in 1892 under its present title of The Rogers Locomotive Company. Mr. R. S. Hughes, for many years treasurer, became president, and Mr. Reuben Wells, well known for his honorable connection with railroad management, became superintendent. These works give employment to about 1400 men, and have an annual capacity of 250 locomotives.

The Schenectady Locomotive Works were established by Norris Brothers in 1848, were incorporated in 1851, and in 1863 passed into the sole control of John Ellis, who associated with him as superintendent Walter McQueen. Mr. Ellis was succeeded, upon his death in 1864, by his next younger brother, Charles G. Ellis, and upon the death of the latter in 1891 Edward Ellis became president. Mr. A. J. Pitkin is now superintendent. The works employ 1800 men and have an annual capacity of 400 locomotives.

The Cooke Locomotive and Machine Company, of Paterson, N. J., began the manufacture of locomotives in 1852, the title of its ownership then being Danforth, Cooke & Company. The works were originally established about the year 1800, and for fifty years were engaged in the manufacture of cotton and other machinery. Upon the entrance of John Cooke, who had previously been in the employment of Thomas Rogers, the manufacture of locomotives was begun. John Cooke may therefore be regarded as the founder of this establishment as a locomotive-works. The present organization is John S. Cooke, president; Frederick W. Cooke, vice-president; William Berdan, secretary and treasurer; and Charles D. Cooke, superintendent. The original shops in Paterson have recently been abandoned to other uses, and new and completely modern shops have been built with a capacity of 180 locomotives per year. The works employ about 800 men.

The Pittsburgh Locomotive Works were organized in August, 1865, and were completed so far as to construct their first locomotive in the latter part of 1866. The works were originally designed for a capacity of thirty locomotives per year, but by the construction of new fire-proof buildings, and the addition of new and improved machinery, the capacity has been gradually increased to 300 engines per year. The works occupy nearly twelve acres of ground, and their equipment includes the most improved hydraulic, pneumatic, and electric appliances for fashioning the work and handling materials. There is also a completely appointed laboratory for chemical and physical tests of materials. The works employ about 1500 men.

The Rhode Island Locomotive Works of Providence, Rhode Island, were likewise established in 1865, at the close of the War of the Rebellion, when the nation once more turned to the arts of peace and began the work of restoring its wasted energies, expanding its means of internal communication, and developing its material resources. These works have occupied an important position in the field of locomotive-manufacture. As now organized, Charles Felix Mason is president, Arthur Livingstone Mason is vice-president, Earl Philip Mason is secretary and treasurer, and Joseph Lythgoe is superintendent. These works employ about 1400 men, and have an annual capacity of 250 locomotives.

The works of H. K. Porter & Company, of Pitts-

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burgh, were established in 1869, and have been devoted exclusively to the manufacture of light locomotives for such special purposes as in mills, furnaces, mines, contractors' and plantation service, etc. The firm was at first Smith & Porter, and later Porter, Bell & Company. It employs 325 men, and has a capacity of 120 locomotives per annum.

The Brooks Locomotive Works of Dunkirk, New York, were originally constructed as the locomotive building and repair shops of the Erie Railway. In 1869, Jay Gould, then president of the Erie Railway, having completed extensive shops at a more central location on the line of that road, ordered the Dunkirk shops to be permanently closed, and the machinery removed to other locations. Mr. Horatio G. Brooks, at that time superintendent of motive power and machinery of the Erie Railway, whose home was at Dunkirk, and whose interests were identified with the welfare of that place, made a proposition to Mr. Gould for a lease of the shops and machinery for the purpose of establishing the business of locomotive-building. The lease was consummated in November, 1869, and before the close of the year the first two locomotives of the new Brooks Locomotive Works Company were turned out. The growth of the works since that time has been constant, until their capacity at the present time is 400 locomotives per year. During the year 1883 the property, comprising twenty acres of land, the permanent plant, additions and machinery were purchased from the New York, Lake Erie and Western Railroad Company by the Brooks Locomotive Works. These works employ about 1500 men. At the present time Mr. M. L. Hinman is president and treasurer, and Mr. R. J. Gross vice-president.

The Richmond Locomotive and Machine Company of Richmond, Va., is the only locomotive-manufacturing plant in the South. The works were established in 1865 for the manufacture of plantation and saw-mill machinery, and were gradually adapted for the construction of tram and street-car motors. In 1880, the shop having been destroyed by fire, it was removed beyond the city limits and reconstructed upon an enlarged scale. In 1889 it secured the contract from the United States government for building the machinery of the armored battle-ship *Texas*, which gave it wide prominence. This contract was successfully executed, but the works have since been devoted exclusively to the construction of locomotives. They give employment to 1200 men, and have an annual capacity of 200 locomotives.

The Dickson Manufacturing Company of Scranton, Pa., are important manufacturers of locomotives and of mining machinery, for which their location in the anthracite coal regions of Pennsylvania is most suitable. These works were established in 1862. They have a capacity of 100 locomotives annually, and employ from 400 to 450 men.

The Manchester Locomotive Works, of Manchester, N. H., established in the early fifties, are under the management of Aretas Blood. They employ about 700 men, and are capable of producing about 100 locomotives annually.

From the foregoing it is apparent that, exclusive of such locomotives as are built in railroad shops or shops not regularly engaged in the business of locomotive building, the locomotive-manufacturing establishments of the country have an aggregate capacity of about 3000 locomotives a year. At the present time this capacity is largely in excess of the requirements of the country. The actual reported production of the past six years, with the number exported (not including Canada and Mexico), is as follows:

LOCOMOTIVES PRODUCED AND NUMBER EXPORTED.

Year.	Total Production Reported.	Number Exported (Omitting Mexico and Canada).	Remainder not Exported.	Number of Works Reporting.
1889	1860	187	1673	16
1890	2213	137	2076	14
1891	2300	357	1943	15
1892	1764	141	1623	12
1893	2011	205	1806	13
1894	695	189	506	13
Average...	1807	203	1694	

The total number of locomotives in use upon the railways of the United States, Canada, and Mexico for the same years, as reported to "Poor's Manual," is as follows: 1889, 31,062; 1890, 32,241; 1891, 33,563; 1892, 35,281; 1893, 36,012; 1894, 35,813.

As the average life of a locomotive may be taken at twenty years, it is apparent that an annual production of about 1800 locomotives will supply the natural wear, whilst there is in the country a capacity for constructing in contract and railroad shops about twice that number. The difference between the number requiring replacement on account of natural wear and this total capacity must be absorbed by locomotives for new lines, for permanently increased traffic, and for export. The locomotive-building establishments above mentioned employ in the aggregate 15,000 men, who receive in wages about $10,000,000 annually. The total value of the product of these works, when operating to their full capacity, is about $30,000,000.

Although the earliest locomotives used in the United States were imported from the mother country, it was not long before the achievements of American mechanics attracted attention abroad. In 1845 the Baldwin Works exported locomotives to the Royal Würtemberg Railroad. In 1848 Rogers shipped locomotives to Cuba; and while the exportation of locomotives during recent years has been largely to those countries without the resources requisite for locomotive-building, in the earlier years it was not uncommon for American manufacturers to ship their products to Austria, to England, and elsewhere in Continental Europe. Statistics fail to show the number of locomotives exported during the earlier years, and even recent statistics are inaccurate in not covering shipments of locomotives to Canada and Mexico. During the twenty-five years comprised within the period from 1871 to 1894, there were exported 2879 locomotives to countries exclusive of those reached by rail connections from the United States. These locomotives were distributed throughout South America, Cuba, Australia, Japan, Norway, Sweden, Russia, South Africa, and the Islands of the Pacific. The shriek of the American locomotive is heard in the Holy City. Although the line from Jaffa to Jerusalem was constructed by French capital, the locomotives were supplied from the United States.

The market price of a locomotive in 1832 appears to have been $4000, this sum having been agreed upon between Matthias W. Baldwin and the Philadelphia, Germantown and Norristown Railroad for the locomotive "Old Ironsides." The highest prices known in locomotive-building, as in other industries, were those obtained during the War of the Rebellion, when heavy freight or passenger locomotives commanded from $30,000 to $35,000. Prices declined after the close of the war to about $7000 for a thirty-five-ton passenger locomotive in 1878–79. During the so-called boom of 1880–81, prices again rose to about $15,000 each for similar passenger locomotives; but since that time there has been a constant reduction in the price per pound, the weights of locomotives gradually increasing with the demands of increasing traffic, while prices have remained nearly stationary at about $8000 to $9000 each for average passenger locomotives, and from $9000 to $10,000 each for average freight locomotives.

The importance of fuel economy was appreciated in Europe earlier than in the United States. Progress had been made in the development of the compound locomotive by Lindner, Von Borries, La Page, Worsdell, Webb, and others. W. S. Hudson, superintendent of the Rogers Locomotive Works, designed a two-cylinder, or cross-compound, locomotive, as early as 1873, but it was never built. In 1882 Henry D. Dunbar designed and patented a four-cylinder tandem compound locomotive, which was tested on the Boston and Albany Railroad. In 1889 the Pennsylvania Railroad imported from England a compound locomotive of Webb's pattern for experimental service. The same year Samuel M. Vauclain, superintendent of the Baldwin Locomotive Works, designed a four-cylinder compound locomotive, in which a high-pressure and a low-pressure cylinder are placed one above the other on each side of the locomotive, both formed within a single casting, together with the steam-chest, and occupying the same place as the ordinary single-expansion cylinders. The two piston-rods connect to a common cross-head. From the cross-head pin back, the locomotive does not differ in any essential respect from the ordinary engine. The first locomotive of this pattern was built the same year for the Baltimore and Ohio Railroad. Tests indicated highly economical results. About the same time A. J. Pitkin, superintendent of the Schenectady Locomotive Works, brought out a two-cylinder, or cross-compound locomotive, having a form of intercepting-valve differing from those previously used abroad. The general interest in compound locomotives, together with the powerful influence of two of the most prominent works in the country, led to the rapid introduction of compound locomotives, and caused other locomotive-builders to bring out similar designs. There have since been built in the United States about 800 compound locomotives, of which nearly 600 are of the Vauclain pattern, four are of the four-cylinder "tandem" type, and most of the remainder are of the two-cylinder or cross-compound type. The compound locomotive is unquestionably a step in advance, realizing as it does an economy of from fifteen to forty per cent., according to the service in which it is employed.

The most conspicuous improvement in transportation, which resulted from the introduction of steam-power, was the great increase in the capacity for high speed. Peter Cooper's first locomotive is said to have attained a speed of eighteen miles per hour. Baldwin's "Old Ironsides" is recorded as having attained a speed of sixty miles per hour for a short distance. Speeds of sixty miles per hour have therefore been known from the inception of American railways. The real progress of locomotive development has not been so marked in increasing the capacity for speed as in increasing the weight of trains which can be hauled with certainty at rates of speed which have previously been regarded as phenomenal. Up to the year 1889, when the compound system was introduced, there did not exist a demand for sustained speeds exceeding fifty miles per hour. In November, 1892, one of Vauclain's compounds, No. 385, running on the Philadelphia and Reading and the Jersey Central railroads, between Philadelphia and Jersey City, with a train of four heavy cars, attained a speed of ninety-seven miles per hour by covering one mile in thirty-seven seconds. On May 10, 1893, locomotive No. 999, of the New York Central Railroad, is said to have covered a mile in thirty-two seconds, equivalent to 112½ miles an hour, hauling the Empire State express, consisting of four heavy cars. On July 19, 1893, engine No. 682, of the Philadelphia and Reading Railroad, hauled a train of nine loaded passenger cars from Winslow Junction to Pleasantville, twenty-six miles, in twenty-two minutes, or at the rate of 70.9 miles per hour, and on August 27th, the same locomotive hauled seventeen loaded passenger cars over the same distance in twenty-seven minutes, or at the rate of fifty-seven miles per hour. These performances are remarkable for the weight of the trains hauled. The locomotive is a Vauclain compound. On September 11, 1895, a locomotive of the New York Central and Hudson River Railroad hauled the Empire State express, consisting of four cars, from New York to East Buffalo, 436½ miles, in 407⅔ minutes, being an average speed of 64.26 miles per hour. It is believed that the steam locomotives of to-day possess capacity for running at as high a speed as is required by public demand, or as is consistent with the commercial conditions governing the business of transportation.

During the past few years the general substitution of electric power for horse-power and for other means of propulsion on tramway lines has caused electricity to be regarded as perhaps a rival of steam, or at least as a competitor which may prove to be a serious rival in the future. The progress of electrical science is so rapid that what is written to-day is obsolete to-morrow. What we regard as impossibilities now may shortly become established facts. In 1840 Davis & Cook constructed a walking-beam engine with a zinc and copper battery, using a solution of blue vitriol. In 1842 Davidson, of Scotland, constructed a five-ton electric locomotive, which was actuated by seventy-eight pairs of thirteen-inch-square zinc and iron plates in sulphuric-acid solution, and propelled itself at the rate of four miles an hour. In 1844 Channing conceived the idea of substituting electro-magnets for permanent steel magnets, and of exciting the field magnets by an electro-magnetic machine. This idea was subsequently developed by Henry Wilde, Manchester, England, between 1863 and 1866. In 1847 Farmer constructed an electro-magnetic locomotive having forty-eight pint cup cells of Grove nitric-acid batteries. This drew a car containing two passengers on a track of eighteen inches gauge. In 1850 Page, of Washington, constructed an electro-magnetic locomotive of sixteen horse-power, actuated by 100 cells of Grove nitric-acid batteries, having platinum plates eleven inches square. This machine propelled a car carrying a dozen or more persons on the Baltimore and Washington Railroad, at a speed of nineteen miles an hour. In 1851 Thomas Hall, of Boston, constructed and exhibited a small electric locomotive which took its current from a stationary battery by means of the rails and wheels. It was arranged automatically to change the current and return at the end of the track. In 1860 he made a more elaborate model called the "Volta," which was exhibited at the American Mechanics' Fair. In 1859 Farmer invented what he designated the self-exciting dynamo, which was constructed in 1860. Improvements on this were made by Wheatstone, Leaman, and Ladd in 1867, and by Gramme in 1871. It made possible the substitution of the dynamo for the galvanic battery, and permitted the generation of electricity at low cost.

The first experiments in the use of electrical locomotives on steam roads appear to have been made by Leo Daft on the New York Elevated Railroad with a motor of 125 horse-power. In 1886 Frank J. Sprague conducted experiments on the same road with trains of individual motor-cars. In 1891–92 the Thomson-Houston Electric Company built a locomotive of about 125 horse-power for freight service at Whitinsville, Mass. This locomotive handles an aggregate load of 200 to 300 tons at a speed of five miles an hour. In 1892 the North American Company ordered from the Baldwin Locomotive Works a powerful electric locomotive to be constructed from the plans of Sprague, Duncan & Hutchinson, Limited. This locomotive was completed in 1894 and weighed sixty-seven tons. It had four pairs of wheels connected by coupling-rods, and the field magnets were hung from the driving-boxes, whilst the armature was hung on the driving-axle. In 1892 the General Electric Company undertook the construction of an electric locomotive for the tunnel of the Baltimore and Ohio Railroad in Baltimore. This locomotive was completed in 1895, and was designed to weigh ninety tons and develop 1500 horse power. In 1892–93 the General Electric Company equipped in the grounds of the World's Columbian Exposition at Chicago, and operated during the period of the Exposition in 1893, an elevated railroad known as the Intramural Railway. Its mechanical success was such that in 1894 the Metropolitan West Side Elevated Railroad, which had been designed as a steam line, countermanded an order for twenty-five steam locomotives and substituted electric power. In 1895 the Lake Street Elevated Railroad of Chicago discontinued the use of steam locomotives and substituted electric power. The same year the New York, New Haven and Hartford Railroad equipped its Nantasket Beach branch electrically for experimental purposes, and the Pennsylvania Railroad equipped a branch road at Mt. Holly for the same purpose. In 1895 the Baldwin Locomotive Works consummated a working agreement with the Westinghouse Electric and Manufacturing Company, for the production of electric equipment for railway service. There is a large field for electricity in railway work, and it is probable that after it has been applied to switching and suburban service in the great cities, public opinion will compel the abandonment of steam locomotives in these precincts.

Although the steam locomotive is more prominently brought to the attention of the public, and is therefore more popular and better known, yet it has no greater effect on daily life than other steam engines. Mention has been made of steam-power applied to transportation in navigation on the ocean and on inland water-ways, but besides this use for steam it supplies a thousand wants of daily life, such as the furnishing of the water-supply of great cities, the driving of the machinery of busy hives of industry, the lighting of streets and houses, the running of elevators in high modern buildings, the extinguishing of fires, the operating of the electric tram-car, and in many other ways meeting the wants of modern civilization. For many years the development of the stationary engine and the marine engine were identical. The first experimental steam engine built in the United States is said to have been constructed in 1773 by Christopher Colles, a lecturer before the American Philosophical Society at Philadelphia. In 1787 John Fitch launched on the Delaware River at Philadelphia a steamboat propelled by paddles, which attained a speed of thirteen miles per hour, and in 1796 he experimented in New York with one operated by a screw. His efforts were closely followed by those of Robert Livingston. About the same time other mechanics were devoting attention to the problem of steam navigation, among them Samuel Morey, Nathan Read, Nicholas Roosevelt, Oliver Evans, Robert Fulton, John Stevens, and others. Transatlantic steam navigation began in the year 1819, when the American steamer *Savannah* made the trip from Savannah to St. Petersburg. The development of the marine engine through its various forms of single expansion, compound, and triple expansion cylinders has resulted in the powerful mechanisms which drive the *Campania*, the *Lucania*, the *Paris*, the *St. Louis*, and the *St. Paul*, at the rate of 500 miles per day. This development has resulted from the labors of many, among whom may be mentioned John and Robert Stevens, Robert Thurston, James P. Allair, the Copelands, and John Ericsson.

Since 1850 the improvements have been rather in details of construction than in any marked change in type. The engineer has striven and is still striving for the highest efficiency with the greatest degree of economy. The introduction of what is known as the Corliss valve gear marks probably one of the greatest eras in engine building. This is a device by which the steam is admitted into the cylinder for any desired portion of the stroke, and the point of cut-off automatically maintained by the governor without affecting in the least the free opening of the exhaust. Many devices had been introduced before this time for the purpose of using the steam expansively, among which may be mentioned that of Frederick E. Sickles, in 1841, whose drop cut-off with detachable valve gear was used in this country until 1849, when George H. Corliss brought out the improved expansion gear which bears his name, and which is used to-day by builders all over the country. The adoption of the surface condenser may also be noted as an improvement of great practical utility in the economy of that class of engines to which it is adapted.

As the country developed, there was an ever-increasing call for smaller engines with higher speed and higher steam pressure. Excessively high pressures had already been experimented with as early as 1823 by Jacob Perkins, who in 1827 constructed a single-acting engine in which steam of 800 pounds pressure was used, and in the same year he made a compound on the Wolfe plan, in which he adopted a pressure of 1400 pounds, expanded eight times. He even went so far as to propose to adopt a pressure of 2000 pounds, using engines with small cylinder dimension and cutting off the admission at one sixteenth of the stroke. For obvious reasons these excessive pressures were not adopted in general practice, but the experiments had the effect in later years of calling the attention of builders to the greater economy of high pressure steam, and engines and boilers were adapted to its use in a moderate degree. This caused inventors to consider different plans by which high pressures could be utilized and high speed engines constructed. A number of designs were executed, among which may be noted the Westinghouse, which is a double-cylinder, single-acting engine. The low cost and simplicity, combined with a high degree of efficiency, have brought this engine into extensive use.

The competition among engine builders has caused marked changes to be made in simplifying and reducing the cost of manufacture. Probably no change which has been made equals that, adopted by nearly all builders of what may be called the merchantable engine, of reducing the number of main parts to a single column or bedplate, in which the revolving and reciprocating parts are supported and the cylinder secured directly to this column or bed. Engines of this class, both vertical and horizontal, are manufactured by builders all over the country, and perhaps no better estimate can be derived of the advance in this particular than to consider that in 1795 there were exceedingly few in this country who were interested in the introduction of the steam-engine, whereas in 1895 scarcely a town of any importance exists which does not boast of one or more shops where steam-engines are built. The marked advance in the efficiency of the steam-engine may be seen when we consider that previous to 1850 it took from five to eight pounds of coal and something like eighty pounds of water per horse-power per hour to operate what was then considered the best class of engine, whereas to-day the same work is done with an expenditure of one and eight tenths pounds of coal and fifteen pounds of water per horse-power per hour. The manufacture of stationary engines is so widely distributed and so extensively followed that neither in the United States Census nor in other compilations of statistics is it possible to determine the number of men employed, the number of employers interested, the amount of capital involved, or the value of the productions of this branch of engine building.

The steam fire-engine is an important factor in securing the safety of human life and property, and the improvement in such engines within fifty years has been great. Captain John Ericsson built a portable steam fire-engine, which was tested in New York City in 1842, but was not put into regular service. The time required for raising steam was then eighteen minutes. Steam fire-engines were put into permanent service in Cincinnati about 1853, and at that time steam could be raised in less than four minutes from the time the torch was applied. Economy is not a matter of prime importance in steam fire-engines, the first requisites being power and portability. Modern machines of beautiful design and superb workmanship can be drawn by two horses, and can be made ready for delivering enormous quantities of water within three minutes after the sound of the alarm. This comparatively small apparatus can throw a stream of water over all except the highest buildings in the large cities, and can run for hours without damage. The boiler of the steam fire-engine is one of the most powerful for its weight used in any practical work. The fire-engines manufactured in the United States are admittedly superior to those manufactured elsewhere. This superiority has doubtless resulted from the need of the most efficient apparatus to protect cities largely built of wood, and which are much more subject to conflagration than those of older countries, where brick and stone are the principal materials used in construction.

While the progress of steam-engineering during one hundred years has largely revolutionized the methods of living, this development has not reached its termination. On the contrary, the engines and boilers which have recently been used in torpedo boats, the experiments of Maxim in England, and of Langley in the United States, introducing steam-engines and boilers of power heretofore inconceivable for their lightness, and the light engines and boilers which are used in road carriages, indicate that we may expect in the near future an enormous saving in the amount of coal used in producing power, and in the convenient subdivision of power for a great variety of uses. It is reasonable, therefore, to expect that this advance will continue at an accelerated pace, and it may be predicted that the further development of steam engineering will result in the increased conservation of the world's resources and in an added contribution to the comfort and happiness of mankind.

A. B. Johnson

CHAPTER XLIX

MACHINERY MANUFACTURING INTERESTS

WHEN the harvest of a century is gathered we are able to measure its quantities and to determine its values; but the improvement in the arts of a century can be estimated only by comparing the conditions existing at its beginning with those at its close.

Looking backward, then, to 1795, we discover a sparsely settled country, with means of transportation limited to the slow ox or to the more speedy horse; the forest is cleared by a clumsy axe, adapted more for dressing the timber after it is felled than for felling it; the ground is tilled by the spade and the plow of wood, saving only the coulter and sometimes the mould-board, which turns the soil but little below the surface; and the harvest is gathered by the scythe and the sickle, wielded by arms and hands strengthened and hardened by toil. A few sawmills have existence, but most of the timber for construction is hewed. The grist-mill is the most complex piece of machinery; its shafts and gear-wheels are of wood, and its owner, the jolly miller, depends upon his customers not only for his tithe of the grain, but also for the assistance necessary to grind it. The condensing steam-engine of Watt, patented in England in 1769, was only practically at work there for the first time in 1776. The non-condensing engine of Oliver Evans had demonstrated here in 1780 that it would operate, but in this country both the condensing and the non-condensing engine were absolutely unknown in practice. The spinning-frame of Arkwright, introduced into England in 1771, was as yet an experiment here. The spinning-wheel propelled by the foot, and the loom by the foot and the hand, were the sole domestic agencies for clothing the people and their beds, upholstering their furniture, and providing their table-napery. Iron had been made in the forge for more than a century, and castings of iron of uncertain quality were supplied from the small cold-blast furnaces, whose output was from one and one half to two tons daily, a few of the largest making from twenty-five to thirty tons per week. With few exceptions every kind of production was by hand, or if machinery aided, it was directed at every stage by human intelligence. When in 1771 Arkwright established his spinning-frame in England, and a few years later Oliver Evans organized a flour-mill in this country to execute the several operations of the mill previously conducted by the miller, machinery was enabled for the first time to perform successive but dissimilar operations without human direction.

The jealous policy of Great Britain, which aimed to concentrate within her borders all the improvements in the arts, prompted legislation from 1750 to the close of the century, first to prevent the manufacture of iron in this country beyond the stage of pig and bar, then to prevent the exportation from Great Britain of any "tool or utensil used in working up or finishing cotton or linen, woolen or silk manufactures, and of any other tool or utensil which now is, or at any time or times hereafter may be, used in working, finishing, or completing of the iron or steel manufactures of this kingdom," under penalty of forfeiture of such tools or utensils, a fine of £200, and imprisonment for twelve months. That the unfortunates outside of the kingdom should never be enlightened, they were forbidden, under penalty of £500 and imprisonment in the common jail for twelve months, "from seducing artificers, and others employed in the manufactories, to depart out of this kingdom; and if any artificer has promised or contracted to go into foreign parts to practise or teach his trade, such artificer may be obliged to give security, at the discretion of the court, that he shall not go beyond the seas, and may be committed to prison until he give such security."

At the close of the last century and during the early part of this, these acts were rigidly enforced, and they were not rescinded until 1845. In consequence of this legislation machinery could not be obtained from England, and the only alternative was to rely upon our own mechanical ability and construct what was needed at home. Our workmen were skilled in the use of the axe, the adze, and all carpenters' tools; they had successfully constructed our sawmills and grist-mills, in which the gearing and shafting were of wood, the latter revolving upon small iron journals ingeniously secured in the ends of the wooden shafts. Our blacksmiths fashioned our iron with facility in the forge, but the new machinery then coming into extensive use in England demanded that this iron should receive a higher finish and be given a more exact form than could be afforded by the forge, and out of this necessity the machinist was born.

From the "History of American Textile Machinery," by John L. Hayes, LL.D., we learn that Samuel Slater, a young Englishman, aided by the capital of some enterprising men in Providence, R. I., constructed at Pawtucket, in that State, in 1790, the first of the textile mills in this country to use the Arkwright system. All of its machinery was built by him on the premises, and we may conceive the difficulties under which he labored when we consider that he brought with him from England no plans or models of the machinery, and in that age of the world not one of the machines now so common for shaping cold iron had existence. What expedients he must have resorted to, and what a school it was for his workmen! At this period woolen cloth fabricated in the household was the only domestic source of the supply of that article; but in 1793 John Schofield and his family, with his brother Arthur, emigrated from England to this country, and, being well skilled in the most approved method of manufacturing woolen goods in England, constructed, with the aid of some persons of wealth in Newburyport, Mass., the first carding-machine that was worked in the United States. This apparatus was first turned by hand; but when the remaining machinery was completed the factory was put into operation by water-power, the business thenceforth being conducted prosperously. Like the cotton-mill of Slater, the machinery of this first woolen-mill was built by Schofield on the premises. Rude indeed must such machinery have been; but it served its purpose, not alone to prepare the fiber and to spin the yarn for which it was designed, but also to educate every man, woman, and child who aided to construct or to operate it.

Out of such experience came, first, that adjunct of the lathe, the slide-rest, the progenitor, in fact, of nearly all the appliances for automatically shaping cold iron. At this time the lathe had but lately advanced beyond the first stage of its existence, that of two dead-centers, which supported the work as it was rotated backward and forward by a band around it, one end attached to a spring-pole above it, the other end to the foot of the operator, while the turning-tool was held in his hand. Think of the skill and the patience required to produce good work with such an implement! And yet with no better appliance all of the domestic turned work of our colonial period was executed.

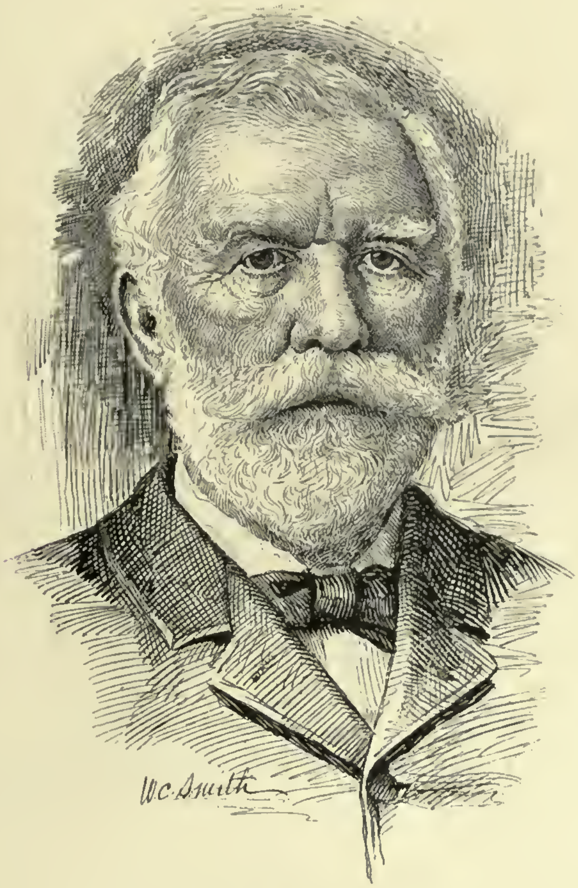
The lathe had now, however, advanced beyond this first stage, and was provided with a revoluble spindle and center, by which the work was axially supported and rotated; but the tools for turning either wood or iron were still held and manipulated by hand. The new industries demanded large numbers of cylindrical iron pieces exactly parallel and of like diameter, for the production of which manual skill was inadequate. This want was supplied by the slide-rest, which theretofore had been found only in the workshop of the optician and the mathematical-instrument maker, but was now to become a common adjunct of the lathe. From this time the capacity of the lathe to produce cylindrical work of the required exactitude was unlimited, but the workman had to manipulate the slide-rest to enable the cutting-tool which it carried to perform its work. The preparation and the adjustment of the cutting-tool, as well as its rate of traverse, required skill; but to perform the work after that demanded only constant attention, and the number of workmen who could patiently give that was limited. As a consequence the slide-lathe was introduced, whereby the advance of the cutting-tool, and the rotation of the work, were automatically performed. The facilities for producing the long, flat, and straight surfaces best adapted for such a machine were then limited to the hammer and the cold-chisel, the file and the straight-edge, the latter then produced by grinding three surfaces alternately upon one another until they touched uniformly, in any order of pairs. The slide-lathe, therefore, had a curious development. The hand-lathe, with its wooden bed and short slide-rest, could produce cylinders economically, and these were utilized for slide-lathe beds; but lacking stability, as well as security for the slide-rest, the cast-iron bed dressed by the cold-chisel and the file was finally adopted. The form of the guiding surfaces of the slide-rest was, however, modified in the lathe to save hand labor, and this distinctive form has maintained an existence to the present day.

The next development of the slide-rest was the planing-machine, whereby the rough and irregular surface of the castings and forgings, traveling slowly under a cutting-tool movable at right angles to the travel of the work, was smoothed and reduced to a true plane. The advent of this machine was an era in the life of the machinist, as great, perhaps, as that of the slide-rest. I am unable to determine when the first one was started, but to give some idea of its development I may say that in 1838 it was generally understood that there were but four of these machines in the United States. With this machine it was at once possible to construct lathes of increased capacity, power, and exactitude. The drill, which before that had been limited to a revolving vertical spindle, was endowed with an iron frame, and a table at right angles to it, upon which the work might be rigidly supported and adjusted with ease and certainty. The boring-mill or vertical lathe was then economically possible, and took its place in the machine-shop to execute a large class of turned work that did not require to be supported upon centers, or as preparatory thereto. Much of this work consisted of wheels that had to be keyed upon their shafts. The seats for these keys were chipped and filed, and the first development of the planing-machine was the key-seating machine, in which the tool moved while the work was fed against it. The capacity of such a machine for other work was soon developed, and when provided with compound slide-rests and a revoluble table mounted thereon, it took its place as a standard tool in the machine-shop, under the name of the slotting-machine. This planer, with its vertically movable tool, was the progenitor of a machine with similar attachments, but with its tool moving horizontally, upon which work could be conveniently shaped in a great variety of forms; and the shaping-machine, as it was called, soon became one of the standard tools of the machine-shop.

With the advent of these tools the art of driving the cold-chisel and of guiding the file, once the criterion of a good workman, was rarely exercised. In the mean time, however, the vertical spindle-drill, with its compound tables, movable vertically and adjustable horizontally in two directions at right angles with each other, had been supplemented by the horizontal drill, with similar tables, but with its drill-spindle parallel to the tables; and the further requirements in this direction had been supplied by the radial drill, in which the vertical drill-spindle is movable about a vertical axis, toward and from which it is adjustable radially.

The development of the machine-shop was not, however, exactly in the order above indicated; it had other requirements which these tools supplied inadequately, if at all, among which were the screw-bolts and nuts for securing the parts of the machines together, a want which had been imperfectly supplied before even the original lathe had an existence. The iron screw-bolt was then formed by compressing a split die upon it, provided with spiral threads, and rotating the bolt or the die backward and forward until the thread was partly cut and partly raised to its completed form, while a taper-tap was screwed into the nut from one side and then from the other, until by trial the nut was found to enter upon the bolt. The apex of the thread was always larger than the diameter of the bolt, and bolts and nuts were only interchangeable by accident. The slide-lathe made it possible to cut out the thread without raising it, but for the great mass of bolts this was far too expensive, so that the split die continued to produce its imperfect product in this country until the solid die patented by Philetus W. Gates, May 8, 1847, with sectional threads, was introduced. After this die had cut the thread at one pass, its direction of rotation was reversed to unscrew it from the bolt, which not only left a mark upon the thread, but was liable to injure the die, and no compensation for wear was possible. It was not until 1857 that a bolt machine was devised by William Sellers, and constructed by his firm in which dies to cut the thread at one pass, and adjustable to size, could be opened and closed while running continuously in one direction, and thereafter ordinary screw-bolts could be made interchangeable. In 1860 this tool was introduced into England, and subsequently upon the continent of Europe.

Another of the early machine-shop tools was the gear-cutter, simply a revolving milling-cutter against which the wheel was forced, mounted upon a spindle above the dividing-plate on the same spindle. The only power used was that required to rotate the cutter; the movement against the cutter and its reverse, and the division or adjustment for the next tooth, being all performed by the workman. The cost of such work was so great that the teeth of nearly all wheels, even for fine machines, were cast, until a machine was devised by William Sellers, and constructed by his firm in 1867, and exhibited at the exposition in Paris in the same year, in which the work of the operative was limited to adjusting the wheel to be cut to the cutter. After that the machine proceeded with the work of cutting each tooth, retracting the cutter, turning the wheel for the next



William Sellers.

tooth, and so on, until the wheel was completed in less time than it could be done when these movements were effected by hand; so that now one man can easily attend several machines, and cast teeth are no longer admissible in good machines.

One other typical machine-tool which has received its greatest development in this country must be referred to—the milling-machine, by which the various shapes for use or for ornament in our firearms are fashioned. Its use is so varied that it has become a necessary adjunct to every machine-shop, and I close with this the list of machine-tools necessary to make other machines. It must not be supposed, however, that the above comprise all or nearly all of the machine-tools now in common use; they are but types, upon which an infinite variety of changes have been wrought to adapt them to special requirements. Their development marked the first stage of the machinist's art, when machine-tools were only required to perform the simple operations of turning and planing, drilling and milling, to make other machines.

Along with the development of these tools for general purposes came a development of the system of interchangeability as an economical principle in manufacturing machinery, requiring in some instances special machines, but more commonly special tools or appliances for use in connection with the ordinary machine-tools. While it cannot be claimed that this country was the first to attempt manufacturing machinery upon this principle, it must be admitted that the system was in successful use here very many years in advance of any other nation, and that, in fact, the demonstration here that the system was economical, as well as advantageous in other respects, induced the nations of Europe to adopt it and procure the necessary apparatus here to establish it at home.

For the economical manufacture of machinery or of apparatus in which large numbers of the parts shall be interchangeable there are certain preliminary conditions which must be observed: first, reference standards must be provided, with which to compare the several parts and determine the tolerance—that is to say, the amount of variation permissible between the standard and the product; second, every part of the finished piece must be completed without the intervention of hand labor; and third, for every piece a base must be established, to which each and every succeeding operation must refer; consequently every piece must form a separate study to determine the best appliances for each operation, so that the efficiency of the operation shall not be dependent upon the skill of the operator.

The first application of these principles was made upon firearms in our government arsenals, under the direction of Mr. Eli Whitney, the inventor of the cotton-gin. The growth of the system must have been slow, and confined for a long period to a few of the principal parts; but from the first it had proved economical, for in 1822, Mr. Calhoun, then Secretary of War, admitted to Mr. Whitney that the government was saving $25,000 per year at the two public armories alone by the use of his improvements. The drop forging-press, with its dies conforming to the shape desired, served to produce expeditiously in red-hot metal all of the smaller parts of the gun, closely approximating the finished size and shape. The milling-machine, when its capacity was developed, finished these forged parts, however varied the shape, with an accuracy well within the limit of tolerance; and the drill, when the order of procedure had been determined and the guiding templets were provided, fashioned the bearings for the working parts and the holes for securing the parts in position. The wooden gun-stock, of irregular form, was rapidly and automatically shaped exteriorly as it and its model revolved in a lathe designed by Thomas Blanchard, and patented by him January 20, 1820. Other special tools routed the groove for the gun-barrel and the cavity for the lock, with the other details required to receive the guards and fastenings of the gun, with such accuracy that the several parts could be assembled as they came from the machines. The accuracy then attainable, however, was far short of that now demanded; the gun then produced did not require it. The machine-tools were limited in variety and comparatively rude of structure, so that the quality of their work could not be depended upon. The vernier caliper was the most delicate instrument of measurement, and a thousandth of an inch was its extreme limit of accuracy, while the form of the screw-thread did not admit of very accurate determination.

As the quality of our machine-tools improved, the skill of our workmen advanced and their appreciation of accuracy was enlarged. Appliances necessary to detect with certainty an error of the twenty thousandth of an inch were supplied by the Pratt & Whitney Company, after designs by Professor W. A. Rogers and Mr. George M. Bond; and the form of screw-threads advocated by Mr. William Sellers in a paper read before the Franklin Institute, April 21, 1864, has since become the standard for the

United States; so that now a degree of accuracy is easily attainable which, at the introduction of the system, was impossible. The failure of the earlier attempt to establish an interchangeable system of manufacture in France was perhaps due to rude apparatus; but from the description that has come down to us it would seem that the cardinal conditions before referred to had not been observed, with the result that a commission appointed by the French government in 1791 decided that it was inexpedient to establish a central manufactory of locks, mainly for the reason that it had not been found economical, and in 1807 the last factory engaged in the manufacture was suppressed.

From the first our method of working the interchangeable system had proved economical, and, with the growth of excellence in every detail of machinery, the system had been so extended and improved that the knowledge of its advantages reached to foreign countries, and various commissions were appointed to investigate it. In 1870 the German government contracted with the Pratt & Whitney Company for gun machinery to the value of $350,000, and within the next three years for $1,250,000 more; and until 1875 the company was kept busy on European orders. By a supplemental contract with the German government the Pratt & Whitney Company agreed to superintend the erection of the machinery they had furnished, and to instruct native workmen how to operate it. The results were so satisfactory that, departing from precedent, the authorities forwarded a letter, from which the following is an extract:

"The Pratt & Whitney Company has furnished the royal armories of Spandau, Erfurt, and Danzig with plants of machinery which execute the work with such nicety and precision as to save one half the wages, and to render the government in no small degree independent of the power and skill of the workmen." About the same time other manufacturers of gun-making tools—notably Brown & Sharpe, of Providence, R. I.—received large orders for such machinery from other foreign countries, and our system for the manufacture of this class of interchangeable parts was thus established in England and on the continent of Europe.

The record, therefore, discloses the fact that for more than half a century this country has been in possession of a system of manufacture peculiar to itself, developed first in the manufacture of the larger class of firearms, then extended to pistols, and subsequently to a great variety of products, such as the sewing-machine, the type-writer, the bicycle, and the watch, in all of which we stand to-day unrivaled.

Within the period I have been reviewing every art has advanced enormously, and many have been developed that had no previous existence. The farmer no longer scratches the surface of his fields. His plow of steel suffices to turn the sod to a depth that compels a more bounteous harvest; his seeds are planted and his crops are tilled by machines which he rides and guides; and his harvest is cut and cured by still other machines, that carry him to their work, obedient to his will.

Textile fabrics, at first hand-made, by successive steps have become the product of machinery to which the raw material is supplied, and from which the finished material only is removed by hand. The twine for the fisherman was once spun and the meshes of his net were knit by hand. But he need no longer knit, because he can buy his net for less than he must pay for the twine of which to make it. The yarn for knitting, formerly hand-made, is no longer in the market, and its knitted product, once a fireside occupation, is now supplied at a cost that even those so-called idle hours could not compete with. Boots and shoes then required a skilful workman to produce. Each was the work of one man. But the shoemaker no longer exists. More than half a hundred workers each contributes his mite to the shoe which machinery produces, while garments then cut out and laboriously stitched by hand are now fashioned in piles and stitched and buttonholed by machinery. While machinery has thus been adapted to feed and to clothe us, it has been taught to produce almost every article required in the household or the workshop. Indeed, the very houses that shelter us no longer represent the skill of the joiner, for the mill has usurped his place, and the carpenter only assembles its work.

The same changes have occurred in the fabrication of metals. The blast-furnace, whose maximum product early in the century was 25 to 30 tons per week, now produces 500 tons per day. The bloom of iron, then the unit from which the largest masses were built up, small as we now regard them, has given place to the ingot of steel, weighing many tons, which requires less labor to produce than the bloom of as many pounds. The forge and the rolling-mill which fashion the ingot in great masses are new creations, and the machines which shape it in detail with such marvelous rapidity, and at one heat, are developments so great that the original parent is barely recognizable. In transportation the team of horses has long since been displaced by the locomotive, and present indications point to another and more efficient substitute.

The immense number of similar parts which the automatic machinery of these and other industries demanded afforded opportunity for the introduction of machine-tools to manufacture machinery, as distinguished from those designed simply for making it. The difference may be illustrated in the two processes of making a turned bolt with a square or hexagonal head, the one after the introduction of the slide-lathe, and the other at the present time. Then, a bar of iron of suitable size was heated and forged by the smith to a size and shape approximating that of the finished article; this was centered; a carrier was secured upon one end whereby it could be rotated; the end opposite the carrier was squared in the slide-lathe by a side-tool, the carrier was transferred to the other end of the bolt, and the opposite end was squared, the side-tool was changed for another tool, adapted to turning the body of the bolt, and this again for another, adapted to cutting the thread. At each change of carrier and of tool the lathe was stopped that the workman might release the one tool and secure the other. Now, the iron bar, square or hexagonal, and of the size and shape of the head of the bolt, is delivered from the rolling-mill to the attendant of the machine, who thrusts it into the machine against a stop; the machine grips it, squares off the projecting end, turns up the body of the bolt, cuts the thread, bevels the end, and finally cuts off the bar beyond the last turning, to make a head, and the bolt drops, a finished product. The machine releases the bar, moves it forward the distance required for another similar bolt, and repeats its operations, until the bar is converted into bolts; and it could, if desirable, inform its attendant that it was out of work, or notify him of the fact by stopping its movement. The attendant is no longer of necessity a machinist, for his only occupation is to provide his machine with bars, to remove its product, and to keep it clean, duties which attendance upon a number of such machines does not make onerous. The turned bolt so manufactured is as good as, but no better than, that which was first forged and then finished upon the simple slide-lathe; but the product of the workman is vastly greater, and the skill required for it is far less. For such apparatus quantity of like product is the first requisite. Given this, and the skill of the engineer and the machinist is demanded to produce by successive automatic operations the desired result. These operations without the intervention of human intelligence may at first be few in number, but they will be extended from time to time as experience warrants or as future discoveries may render possible.

The field, then, for machinery and for manufacturing interests is forever widening. Every secret of nature that is unfolded, every discovery in the arts, every combination that produces new results, only opens other avenues of progress, which must become more rapid and more diverse with the growth of the centuries.

At the close of this century, however, it should be noted that within the period I have been reviewing the trade of the machinist had its origin. It would be interesting to determine accurately, if that were possible, what is now the annual product of this new industry; but the census gives only the aggregate value of the machinery, tools, and implements in use, and the annual production of all manufacturing industries. From this source, however, we find that the annual product of all manufacturing industries per employee amounts to $1988, a sum considerably in excess of what I believe would be found to be the product per employee in a manufactory comprising foundries and machine-shops. The last census gives the number of foundries and machine-shop establishments at 6475, the capital employed at $382,798,337, and the number of employees at 247,754; and if we assume the annual product per employee to be $1500, we shall have an annual production of machinery equal to $371,631,000, which is probably a moderate estimate. The importation of machinery is so small compared with our own production that the cost has but little effect upon our market, particularly so as its design and construction are generally regarded as inferior to our own; but it is of interest to know that our average annual importation for the last five years has been $2,512,417.

It is to be hoped that, with a more widely disseminated knowledge of the value of statistics, the coming decade will develop census reports from which, for the principal industries at least, an accurate knowledge of our production per operative may be determined.

Wm Sellers

CHAPTER L

AGRICULTURAL MACHINERY AND IMPLEMENTS

KNOWLEDGE is not a matter of words: it is an acquaintance with things. Theories may present a seemingly formidable front, but they must ever yield before the battering-ram of facts. The farmer who hitched his small horse to the short end of the whiffletree to balance the large horse at the longer end may not have appreciated the stern philosophy of the failure of his scheme, but the failure itself was a demonstrated fact. Needless to say, he was not a farmer of the present day and age, to whom the laws of mechanics, as applied to his calling, are almost as familiar as to the inventor himself. The contributions of invention to the advancement of agriculture are as self-evident as cause and effect. These contributions—the things contributed—are familiar to the great farming public. This acquaintance with the various machines and implements designed for his use has given the agriculturist a knowledge that is power—a power that is seen not only in his own ameliorated condition, but in the generally augmented commercial prosperity of the nation and of the world. The universality of the value of important agricultural inventions is uniformly recognized by writers upon commercial and economic subjects. In 1869 Mr. J. J. Thomas published a book entitled "Farm Implements," and in the course of his introductory remarks said: "The great value of improved farm machinery to the country at large has been lately proved by the introduction of the reaper. Careful estimates determine that the number of reaping-machines introduced up to the beginning of the great Rebellion performed, while working in harvest, an amount of labor nearly equal to that of a million of men with hand implements. The reaper thus fills the void caused by the demand on workingmen for the army. An earlier occurrence of that war must therefore have resulted in the general ruin of the grain interests, and prevented the annual shipment, during that gigantic contest, of the millions of bushels of wheat which so greatly surprised the commercial savants of Europe."

In contemplating the subject of farm machinery and implements, one is struck by the infinite variety of useful inventions extant, and is at a loss to know where, within the scope of a brief sketch, the line shall be drawn between special mention and mere allusion covering the general field. Research in this direction, however, as doubtless in most other industrial lines, discloses the names of a few whose individuality has become so indelibly stamped upon the age as to entitle them to more than a passing notice. Aside from these apparently necessary exceptions, it is not the purpose of this article to dwell upon particular inventions, classes, or individual inventors, but rather to indicate in a comprehensive manner the growth and development of the specified art during the past 100 years, and to show or attempt to measure the accruing advantages not only to agriculture but to the commercial progress of this wonderful century.

There are no tangible figures relative to the early manufacturing interests of the United States. The government made an effort to secure data on this subject in 1810, and, under the direction of the Secretary of the Treasury, the marshals of the several States, and the secretaries of the Territories, began the work, but the returns were so irregular and deficient in specific particulars that they have never been accepted as possessing any value for the statistician. It may be said, however, that down to the beginning of the present century but little progress had been made in the improvement and development of agricultural implements. It is true that during the eighteenth century in Great Britain there were various spasmodic efforts at improvement which showed that inventors were dreaming of something better than was then in common use, but they either lacked

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capacity to make their new devices practically operative, or agriculturists lacked sufficient intelligence to appreciate and operate them. The first quarter of this century had passed before invention in this line had made any practical progress, and it was not until the middle of the century that manufacturers undertook a general advance, and began to push their product and arouse agriculturists to the advantage of improved implements. Then opened this modern period of rapid progress, development, and perfection. The movement began in this country, and Americans have maintained the lead ever since.

The centennial character of this publication suggests the fact that 100 years ago the patent on Eli Whitney's cotton-gin was two years old. As a factor in the acceleration of the national resources and wealth, its value can scarcely be overestimated. Referring to it, Lord Macaulay is reported as saying: "What Peter the Great did to make Russia dominant, Eli Whitney's invention of the cotton-gin has more than equaled in its relation to the progress and power of the United States." In 1791, just previous to the time of Whitney's invention, the cotton crop of the world was estimated at 490,000,000 pounds, of which the United States produced about one two-hundred-and-forty-fifth. As early as 1845 the total product had increased to 1,169,600,000 pounds, of which the United States supplied 1,000,000,000 pounds, or more than seven eighths. Other cotton-producing countries were slow to avail themselves of Whitney's invention, and were consequently distanced in the race to supply the world's increasing demand. In this connection it is interesting to note that in 1784 a consignment of eight bags of cotton, a total of about 1600 pounds, was seized at Liverpool on the ground that so large a quantity could not have been produced in the United States! A conservative estimate of the cotton crop of this country for the current year places it at about 9,500,000 bales of 477 pounds each.

The first need of the original agriculturist was an implement for stirring the soil, and for this purpose he fashioned a stick with a hooked end, which he himself drew. In time, when beasts were trained for the bearing of burdens and for draft, this stick was enlarged and drawn by them; later it was shod with iron, and through all the centuries down to a little more than 100 years ago it remained substantially the same, even among the most highly civilized peoples, being to this day in common use in Mexico and in other Latin-American nations. Some improvement was made in Great Britain during the last century in the form of plows, and iron was increasingly used in their construction, but the plow still in common use was the primitive implement, generally made by the farmer himself. The first American patent on a plow was granted to Charles Newbold of New Jersey, in 1797. The claim was for a plow of solid cast iron, excepting handles and beam, consisting of a bar, sheath, and mold-plate. It cut and turned over the soil very well, but farmers did not accept it because they thought that iron was poisonous to the land.

The man who laid the foundations of the modern plow was Jethro Wood. He gave it its present form and made it of cast iron, with share, shin, mold-board, and landside, the parts being common to any plow — that is, interchangeable. It was patented September 1, 1819. During the forties plow-making was carried on extensively in the Eastern States, but the demands of the Western and prairie States from 1850 and onward, and the use of chilled iron, expanded the industry and led to the many inventions and the perfection that have followed. Among the names that will ever be associated with the plow are John Deere, pioneer inventor and manufacturer, and James Oliver, whose perfection of the chilled plow was an important advance in this line of invention.

The first drag, or harrow, was the limb of a tree, with extending branches. This suggested the A form of drag with teeth inserted, and it, in turn, the square or oblong Roman harrow. These came down to the middle of this century, substantially unchanged. The first improvement in harrows was the revolving disk, for which the first patent was issued by our Patent Office to G. Page on August 7, 1847. Many and various have been the improvements in harrows since.

Hand dropping or sowing of seed was the common practice down to the middle of this century. A sort of drill plow was produced in Assyria long before the opening of the Christian era, and the Chinese claim the use of a similar implement some three or four thousand years ago. About 1730, Jethro Tull, an Englishman, produced a machine that was the prototype of the modern drill. By the end of the century, considerable advancement had been made in England, and a broadcast seeder mounted on a wheelbarrow had been invented. The first American patent on a seeding-machine was granted in 1799 to Eliakim Spooner, and several others were issued during the early years of this century; but nothing practical resulted until about 1840. J. Gibbons, on August 25, 1840, patented the feeding cavities and a device for regulating the amount delivered. Next, M. and S. Pennock, of Pennsylvania, obtained a patent March 12, 1841, for improvements in cylinder drills, a class of drills they largely placed upon the market. Patents on slide drills and "force-feed" drills followed, the first patent on the latter having been granted to Foster, Jessup & Brown, November 4, 1851. The feeding or dropping devices having thus been invented, various kinds of seeding-machines followed — drills, broadcast seeders, and combinations, etc., to be developed and perfected as the years passed.

The original cultivator was like the original plow, simply a hooked stick. This in time was developed into the hoe, and remained the common cultivating implement until this century was well advanced. Early in the eighteenth century Jethro Tull originated in England the "horse-hoe" system of cultivation. He sowed grain in rows, cultivating between them. To carry out his system he invented the horse-drill and the horse-hoe, or cultivator, with which to work between the rows. His system failed for the time, cultivating continuing to be done with the hoe, and sometimes by plowing between rows, until corn-fields began to be of considerable size, when the single-shovel corn cultivator for one horse was produced by some blacksmith, and later another shovel was added, forming the two-shovel plow. The latter was generally used in the prairie corn-fields up to 1860. April 22, 1856, George Esterly took out a patent on a straddle-row two-horse corn cultivator, which was the first in the invention of a line of implements in the manufacture of which millions are now invested; there being an almost endless variety of cultivators — hand and horse, single and double, walking and riding, shovel-bladed, spring-tooth, disk, etc.

Among the prehistoric implements that have been found are several forms of sickles and scythes for cutting grain. The earliest are of flint, but curved and shaped quite like the old sickle that our grandfathers used; the scythes being similar in shape, but larger, some having shanks for handles, or snaths. These were the implements with which grain and grass were cut, down to about fifty years ago. Of course, through the many centuries they were improved in form and material; the snath of the scythe was given the proper shape, and finally fingers were added, forming a cradle, early in this century. It is true that Pliny describes a crude stripping-header, as in use in Gaul during the first century of the Christian era, and several efforts were made to produce a grain-cutting machine to be drawn or pushed by horses, in England and in this country, toward the end of the last century and the fore part of this; but nothing practical came of these efforts.

The earliest demonstration of a successful reaper was made by Cyrus Hall McCormick in Virginia in the summer of 1831. His first patent was granted on June 21, 1834. Letters patent bearing date December 31, 1833, were issued to Obed Hussey, but the McCormick reaper had been operated in the field two years before Mr. Hussey claimed to have invented his machine. Both McCormick and Hussey built reaping-machines that did good, practical work. Hussey, however, was hardly strong enough for the struggle necessary for pushing a radical innovation; but McCormick zealously persevered, improving and perfecting his machine, building an increased number each year, and pushing their sale with untiring energy, until the demand so largely outran manufacturing facilities that in 1847 the plant was removed to Chicago and fully equipped for supplying the harvest-fields of the West.

In 1849 the United States Commissioner of Patents, referring to the McCormick reaper, said: "In agriculture it is in my view as important a labor-saving device as the spinning-jenny and power-loom in manufactures. It is one of those great and valuable inventions which commence a new era in the progress of improvement, and whose beneficial influence is felt in all coming time." Mr. McCormick exhibited his machine at the London Exposition of 1851, and after witnessing its field work the juries were enthusiastic over its success, it being openly asserted that this machine alone was worth the entire cost of the Exposition. In recognition of the value of Mr. McCormick's invention, it is worthy of note that in 1878 he was elected a corresponding member of the French Academy of Sciences, on the ground of his "having done more for the cause of agriculture than any other living man."

Since the invention and general introduction of the reaper, improvements have been many and valuable. Among those marking the progress of the development it should be noted that in July, 1851, Palmer & Williams were granted a patent on their self-raking reaper. During the fifties patents were also issued to John H. Manny, Walter A. Wood, Cyrenus Wheeler, and others, for improvements on reapers; to Louis Miller for important features of both reapers and mowers, and to C. W. and W. W. Marsh for the first practical hand-binding harvester, with which, later, the binder was successfully incorporated. The first patent on a grain-binder was granted to John E. Heath on July 22, 1850. Coming down, however, to the automatic twine binder, as in use at the present time, the McCormick device patented by Marquis L. Gorham, February 9, 1875, is the original successful invention. The early reaper has gradually developed into the modern harvester, and is now quite generally superseded by it. The range of the harvester's utility is also being enlarged, and we have a machine adapted to the successful cutting of rice, and another to corn and sugar-cane. Within the past decade some attention has been given to the Universal Harvester, designed for the simultaneous cutting and threshing of grain. It is built to cut from sixteen to forty feet, but climatic conditions are such as to preclude anything more than a very limited adoption, though machines of this type are used to some extent on the Pacific Coast.

Implements for mowing and reaping were originally of the same class, and mowing and reaping machines were thus classified in the Patent Office, so it is not known who first invented a machine intended solely for mowing. The early reapers were generally of the class known as combined—that is, they both reaped and mowed. William F. Ketcham was the first to build distinctively mowing-machines for the market. His first patent was granted on November 18, 1844.

Grain was first pounded out of straw by a stick, next by the flail, and then by cattle or horses on the "threshing-floor," and the larger portion of the grain in this country was thus threshed prior to 1840. The first successfully operated threshing-machine was the invention of Andrew Meikle, in Scotland, for which he obtained a patent in 1788. A fanning-mill was added in 1800, and it then became a complete separator, but it was very imperfect and was stationary—being run by water-power—and the grain was brought to it to be threshed. Threshers without separating devices were used in this country as early as 1825, but to Hiram A. and John A. Pitts belongs the honor of producing the first practical combination of threshing and cleaning, or separating, devices, all in one machine, and that portable. In 1834 they made the combination and successfully operated it. Their first patent was dated December 29, 1837. The Pitts Brothers laid the foundation of the threshing-machine industry, and they and McCormick, who was bringing forward his reaper at the same time, together laid the foundation upon which has since been built the whole structure of the modern agricultural-implement industry. It opened up great possibilities for improvements in other classes, and stimulated invention in all lines.

Corn-planters are strictly an American invention. Several patents on seeding-machines were issued by the United States Patent Office from 1799 down to 1836, when the records were destroyed by fire, and some one or more may have been granted for putting seed-corn into the ground. A patent was issued to D. S. Rockwell, March 12, 1839, for a corn-planter. Afterward other patents were granted, covering various devices and improvements in hand and horse planters, but it was left for George W. Brown to produce a practical and marketable machine of this type. His first patent was issued on August 2, 1853. The hinged marker was successfully attached by Jarvis Case, whose patent is dated December 1, 1857. The first patent on a check-rower was granted to M. Robbins, on February 10, 1857; but to Haworth Brothers is due the credit of making the check-rower sufficiently practical for common use and putting it on the market.

In haying tools and machinery, J. E. Porter's patents of 1872, on carriers, opened the way for a big industry. The Keystone Manufacturing Company were first in the field with a successful hay-loader, and to P. K. Dederick must be accredited the perfection attained by the baling-press.

In view of the fact that windmills for pumping purposes were very generally used in Holland several hundred years ago, it seems somewhat surprising that the farm wind-engine, as we know it to-day, has a history of only some two-score years. In 1841, a man named Wheeler, who was laboring as a missionary among the Indians in Northern Wisconsin, conceived the idea of a windmill for grinding grain and pumping water, but it was not until 1867 that his theories were embodied in a model of what is known as the "solid-wheel" mill. In 1854, Daniel Halliday and John Burnham crystallized their ideas of a sectional windmill, and, engaging at once in its manufacture, stimulated others, until now immense capital is invested in this branch of industry.

It is apparent that there are many other important machines and implements of this class well deserving more than passing note, but the scope of this article precludes any specific reference to them. Of incalculable value is the long line of portable engines, horse-powers, ditching machines, corn shellers, shredders, and huskers, cane machinery, potato planters and diggers, etc. Suffice it to say that in these various lines improvement is the watchword; and if our American inventors have not quite reached perfection, they are making commendable progress toward it, and need have no apprehension of being superseded by inventors or manufacturers of other nations.

The number of establishments engaged in the exclusive manufacture of agricultural machinery and implements, as shown by the census returns of 1890, was 910; or, as specified in the "Government Bulletin," this is the "number reporting," and we can well believe that it is considerably below the actual total. These concerns reported an aggregate capital of $145,313,997, the number of hands employed being 39,580, receiving in wages $17,652,162. The value of the manufactured product, including receipts from custom work and repairing, was $81,271,651. Our foreign trade in this line of manufactures is increasing at a rapid rate, having grown from practically nothing at the time of the Rebellion to $5,027,915 for the fiscal year ending June 30, 1894, a forcible illustration of the fact that American genius and skill, American capital and push, are asserting their supremacy around the globe. The number of farms in the United States is given as 4,564,641, or 623,218,619 acres, worth $13,279,252,649. These farms were supplied with machinery and implements to the value of $494,247,467, this figure representing a gain of over twenty-one per cent. in ten years. It will thus be seen that the modern agriculturist is keenly alive to the value of either improved methods or implements looking to the bettering of his condition and the lightening of his labors. If he does not repeatedly say so in words, he puts it more forcibly in deeds. That he takes kindly to the manufactured products of inventive skill is seen in the gradual ratio of increase of the money annually expended for purchases in this direction. It is also seen in the wonderful increase of our country's cereal product, which has grown from about 600,000,000 bushels in 1840 to considerably more than 3,000,000,000 bushels as estimated for 1895. There has, of course, been a natural logical increase in our farm product, but it is safe to say that a fair percentage of it, as shown by the above figures, has been directly due to the benefits which invention has contributed to modern agriculture.

In the early colonial days, machinery was regarded as a special invention of the devil, and it was a bold step, taken by the Rev. Thomas Barnard, to preach his "manufactory sermon" in Boston, in the course of which he asserted that "an industrious prosecution of the arts of civil life is very friendly to virtue," assuring his hearers that such encouragement to manufactures as would enable them to produce at home what they were then importing from foreign countries would be the part of wisdom and prudence. It was nearly three quarters of a century later before the agricultural-implement industry gave even a hint of its ultimate magnitude, and the story of its wonderful growth during the past fifty years — were it told by a master who should picture all its brightness — would read like a tale of the Arabian Nights.

The invention, development, and marketing of our modern farm machinery and implements have directly advanced the cause of agriculture to a degree that our forefathers never dreamed of, fairly lifting it from the treadmill round of drudgery to the table-lands of thought, so that now, instead of being a mere matter of the application of brute force, its rich possibilities call into constant requisition the God-given attributes of intelligence and reason. In the United States there are more than 10,000,000 persons actually engaged in agriculture in its various branches, a number which far exceeds those employed in all other fields of labor, and in nothing is the progress of the farmer's calling shown so strikingly as in the wonderful improvement in the implements designed for his use. By the aid of these he has, within the last half-century, been enabled to increase the effective force of labor fully twenty per cent., which means an annual net gain to the agricultural community of probably not less than $200,000,000; and when it is remembered that the products of the farm present a most important figure in our commerce, our manufacturing, shipping, railroad, and kindred interests, it will be conceded that the advancement of agriculture means also the advancement of these industries, and a material augmentation of the general prosperity of the whole country, and of all countries.

Eldridge M. Fowler

CHAPTER LI

STOVES AND HEATING APPARATUS

CAREFUL research into the history of the origin and evolution of stoves and heating apparatus develops the fact that advance in invention and manufacture has not followed isothermal lines, as would seem natural, but that the United States, from the inventive character of its people, has easily taken the lead, although in doing so it has not hesitated to appropriate all that was best and most useful in the systems that obtained in other countries. The vast geographical extent of our country, its various climates, and the complex character of its population have been reflected in the history and nature of this as of other great industries.

Stoves are said to have been cast for the first time in Alsace, France, in 1490, and as early as 1509 they were cast at Ilsenberg. The first casting known to have been made in America was a small round-bottomed kettle with a cover, made at Lynn, Mass., in 1642, at the first blast-furnace erected in this country. The jamb-stove was made by Christopher Sower, of Germantown, Pa., between 1730 and 1740. In 1744 Franklin stoves were made in Philadelphia.

Between 1752 and 1768 stoves of the box-stove order were made at Marlboro, near Winchester, Va. In 1760 Baron William Henry Steigel cast stoves at his furnace near Letiz, Pa., and was very successful. In 1786 heating-stoves of the box shape were cast in Philadelphia, and plates for these stoves were shipped to Providence, R. I., and to Troy, N. Y., where they were put together. The Conant stove was made at Brandon, Vt., in 1820. The plates for the Woolson stove were made at Brandon, Vt., and carted seventy miles to Claremont, N. H. The Woolson stove was also made at a later date in Massachusetts, Detroit, Mich., and in Cleveland, Ohio.

The character of heating and cooking appliances at any period is determined by the kind and price of fuel. At the beginning of the century wood was cheap and labor scarce; therefore the fireplace was made capacious enough to contain a large back-log which lay in the ashes at the rear, and in front of which was the forestick, resting on andirons. The space between these two logs was filled with smaller wood. The living-room in which this fireplace was located served for both kitchen and dining-room, and at night high-backed settees were arranged in front of the fire to intercept the heat, and prevent cold draughts from behind. The home idea of the fireside that pervades our literature had its origin in these early family rooms. The fire-place also served for cooking. Hinged to the right-hand jamb was an iron crane filled with dangling pot-hooks. It was pulled out so that pots and kettles might be hung on the hooks, and the crane was then swung back over the blazing fire. Potatoes were baked in the hot ashes. In the wall alongside the fireplace was built the brick oven, with its flat bottom and arched top, having an iron door in front. On baking-day, a wood fire was built inside of this oven, and when it was burned to coals and the oven thoroughly heated, the fire was neatly removed, and the bread placed on the oven bottom. In England, with soft coal for fuel, they still cling to the open fire, and do not take kindly to the substitution of close stoves. In the northern part of America the climate made it desirable to heat other rooms than the one in which the fire-place was located. The first effort in this direction was the jamb-stove. This was a cast-iron box built into the side of the fireplace so that one of its sides received heat from the fire, while the rear end, which could be closed with a door, opened into the room in the rear of the fireplace, which thus received some heat from the adjoining chamber.

In the early days churches were not heated, foot-stoves being used to keep the feet of the congregation warm. These consisted of sheet-iron pans about six inches square, in which live coals were placed, and these were enclosed in casings of metal perforated at the sides and top, having bails by which they were carried. In 1744 Benjamin Franklin devised a cast-iron open fireplace which stood out from the chimney and so caused the heat from its back and sides to be thrown into the room.

The six-plate or box-stove was the earliest form of the present heating apparatus. It was made from iron taken directly from the blast-furnace, and was very heavy. These stoves stood on an ornamental frame, and were made in this country as early as 1752. Early in this century cylindrical or oval stoves of sheet iron were made in Philadelphia, and also in New Hampshire, by Isaac Orr. This developed later into the oval regulator, with a draft-damper, opened and closed automatically by the difference in expansion of a brass rod and the sheet-iron stove-body. In 1836 James Atwater, of New York, made a stove with an illuminated case of cast iron and mica. It had inclosed flues, a check-flue, and a direct draft-damper. The Stanley square heating-stove, with return and exit flues inclosed in the four corners, was perfected about this time. In 1845 Dr. Bushnell invented a cylinder-stove with the inside lined with fire-clay, and having a pipe at each of the four corners, down which the heat returned to a hollow base, and thence went up through a pipe at the back.

Gas-burners or surface-burners next appeared in the order of time. These were both round and oval, and by perforated fire-pots, or perforated gas-rings at the top of the brick, the coal was more perfectly consumed than in any former device. They were mostly made of sheet iron; and generally the flues which returned the heat to the base were inclosed in the stove body. The most popular of these were the P. P. Stewart's oval and round parlor-stoves, first made about 1860, by Fuller, Warren & Company, of Troy, N. Y.

Base-burning stoves have now been long in use. The principle of these stoves is "to place the fuel in such a position that air to supply combustion shall come from one direction, and the fuel from the opposite direction, thereby causing the heated products of combustion to pass from the sides of the pile of fuel, instead of up through it." The magazine idea is first seen in the English patent of David Riz, 1770. Next came the patents of James Watt, in 1785; Pollock, in 1807, and Stratton in 1817 and 1822. Anthracite coal was brought into use in America between 1820 and 1830, being afterward used to a limited extent for heating in open grates. It was so difficult to prevent a fire kindled with anthracite coal from going out, that those who were interested in this fuel sought for an expert to devise the best method of burning it. Dr. Eliphalet Nott, President of Union College, of Schenectady, N. Y., had invented a box-stove in 1820, with which all the students' rooms in the college were heated; and as he was an acknowledged authority on the combustion of fuel, a small quantity of anthracite coal was sent to him. The result of his experiments was the construction of an illuminated magazine-stove of an oblong square section, lined with fire-brick. This worked well, but for the fact that when the cover was removed gas would escape and often explode. When a passage was made from the top of the magazine to the exit flue, which allowed the gas to pass off, the users would often carelessly leave the damper open, thus causing all the coal to become ignited. These defects rendered the new stove of no value.

Jordan L. Mott, Sr., a merchant of New York City, who in 1830 had become a manufacturer of stoves, in 1833 constructed a self-feeding base-burner. In this stove he introduced the burning of the chestnut size of anthracite coal in thin layers, fed from a magazine. Mr. Mott's stove contained the principle of the modern base-burner, as it is now used. In 1852 D. G. Littlefield, of Albany, constructed a self-feeding base-burning stove, which he improved in 1856; and in 1862 he made his "Morning Glory" base-burner, which had a very large sale wherever anthracite coal was used. The construction of this stove, employing chestnut coal, showed how anthracite coal might be burned successfully. In 1862 the "Oriental" base-burner was devised by Perry & Company, being similar to the "Morning Glory" construction. It had a great sale.

About this time the "American" base-burner was brought out by Van Wormer & McGarvey, of Albany, proving very successful. About 1863 Hailes & Treadwell, acting for Rathbone, in Albany, added a magazine to the revertible-flue gas-burner, which drew the flame away from the magazine, and heated the floor more than the direct-draft base-burners had previously done. In 1865 Hunt & Miller, of Hudson, produced a base-burner with very small mica windows opposite the grate. In 1871 James Spear, of Philadelphia, constructed his anti-clinker direct-draft base-burner, with a small illumination opposite the grate, and the same year W. J. Keep brought out "Keep's Side-Burner," which was the first stove that had been made with a full mica section both below and above the fire-pot.

Fuller, Warren & Company, who manufactured this stove, were of the opinion that "no one would admire mica windows opposite a dirty ash-pit," and therefore thought best to be very careful about putting it on the market. Perry & Company, of Albany, were watching the anti-clinker and the side-burner, and in 1873 put the anti-clinker grate and the full double illumination into a case of the graceful proportions of the American base-burner, and produced the "Argand" base-burner. The arrangement of flues in the Argand was the same as had been made by Elihu Smith, who did much to develop the base-burning stove. The Argand construction and shape were exactly what the people wanted. The Michigan Stove Company manufactured it on royalty in the West. The Detroit Stove Works made the "Crown Jewel" of the same shape, except that they sloped the lower windows outward. Fuller, Warren & Company in 1875 made "The Splendid" after the lines of the "Crown Jewel," and in 1876 the Michigan Stove Company dropped the "Argand" and made the "Garland." This type of round stoves held its own until 1880, when the Magee Furnace Company, of Boston, constructed a rectangular double illuminated base-burner, with an artistic ornamentation. This shape was followed by leading firms, but did not meet the approval of the masses, partly because the fire-box was square.

In 1884, the Michigan Stove Company brought out a stove with square base, round front, and nearly square sides, with a round fire-pot, and a round top surmounted by a dome, called the "Art Garland." This was the invention of Mr. Keep, who had removed from Troy, and had become the superintendent of the Michigan Stove Company. This stove was imitated by six of the largest firms the next year. The same year Smith & Anthony of Boston made the "Hub" base-burner, with a modeled ornamentation by Mr. Osburn, designer of the Low Art Tiles. In 1885, the Michigan Stove Company adopted the modeled style of ornamentation, which has since been used by the principal manufacturers. In 1887, Mr. Keep patented the use of an inturned mica section over the fire, with a reflector placed above it, in the "Reflector Art Garland" for the Michigan Stove Company. The patents were respected for about five years, but at present nearly all first-class houses have constructed stoves with the reflectors and the shape of this base-burner.

The first departure from the early brick oven was the tin reflector. When this was set before the fire the baking was done on shelves by radiant heat. In the brick oven the fire was placed inside. The first effort at improvement tended to place the fire outside the oven, so as to impart a continuous heat, and at the same time to make a portable stove which would warm a room by the heat escaping through its outside walls. The first cooking-stove was probably evolved by placing an oven in a box-stove. The James stove was the first of this kind of which we have any record. It was called a nine-plate. The oven door opened on the side of the stove, and the flues about it led the smoke up its sides and over the top to the pipe collar.

The Vermont "Historical Magazine" has this to say concerning the great change wrought by the introduction of the cooking-stove:

In 1819, John Conant invented the Conant stove, and made the first one from castings obtained at the furnace in Pittsford, Vt. In 1820, Mr. Conant erected a furnace at Brandon, Vt., and the first blast was made in October. At this furnace was cast the old Conant stove, the first made in the State, and a great invention for the time, and which was the wonder of the farmer's kitchen. It was the inauguration of a new era in the culinary kingdom. The pleasant old fireplace, with its swinging crane of well-filled pots and kettles, hearth-spiders with legs, and bake-kettles, and tin bakers to stand before the blazing logs and bake custard pies in, all went down at once and disappeared before the first stove, without so much as a passing struggle. Stoves with ovens, but without boilers, etc., had been previously made to some extent. The State of Vermont was being supplied previous to 1819 by a house in Troy, N. Y., who had their castings made in Philadelphia.

The Conant stove had an oven above the fire, with a door in both ends, the front one being over the fire-door. Each side of the stove was extended so as to receive a pot which rested in the recess by its rim. This presented one side and a portion of the bottom of each pot to the fire. At the rear of the stove another chamber was constructed to hold a third pot, and this could be heated by an independent fire, if it was not considered desirable to heat the whole stove. The fire was still under the oven.

The Woolson stove, invented at Claremont, N. H., had the oven at the side of the fire-box, and by dampers the heat could be thrown under or over the oven. The top was flat, and there were several cooking-holes. The "Premium" succeeded, and was an improvement upon this stove. As an illustration of the change in the requirements of the trade, Mr. H. C. Woolson, a son of the inventor, writes: "When my father's stove was first made the farmers said it did not burn half enough wood, but when it was laid aside the complaint was that it burned too much wood. A sheet-iron stove was invented soon after my father made his stove, called the 'Yankee Notion,' which was the beginning of all elevated-oven stoves." Experiments in oven-stoves showed that the fire underneath the oven heated the bottom too rapidly, and the fire at the side caused one side of the oven to bake faster than the other. This led to placing the oven at the rear, and on a higher level than the boiler-holes, which brought the heat uniformly against all parts of the oven. This also enabled the boiler-holes to be placed very near the floor, and brought the oven higher up than in any other construction, making it a very convenient stove to operate.

The next progressive step was Stanley's rotary cook-stove in 1833, a stove which had the cooking-holes and fire-box as low down as the elevated oven. The top revolved by a crank and cogs, so that any hole could be brought over the fire. Tin ovens were placed over the pots or sad-irons to retain the heat, and a tin cover was put over a rack on which were placed loaves to be baked, making a portable oven for the top of the stove. An elevated oven was attached to the stove when required.

The evolution of the cooking-stove did not follow in regular sequence, as would appear from the foregoing account. The Conant, and Woolson, and the elevated-oven were probably made at the same time. Mr. Giles F. Filley, of St. Louis, sheds light on the subject as follows: "A Mr. Hoxie, a Quaker, had gone from Philadelphia to Salisbury, Conn., where pig iron was made before 1812. He had no doubt used the ten-plate stoves, for he held that the heating of an oven from the under side was wrong, and that the fire should be on the top of the oven, and be made to pass around the same to heat it evenly in all its parts. Hoxie's first stove was oval in form, the fire passing down the two end flues, meeting at the bottom of the stove, thence to a chimney by a channel cut in the hearth of the fireplace over which the stove was placed. Hoxie then made a two-flued portable stove, the flues similar to those in the two-flued ranges now in use. He next made a stove with what is now called the three-flued principle. The stoves made by Hoxie were principally sold in the neighborhood of Salisbury, and they were hardly known outside of that place during his lifetime, which ended about 1820." J. G. Hathaway, who made a great stir in the stove trade, obtained a patent on his stove in 1837. He claimed to have invented the three-flue construction, but he afterward admitted that he had seen one of Hoxie's stoves. The Buck stove was invented by a Mr. Crowell, of Palmyra, N. Y.; but according to contract the patent was taken out in the name of Mr. Buck, in 1839.

P. P. Stewart's first patent was in 1838. The fire-box hung in the upper part of the oven, so that the heat from both sides and the bottom was thrown into it. The flame passed down in one sheet in front of the oven, then under and up the rear to the pipe collar on top of the stove. Stewart's large-oven stove was made in 1850, and was at first a three-flue construction, but he soon after adopted a sheet flue under the oven, and three flues at the back. Samuel Pierce about this time invented the curved plate, now generally used at the front of the oven, which threw the ashes from the grate into an ash-pit in the hearth. There have been no important changes in cook-stove construction since that date. Minor changes have been made to increase sales, such as Filley's gauze door, his return-flue construction, the various arrangements of reservoirs and grates, the methods of oven ventilation, and Buck's Stove Company's brilliant glass and enameled oven doors. Several innovations have also been introduced by Bridge, Beach & Company.

Royal Deane, of the Bramhall-Deane Company, N. Y., gives a number of facts regarding French ranges, or those made of wrought-iron and steel. Before 1850 a Frenchman, who, he thinks, was named Gillette, had supplied the Boston market with a sheet-iron range. The fire in this range was suspended inside of a sheet-iron casing in a basket grate, the cooking and heating being accomplished by radiant heat from the fire direct. The firm of Stimson Brothers, or Stimson & Son, of Boston, had also made similar ranges. About 1850 the firm of Duparquet, Huot & Moneuse, of New York, was established, and made a similar range, but later the oven was made a separate part of the construction, and flues were placed around it as at the present time. In 1855 John Van, of Cincinnati, placed on the market the first modern wrought-iron range, intended to be used on Mississippi steamboats; and since that date this branch of the trade has increased very rapidly.

Stoves were manufactured in Detroit during the thirties at the Hydraulic Iron Works foundry. In 1849 the writer of this paper, while learning the molding trade in this foundry, worked on repairs for Woolson stoves, and in this way had his attention turned to the subject of this manufacture, and in 1861, with his brother, James Dwyer, he established the first foundry in Detroit exclusively for

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making stoves. In 1864 this concern was merged into the Detroit Stove Works, W. H. Tefft and M. I. Mills joining the company. In 1871 the present writer, with Charles DuCharme, George H. Barbour, and others, established in Detroit the Michigan Stove Company, and in 1881 his brother organized the Peninsular Stove Company.

Foundries for the manufacture of stoves exclusively were established at Troy and Albany at an early date on account of the superior molding-sand found there. In 1835 Joel Rathbone and Pratt & Treadwell conducted stove foundries in the latter city. Such foundries were also established at various points in the New England States. New York City possessed a number of stove foundries, and Jordan L. Mott was one of the first to use a cupola for remelting iron for stove manufacture.

About 1865 the competition of foundries located in the West became so sharp that eastern manufacturers were obliged to establish branch houses at Chicago to facilitate the delivery of stoves to their western customers. Later, eastern men began to move their entire plants to western points, with the result that at present Chicago is the center of stove distribution.

As the result of the efforts of Mr. John S. Perry of Albany, a meeting of stove manufacturers was held at Delmonico's in New York on March 6, 1872, with Mr. John S. Perry as chairman, and Henry T. Richardson as secretary. General Rathbone suggested that a permanent organization was desirable, and the following committee was chosen for that purpose: Messrs. Resor, Smith, Shepard, Rathbone, McDonald, Tefft, Patterson, Bradley, Greene, and Filley. This committee presented a draft of a constitution and by-laws which were adopted after discussion and amendments, an association being organized with John S. Perry as president; G. F. Filley, first vice-president; David Stewart, second vice-president, and Mr. A. Bradley, treasurer. John S. Perry held the office of president until 1874; Sherman S. Jewett was president until 1878; John F. Rathbone, 1879 and 1880; R. P. Myers, 1881; W. H. Whitehead, 1882 and 1883; Grange Sard, 1884 and 1885; Jacob L. Smyser, 1886 and 1887; George H. Barbour, 1888 and 1889; D. M. Thomas, 1890; Jesse Orr, 1891 and 1892; George D. Dana, 1893 and 1894, and Lazard Kahn, 1895. In 1886 D. M. Thomas was made permanent secretary and held the position until his death in 1895, with the exception of the year 1890, when he accepted a position with a manufacturing concern. He resumed the duties of his office, however, in 1891. T. J. Hogan succeeded him in 1895, having been secretary during the year 1890.

At the first meeting in 1872, Mr. Perry presented the following table, showing the number of stoves manufactured in the years enumerated:

Years.	Number made.	Gain per cent.
1830	25,000	
1840	100,000	300
1850	375,000	275
1860	1,000,000	167
1870	2,100,000	110

The following figures are furnished by T. J. Hogan, secretary of the association mentioned above, the National Stove Manufacturers' Association:

In 1870 there were 275 stove and hollow-ware manufacturers, consuming yearly 275,000 tons of iron. The volume of business in 1872 was $37,-600,000. The stove foundries in the United States January 1, 1895, were 215, with an estimated capacity of $35,840,400. The volume of business in 1892 was $34,578,300; in 1893, $30,035,700; estimated volume of business in 1894, $24,204,810.

The estimated capacity is divided as follows:

Connecticut	$234,000	Maryland	$720,000
Maine	324,000	New Jersey	100,800
Massachusetts	2,580,000	Virginia	216,000
New Hampshire	169,200	West Virginia	100,800
Rhode Island	421,200	Pennsylvania	6,062,400
Indiana	1,098,000	New York	6,776,000
Ohio	4,107,600	Georgia	111,000
Illinois	3,859,000	Alabama	120,000
Kansas	360,000	Kentucky	975,000
Michigan	3,480,000	Oregon	90,000
Minnesota	342,000	Tennessee	1,086,000
Missouri	1,540,800	Texas	45,000
Wisconsin	921,600		

The Stove Founders' National Defense Association was organized in 1886 with Mr. Henry Cribben, president, and D. M. Thomas, secretary. Mr. Cribben has been elected president each year. The office of secretary has always been filled by the secretary of the National Association of Stove Manufacturers. Committees from this association and from the Iron Molders' Union meet each year to decide upon prices to be paid for molding, and to adjust differences and avoid strikes. Through the efforts of this association no reduction in the wages of molders employed by its members was made necessary during the period of business depression extending from 1893 to 1895.

In 1713, M. Gauger, in a treatise on the construction of fireplaces, recommended the heating of air by means of a hollow back or wall of a fireplace. In 1744 Dr. Franklin invented a stove for burning wood, in the form of a box, of a greater distance from side to side than in depth, with an open front. The smoke escaped over the top of a flat chamber behind the fire, and passed downward between it and the real back of the stove, and thence into the chimney. This flat, hollow chamber communicated underneath the stove with a tube opening into the external atmosphere, and a quantity of air was thus passed through the flat chamber into the room, through small holes left in the sides. This was probably the first attempt to construct a hot-air furnace for supplying pure heated air to rooms. A patent was granted Daniel Pettibone of Philadelphia, in 1808, for stoves for rarefying, by heat, air for warming buildings. This system was soon after introduced in the Philadelphia Almshouse, and was used for heating churches and large buildings. In 1835 William A. Wheeler is said to have made at Worcester, Mass., the first warm-air furnaces that were made in New England. Gurden Fox, a grocer of Hartford, Conn., some time between 1835 and 1840 brought out a hot-air furnace which had a large sale. Other hot-air furnaces of an early date were the Blaney and the Culver. The old firm of Richardson & Boynton, of New York, put the Boynton furnace on the market at an early period.

In 1843 Mr. Henry Ruttan began his experiments in heating and ventilation, and later wrote a book on the subject. The first attempt to heat buildings with anthracite coal was made in a very crude way. The furnace was placed in the cellar, surrounded by an air-chamber of brickwork, and the gaseous products of combustion were carried through the building, passing through cylindrical drums on the upper floors and out at the top of the house.

The use of hot water in pipes for heating seems to be an invention of great antiquity. Seneca has accurately described the mode of heating by water in the Thermæ at Rome, which shows that the method of heating baths by passing water through a coil of brass pipes which passed through the fire was known prior to the Christian era. The application of this invention appears to have cropped up at various periods. In France, in 1777, M. Bonnemain used a coil of small pipes filled with water for the incubation of chickens. In 1817 Marquis de Chabannes introduced it in London for heating a conservatory, and also heated some rooms in a private house by means of pipes leading from a kitchen boiler. In 1822 a Mr. Bacon, also in England, introduced hot water for heating purposes, using a single pipe of large diameter, which was slightly deflected from a horizontal line, the hot water passing along the top of the pipe, which gave very imperfect circulation. Mr. Atkinson, an architect, suggested the addition of a separate pipe for returning the colder water to the boiler.

Hot-water heating came into general use in Canada a number of years ago, and the open-tank system seems to have been first used there; but this did not become a popular method of heating in the United States until recently. In 1842 the Perkins hot-water apparatus was introduced in New York and Boston from London, by Joseph Nason; and the business was conducted in both places by the firm of Walworth & Nason. One of the first houses warmed by the Perkins hot-water heater was No. 15 Ashburton Place, belonging to the estate of Ebenezer Melleken, and the apparatus was in 1892 doing good work after a use of forty-seven years. In a Perkins apparatus circular, issued in London about 1820, a heater spoken of as being the only one in the United States is recorded to have been in the residence of Colonel Thomas H. Perkins, Pearl street, Boston.

Hot-water heating has been extensively used in England and in Canada, but was not thoroughly appreciated by the people of the United States until within the past fifteen years. The Gurney and the H. B. Smith heaters were very generally used. During the last fifteen years this method of heating has become very popular, and there are a great number of good heaters on the market. Detroit has done much to introduce hot-water heating. The Peter Smith heater was the first. The Detroit Heating and Lighting Company in 1885 began constructing the Bolton Heater, which had previously been made in Canada. The Mouat was the next. The United States Heater Company has during the past four years done a large business, and the Peninsular Stove Company are heating many buildings by a combination of hot water and hot air, their system being considered equal to any in use.

William Cook, of Manchester, England, proposed in the middle of the last century the heating of houses by steam. In America the practice seems to date from 1841, in which year Mr. J. J. Walworth bought a small stock of wrought-iron pipe and fittings, which had been sent to this country by James Russell & Sons, of Wednesbury, England, to be sold on commission by James Boyce, who soon became discouraged by the small amount of business done, and returned to England. The gas companies were just beginning to use wrought-iron pipe. One year after, Mr. Joseph Nason returned from England, bringing the Perkins Steam Heater, which had been manufactured in England since 1820, and the firm of Walworth & Nason was formed. In 1845 or 1846 Mr. Nason conceived the idea of using small wrought iron pipes, three quarters to an inch in diameter, for warming buildings with steam. The first building warmed in this way was the Eastern Hotel, of Boston, and the first factory was the Burlington (Vt.) Woolen Mill. The steam-fitting in the factory was done by N. H. Bundy, the inventor of the Bundy radiator. For many years every steam-fitting firm in this country could trace its origin to the old shop of Walworth & Nason, through either one or two removes.

The improved methods of heating buildings by steam and of ventilating them by "fan blowers," now so extensively used throughout the United States, owe much of their development to James J. Walworth. It was in 1841 that he entered into partnership with his brother-in-law, Joseph Nason, and established the business of steam and hot-water warming and ventilating buildings by radically new methods. In 1844 the construction of apparatus for warming buildings, especially manufactories, by steam, was begun and rapidly extended. Immediately following this came a new system of ventilation by the use of the "fan blower," propelled by steam-power, which was and is used in conjunction with the system of steam-heating. Though J. J. Walworth has been the business head of the concern, yet as an engineer in steam-heating he has designed and executed many important works. Mr. Nason retired from the firm in 1852, and at present the Walworth Manufacturing Company owns an extensive steam-heating plant at South Boston, employing there and elsewhere upward of 800 workmen.

In 1846 Mr. Thos. F. Tasker, Sr., of Philadelphia, introduced the first closed apparatus returning the water of condensation to the boiler, and thus keeping up the circulation for heating purposes. His firm, Morris, Tasker & Morris, became very prominent soon afterward, in both steam and hot-water heating, being also manufacturers of pipes and fittings. This establishment subsequently became widely known as Morris, Tasker & Company. They made the first wrought-iron pipe that was made in this country.

Men who have been prominent in the introduction of steam and hot-water heating apparatus are Henry B. and Edwin Smith, John H. Reed, John H. Mills, and George B. Brayton.

Cast-iron radiators have been extensively manufactured in this country. The first we have record of is the N. H. Bundy radiator, and after that the Gold Pin radiator. The Gurney Manufacturing Company and a large number of others are making radiators, probably the largest concern being the American Radiator Company, which controls two extensive plants in Detroit and one in Buffalo.

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Jeremiah Dwyer

CHAPTER LII

PLUMBERS' AND STEAM-FITTERS' SUPPLIES

IT is through the agency of the plumber and sanitary engineer that life in cities, under the healthful conditions which govern it at the present time, is made possible. Though to the ordinary layman the work of the plumber may be less obtrusive, he really deserves a much more prominent position as a benefactor of communities than his fellow-craftsmen of the building trades are disposed to accord to him. The architect may prepare plans of edifices, the symmetry and beauty of which excite the pleasure of the eye, and his more mechanical co-laborers, the mason, the brick-layer, and the carpenter, may follow his tracings with the finished skill in the acquirement of which their lives have been spent; these create a habitation. But to the man who interweaves, as it were, his efforts with theirs, who provides sanitary appliances after a fashion compatible with the sternest laws laid down by the dictators of public health—to this man, the aim of whose life is to provide safeguards insuring his fellows against all danger of infection from that most insidious enemy of human life, the microbe bred by careless or imperfect domestic surroundings, is due a meed of gratitude but seldom forthcoming, because the reasons for it are so slightly understood.

Engineers, architects, and health officers accomplish much by their influence with individuals and by the exercise of their professional and official functions. They reach, however, only a limited portion of the community, while the plumber makes his influence felt on every hand. A certain trust is thus imposed upon him, which raises the better and more conscientious element of his occupation to a higher plane than is usually awarded to the followers of mechanical pursuits, as it has converted the calling itself into what enthusiasts on the subject might be tempted to denominate one of the fine arts. The word "plumbing," derived from the Latin *plumbum* (lead), meant originally to seal or repair with this metal. In the earlier ages lead was the material most favored for such purposes, owing to the ease with which it could be manipulated. Lead pipes were used to some extent by all the nations of old, and were invariably utilized in the ancient cities of Asia, Egypt, Syria, and Greece for conveying water under pressures too great for pipes made of earthenware. These pipes were made from sheets of lead rolled into the form of cylinders and soldered at the edges.

When the improvement in plumbing fixtures is compared with that of other materials used in mechanical pursuits a curious disproportion in the relative time that has been required for this development is revealed. Almost the entire history of progression in this department is covered by the past fifty years. Hardly a half-dozen plumbers were known in New York a half-century ago, and all these were men who fashioned in their individual workshops the somewhat crude fittings they supplied. After the completion of the Croton Aqueduct in 1842, however, the necessity for durable pipes and fittings began to be felt, and this led to the establishment of manufactories of plumbers' supplies. At first these concerns were engaged almost exclusively in the manufacture of lead pipe, sheet lead, or iron pipe. In the earlier part of the century, wooden pipes, or logs bored out, were used for conveying water through the streets. This was under the old Manhattan system. There was at that time, and is there yet, a tank in Reade Street for maintaining which the Manhattan Bank received its charter.

A modern chef would regard with curious contempt the kitchens of that day, though their occupants doubtless thought them adequate for all purposes of the culinary art. In contrast to the elaborate arrangements now in vogue for producing every degree of temperature desired, there was then the ordinary kitchen range with its water-back contrivance for heating water, which, however viewed by modern eyes, was then regarded as being almost the veritable culmination of that half-century's development in domestic apparatus. The same principle applies in ranges to-day, and is in general use in private houses, although for hotels and other large buildings special appliances for heating water, independent of range connections, have accompanied the increased magnitude of such structures. The first kitchen appliance independent of the range, with its water-back and boiler connections, was a sink used in the kitchen, with the usual hot and cold water faucets over it. This for many years comprised the entire plumbing of an ordinary dwelling. The next feature was a bath—a wooden box lined with lead, a primitive and unsightly fixture. Following that came cast-iron bath-tubs, painted inside and out, and next a box lined with copper, which was the favorite bath for many years.

A quarter of a century ago was commenced here the manufacture of porcelain-lined bath-tubs, which for a long time were brought out exclusively by the company of which I am the head. To-day similar goods are made in various parts of the country by other concerns. The most popular and elegant tub—the very acme of perfection in bathing apparatus, in fact—is one of solid porcelain, which has become almost indispensable in the finest plumbing. These goods were, until a year ago, always imported from Europe; but since that time one of the most enterprising potters in the United States has so perfected this variety of ware that the American article to-day stands on an equal footing with the world's production. There is practically no expense to which one may not go in this direction, should he feel so disposed, and some of the private bath-rooms in the homes of modern millionaires could compete in point of beauty with the famous public baths of ancient Greece and Rome.

In the possession of our house is a Dresden-china bath-tub, the only duplicate of which is owned by the emperor of Germany. It is comparatively simple in design, and betrays but few evidences of the value put upon it—$3000. It is seldom, however, that extravagance extends thus far with this particular article. As a rule it is more generally distributed throughout the bath-room; and hand-painted tiles, which constitute the material for walls and floors, come in for a fair portion of the financial outlay, much fanciful decoration being permitted with these. Then the more immediate toilet accessories are to be considered, and among these are found onyx and variegated marble slabs with brass supports, plated with nickel, silver, or gold, and furnished with the most elegant Cauldon-china basins, painted by prominent artists. These adjuncts themselves constitute an important item of cost in the equipment of the thoroughly up-to-date bath-room.

In examining the subject of domestic sanitation it is worth while to note that while the expense of the plumbing of the average first-class dwelling of thirty-five or forty years ago could be computed at $250, this work to-day may be reckoned, in the majority of instances, at from $2000 to $6000, according to the size of the building and the fancy of the owner. As has been aptly observed, "Look out well for the health-rate, and the death-rate will lose its significance." Doctors for many centuries had the monopoly of what little knowledge existed of the conditions affecting public health; but of late years the Dwelling Reform Association of New York, American Public Health Association, Public Health Association of New York, and similar organizations in other large cities throughout the Union, together with the architect, the plumber, and the inventor and manufacturer of plumbers' supplies, have done more to reduce the death-rate from zymotic disease in our large towns and cities than probably the doctors have themselves.

As a part of the general sanitary system now to be considered, each house has its own network of pipes which convey the refuse of the basins, sinks, and closets to the general sewer. It is obvious that any leakage or deposit from these would nullify the purpose for which they were designed. The air within them must also be kept out of the dwelling by placing a water-trap at every opening through which sewage is to enter the pipes, and by making all internal pipes gas-tight. It is necessary that a current of fresh air have free access to the pipes, that the filth within them may be oxidized; and the air of the sewer outside must be rigorously shut off from that of the pipes within the house. This secures freedom from contagion from without, and the water-trap, as previously mentioned, furnishes protection against the passage of gas within through openings which admit of the entry of water.

The inverted siphon, which is sealed by water lying in the bend, is almost universally regarded as the simplest and best form of trap. True, inventors are appearing from time to time with other propositions in the way of a seal, but a better device hardly seems possible. A separate, distinct trap is placed in the house-drain to disconnect the main sewer from the house. This will not insure perfect security, however. Practically a distinct trap is required at each basin or other fitting, its function being to shut out the air of the house-drains from the rooms. The soil-pipe is ventilated by a current of air which flows upward, and must always extend to a point above the roof. This, together with the ventilating of each trap, insures the most perfect immunity against the accumulation of sewer-gas within the pipes that is known. Sometimes the additional flushing received by a soil-pipe into which the refuse of both a water-closet and a bath or wash-basin is discharged works rather as a benefit, and it may be contended that plumbing-work after the ideas just set forth, with proper traps, light and ventilation, good workmanship and first-class material, is all that is necessary to insure perfect safety from contagion.

A bedroom basin is usually made perfectly safe by leading its waste-pipe into the ordinary drain-pipe which connects with the sewer, and which must be protected by a water-seal, itself ventilated to prevent siphonage. It is a good general rule to have all plumbing fixtures ventilated in the same way. Occasionally rain-pipes are utilized as ventilating continuations of soil-pipes and waste-pipes. This should never be, for these pipes terminate under the eaves, a point where the drain-air is likely to be carried back into the house.

All drain-pipes should be made of iron. Lead pipe is affected by hot water and is often destroyed by rats. Clay decomposes and is easily broken. Two grades of soil-pipe are known to the trade—common and extra heavy. The common pipe, if certain conditions exist, can be trusted to serve for a considerable length of time. The heavy-grade pipe is the safest to select, however, and its diameter is a leading point of importance, as the quantities of water usually proceeding from bath and accumulating fixtures will, as a rule, flush a four-inch pipe better than one of larger size. Every joint of the soil-pipe should be made with a view to its being tested under pressure. Iron, as already indicated, is preferable in pipe to any other material. With the introduction of sewers generally the manufacturers in New York for some time supplied every section of the United States with iron pipe. The custom of tarring pipes cannot be too strongly condemned, as imperfections may exist which cannot be discovered after this has been done, but which manifest themselves after the pipes have been put into actual use and when it is too late to remedy them without great expense.

In the interests of good ventilation it is best to continue the soil-pipe and all vent-pipes to a point above the roof without any reduction in diameter. That the greatest care must be exercised in the manufacture and the adjustment of this class of pipe will be appreciated when it is stated that any want of air-tightness in drains or soil-pipes within a dwelling leads to the pollution of the air, both by indraft as well as by diffusion. A common method of testing such leaks as may admit foul air is to fill the house-drains, soil-pipes, and the rest with smoke from cotton-waste soaked in oil. The escape of these unpleasant fumes by other than the proper channels is readily detected. In occasional instances, too, the lower end of the pipe is stopped and the pipe itself is filled with water, the fall of which, of course, denotes an imperfection somewhere.

I have already referred briefly to the subject of traps, which, above every other branch of the more practical part of plumbing, causes the most vexation, and continually presents a problem that every aspiring sanitary engineer feels called upon to cope with. Few there are who have shrunk from charging this barrier, and but few of these, in turn, have failed to contrive some sort of a trap that for the nonce, at least, seemed to combine the essential features of which the plumbing world has been so long in search. In general, though, from its simplicity and practical utility, the system of back ventilation, indorsed by all the boards of health, is believed to be the most efficacious and satisfactory in existence.

In any article dealing with this subject attention must necessarily be directed to the progress which has been made in the construction of water-closets. It is with this division of plumbing more than any other, perhaps, that the question of general public health is most intimately concerned, and upon this point particularly have the manufacturers of plumbing fixtures brought all their inventive faculties to bear. Water-closets, apparently, were of as early origin as definitely constructed baths. In the history of Rome we find records of some which were designed in gold and silver. It is contended that traces of others were found in the ruins of Pompeii, and that they even existed in Egypt. Fosbroke, writing on this subject, speaks of closets in the palace of the Cæsars which were adorned with marble and mosaic, and which were provided, apparently, with complete drainage by water.

Throughout Europe, however, the subject seems to have received but slight serious attention until the eighteenth century. The first English patent for a water-closet was issued in 1775 to Alexander Cummings, a watchmaker in Bond Street. This closet had a sliding valve between the trap and bowl, and here we find the first recorded instance of a siphon-trap being used in this connection. In 1778 Joseph Bramah received a patent for a closet with a valve at the bottom of the bowl, working on a hinge. Bramah's closet was the forerunner of a large number of inventions founded on the same general principles as the first, and in most respects but slight improvements over that one. A valve closet supplied by a tank, the hopper of which was flushed by pressure on the seat, was patented in 1792. No patents were issued for water-closets in America until 1833, nor does it seem that previous to the nineteenth century they were considered as coming within the province of the plumber at all. At the present day we have for consideration valve closets, pan closets, plunger closets, hopper closets, cistern closets, siphon closets, and latrines. A score or so of years ago the pan closet was the type generally in use. Then came the valve and plunge closets, which have been superseded by the siphon closets. The valve closet takes its water from the main service-pipe, and cisterns are not usually required with this class of closets. A cistern closet differs in that its water supply is taken into the cistern direct from a main or a tank, and is released into the bowl by a system of valves and pulls. In the material of construction water-closets have followed the general trend of toilet furnishings, and are now made mostly in one piece and of glazed earthenware. Next to the water-closet, urinals are of vital sanitary importance, but their general construction and principles scarcely require extended discussion.

Thus it will be seen that never in history have plumbers had so much to do with the health of the families in our large cities as now, nor have they ever so well understood the principles of internal plumbing-work as at present. The knowledge of sanitary work is spreading rapidly, and to keep abreast of his trade the plumber has to educate his eyes as well as his hands; for it is not enough that he becomes a skilled hand-worker—he must become an intelligent head-worker as well.

An almost incalculable advantage now exists in the fact that even in the cheapest flats all kinds of closed plumbing have been superseded by open work, with no boxed fixtures or pipes. This is to be commended on account of its cleanliness, healthfulness, and availability in event of the necessity of repairs. Much of the progress made by the plumber has been due, without doubt, to the intelligent action of the boards of health. When it was definitely felt that this aid and coöperation were being furnished, the efforts of the better class of plumbers were strengthened and stimulated. To Mr. John Demarest, more than any other inventor, the public is indebted for the best plumbing fixtures known in any section of the globe. Many of these he himself has patented, and his entire career has been fairly illuminated with repeated successes in the devising of appliances to conform with the consensus of opinion expressed by the most capable sanitary engineers of modern times.

In proceeding to the second division of the subject I might remark at the outset that in these days it would be considered about as sensible for a man to contemplate the construction of any building of consequence without the aid of the workmen who fit the stone and lay the floors as to eliminate the steam fitter from his calculations. But few American industries have grown with such rapidity as this one, which has pushed ahead at a pace parallel with the manufacture of wrought-iron pipe. With the latter, too, its progress has been almost inseparably connected, for had not the production of wrought-iron pipe by perfected machinery and at a reduced cost occurred at the time it did, the development of steam and hot-water heating would have been greatly retarded. This growth may be said to date practically from 1840, though it did not assume proportions of consequence, relatively to the great industries, until after the close of the war. The earlier developments of the industry were largely assisted by Joseph Nason, of New York, and J. J. Walworth, of Boston.

Attempts at steam heating had been made in England by the employment of the Perkins system, in which very small pipes were connected with boilers, on the calculation that a high temperature would thus be generated. Sometimes this temperature became sufficiently high to elevate also its environments, after a most unexpected and distressing fashion; and because of this liability to explosions, as well as through its irremediable extravagance in the consumption of fuel, it was finally abandoned. At the period referred to it is probable that not twenty buildings in New York City were heated by steam. With the introduction of low pressure, the early development of which was greatly assisted by the two gentlemen mentioned, a change became almost immediately apparent. Low "pressure" meant practically no pressure at all, and possessed economical advantages hitherto unheard of. It was durable in that there was practically no wear upon the apparatus, and no fuel was wasted in generating high temperatures.

All of this was brought about, of course, by successive inventions and improvements. Though the two are included under the one title now, steam heating really preceded heating by hot water in pipes. The first boilers set up were similar to those that had been used for power purposes. They were made from wrought-iron. Radiators followed quickly, being constructed from wrought-iron tubes, both vertical and horizontal; but as low-pressure work came into more general favor other forms of radiators in sheet-iron were adopted, chiefly because of the low rates at which they could be sold. They lacked durability, however, and at last their use was abandoned. About 1865 the attention of manufacturers was directed to the construction of heating boilers and radiators from cast-iron; and though for a time progress in this direction was slow and the sale of these goods limited, it had assumed by 1880 proportions of fair size, and since that date has expanded with such rapidity as to make the manufacture of steam and hot-water furnaces one of our most important industries. A number of American manufacturers, in fact, are exporting goods of this description, and find that they can successfully compete with foreign makers. Because of the development of hot-water and steam heating, also, a strong impetus has been imparted to an auxiliary occupation—the making of such hardware goods as bolts, nuts, washers, gauges, facings, and various tools—which represents large investments of capital and on which the success of the main industry largely depends.

While the advancement in supplies for steam and hot-water heating has not hinged absolutely upon the development of the modern office building, it is undeniably true that this institution has constituted the most important factor in its increased prosperity, and has added enormously to its growth. The boilers used for this purpose are almost always of wrought-iron or steel, owing to the fact that in nearly every instance high pressure is used on the boilers for the running of elevators, electric lights, and for pumping. In a large number of these buildings the exhaust steam from the engines is alone sufficient for all heating purposes, and where it is not, a reducing pressure-valve is used, so that the pressure in the distributing pipes and radiators rarely exceeds five pounds, and the water condensation is returned to the boilers by automatic devices of various kinds, the manufacture of which occupies the attention of several large factories.

It is safe to state that in 1840 the amount of trade in this line did not exceed $200,000 per annum, and that not more than $75,000 were invested in it. In 1860 the trade had increased to about $2,000,000 per annum, which represented a capital of about $500,000. By 1880 these figures had increased to an annual trade amounting to $15,000,000, the capital behind which was $4,000,000; and at the close of the season of 1895 I can safely assert, I believe, that this industry has expanded in its yearly transactions to between $80,000,000 and $100,000,000, and that the invested capital will amount to $50,000,000. As an illustration of the rapid development of certain branches of this business it may be stated that while in 1870 only 8 firms were engaged in the manufacture of house-heating boilers, in 1880 there were 18; in 1890, 63; and for 1895 the number is estimated at 150.

The manufacture of cast-iron radiators has kept pace with that of the boilers. Only from 250,000 to 300,000 feet of radiators were cast in 1870, while in 1880 the output was little less than 2,000,000 feet. By 1890 it had increased to between 6,000,000 and 7,000,000 feet, and for 1895, as far as reports can be gathered, close to 18,000,000 square feet of surface will have been cast. The lowering of the cost of production has been a very material factor in the progress of this trade; in fact, it may be said that the reduced cost of steam and hot-water heating had a very sensible effect on its growth generally. As an illustration of this we may revert to 1880, when radiators were sold at thirty-eight and forty cents per square foot, figures which by 1895 had dropped to from sixteen to eighteen cents per foot for the standard sizes.

In other branches of this industry, as well, have occurred reductions as great proportionately to the cost of production. This is most notably the case in the manufacture of iron pipe and brass valves. These reductions have been brought about by improved methods of manufacture, better systems of management, and by largely increased trade, which permits business to be done with a smaller margin of profit.

In the foregoing, reference has been made at more or less length particularly to the culinary, bath, toilet, heating, and supply and waste pipe systems; but there are one or two subjects that have only indirectly been touched, among which one of the most important is ventilation or pure air. The outside air, as is well known, contains carbonic acid varying between 3 and 6 parts in 10,000 volumes; but in close places, such as crowded buildings, this rises to the extent of even 25 volumes in 10,000 of air. It has been experimentally proved that

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when the heat is excessive organic matter charging the air of crowded places rises in amount as the carbonic acid increases, so that we have a foulness of the air, or, as it may be termed, want of ventilation. The sanitary plumber must fully understand this, just as he must also know that wherever there are sewers there is certain to be sewer-gas, which, when it finds its way into houses, becomes a deadly enemy to the human race, and the source or promoter of nearly all the so-called zymotic diseases. To abate this evil has been one of the greatest problems which the modern sanitary plumber has had to encounter, and which he has now happily solved for the benefit and welfare of the millions who live the artificial existence of our large cities. The wise and exact observance of all these sanitary laws and regulations by our plumbers in their work has within the past quarter of a century materially reduced the death-rate in our larger cities. Thus it will be seen that the work of the practical or sanitary plumber demands high and peculiar qualifications. His ordinary work is easily learned, but the scientific or sanitary part requires careful study. There are four things in a building which cannot be sacrificed to economy. They are the foundations, the roof, the plumbing-work, and the apparatus for heating. The two essentials first mentioned are usually secured at any cost; but the attempt to economize comes in the plumbing-work and furnace. As time goes on and the importance of the plumber's work comes to be still better understood, the vital interests affected by this false economy will be realized, and people will come to appreciate that the best way for all concerned is to pay the plumber a fair price and hold him to a strict account for the quality of the work.

In closing this article it may be interesting to show by figures the exact importance of the allied industries under discussion. The following tabular statement gives the number of plumbing and gas-fitting and plumbers' supply establishments, with the invested capital, the value of the product, etc., in thirty-seven of the principal cities of the Union, taken from the census reports for 1890:

PLUMBING AND GAS-FITTING AND PLUMBERS' SUPPLIES, 1890.

	Plumbing and Gas-Fitting Establishments.				Plumbers' Supplies.		
	No. Estab.	Capital.	Employees.	Product.	No. Estab.	Capital.	Product.
Atlanta, Ga	4	$44,050	105	$205,892	....	....	....
Baltimore, Md.	116	299,637	515	799,525	4	$295,819	$495,500
Boston, Mass	251	886,860	1,887	3,250,086	3	78,100	73,800
Brooklyn, N. Y.	327	1,307,356	2,321	4,137,514	10	611,650	546,750
Buffalo, N. Y.	63	673,569	815	1,360,070	....	....	....
Charleston, S. C.	14	27,862	42	54,825	....	....	....
Chicago, Ill	278	1,550,718	2,586	5,608,857	6	1,255,346	1,248,404
Cincinnati, O.	114	381,970	674	1,455,915	5	149,400	363,227
Cleveland, O.	45	225,980	453	783,926	....	....	....
Denver, Colo	8	44,450	72	181,860	....	....	....
Detroit, Mich	58	363,609	477	913,503	4	110,552	275,972
Galveston, Tex.	6	35,465	20	57,300	....	....	....
Indianapolis, Ind	12	63,720	115	184,165	....	....	....
Jersey City, N. J.	37	156,707	233	401,712	....	....	....
Kansas City, Mo	27	306,087	527	1,155,254	....	....	....
Louisville, Ky	40	138,249	286	418,613	....	....	....
Memphis, Tenn	10	222,450	192	399,850	....	....	....
Milwaukee, Wis	39	437,712	612	927,024	....	....	....
Minneapolis, Minn.	33	442,847	647	1,232,541	....	....	....
Mobile, Ala.	7	14,165	33	43,860	....	....	....
Newark, N. J.	88	547,469	774	1,352,845	....	....	....
New Haven, Conn.	35	196,450	312	535,526	....	....	....
New Orleans, La.	16	182,883	158	329,748	....	....	....
New York, N. Y.	769	2,705,093	5,537	10,304,253	17	1,408,954	2,345,383
Norfolk, Va.	7	37,305	54	61,423	....	....	....
Omaha, Neb.	20	243,700	310	728,696	....	....	....
Philadelphia, Pa	498	2,612,597	2,975	5,701,478	15	1,401,675	1,100,031
Pittsburg, Pa.	27	136,407	173	279,380	....	....	....
Portland, Me.	16	95,625	116	240,892	....	....	....
Providence, R. I.	46	177,319	251	441,565	....	....	....
Richmond, Va.	28	315,895	271	495,850	...	....	....
St. Louis, Mo.	124	581,067	1,047	1,651,169	....	....	....
St. Paul, Minn.	35	364,835	477	1,075,827	....	....	....
San Francisco, Cal.	116	393,847	824	1,660,346	3	97,550	169,600
Savannah, Ga.	11	27,650	46	80,020	....	....	....
Syracuse, N. Y.	14	154,300	172	373,259	....	....	....
Washington, D. C.	86	467,735	646	1,130,574	...	....	....

Thirty years earlier the census reports for 1860 divided the plumbing business and its branches into four general classes, reporting them as follows:

	Number of Establishments.	Capital Invested.	Cost of Material.	Employees, Male.	Annual Wages.	Value of Product.
Plumbing materials	1	$14,000	$26,905	35	$7,200	$40,000
Plumbing	3	3,500	5,172	6	2,580	9,200
Plumbiug, etc.	4	22,100	20,200	42	15,900	50,300
Plumbing and gas-fitting	163	636,800	694,456	1,015	389,910	1,599,420

As showing the material increase since then, each one of a half-dozen of our principal cities exhibits in 1890 a larger value of product than did the whole country in 1860. With these figures to demonstrate its growth, and its own achievements to vouch for its worthiness, the trade of the plumber is one to which the future can only mean progress. Much has been done in fifty years, as I have shown; but more remains to do, and the next century will see the fruition of this one in the enlarged scope of new and changed conditions.

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CHAPTER LIII

BUILDING MATERIALS

THE improvement in the art of building indicated by the variety of building materials, in iron, stone, clay, and wood; the machinery for their production; the skill with which these materials are used singly and in combination; the appliances for rapid construction; the devices for the conveniences and comfort of the occupants of buildings; and the artistic treatment of the interior and exterior of edifices, is self-evident to any person who compares the structures erected within the past few years with those put up less than a quarter of a century ago. These improvements in the art and science of building may be said to have been achieved within the business period of a single lifetime, without going back to the time when brick, stone, iron, and wood were worked into shape by laborious processes, afterward being used in the most commonplace manner, and when almost everything in which artistic effect was sought had to be imported from Europe, or the skilled labor to produce it had to be specially brought from the old countries. There are still standing in the lower sections of the city of New York dwelling-houses erected a century ago, old office buildings proudly named after owners who have passed away in the natural course of events, and old hotels that were once looked upon as marvels in their way. And yet many things that appeal to the eye and receive admiration as component parts of new buildings cannot strictly be classed as building materials, however essential to artistic effect or to comfort and convenience such things are. Decorations in oil and water colors on walls and ceilings, hangings of paper, leather, and other materials, electric lighting, steam-heating, and even the elevator, without which the modern high building would be impracticable, are among these.

The height to which many new buildings are carried indicates the greatest advance in the art of construction, for such edifices represent principles untried twenty years ago, and have for their basis the use of iron or steel for the support of the floors, instead of masonry, reducing the walls to a mere inclosure for keeping out inclement weather, and for protecting the ironwork incased in them from damage by fire. Twenty-five years ago a six-story building was considered very high; but passenger-elevators came into use, adding value to the upper stories. Ten and eleven story edifices followed. With solid masonry the thickness of a wall is regulated by its height, tapering by stories from the bottom to the top. Under this method the great thickness of the lower portions of the walls occupied the most valuable space for rentals, and with a height of ten or eleven stories the greatest practicable limit seemed to be reached. No more of the area of a valuable lot could be given up to the occupancy of brick walls. Suddenly and simultaneously a number of architects and engineers grasped the idea that metal columns could be carried up to any desired height, having girders between on which to carry the floors and the requisite amount of masonry as an outside protection. Thus an edifice could be elevated to the clouds, and, irrespective of height, take up far less of the area of a lot than would be required by the old-fashioned method of solid brick walls. Fifteen, twenty, and twenty-five story buildings quickly followed, and it is conceded that structures 500 feet high, or of any height whatever, can be safely erected on this plan.

The use of a framework, or, as it is generally termed, a skeleton, of iron or steel, with curtain-walls supported on girders placed between the columns, the latter and the girders carrying the floors in addition, is an American novelty, notwithstanding it has for its immediate prototype the cast-iron fronts with column standing upon column. The first cast-iron front ever erected in the world was put up in New York in 1848; yet that was but a repetition of iron columns and lintels long previously used as a substitute for stone and brick to the extent of a single story. The skeleton, as used in the lofty buildings, is simply an evolution or expansion of the principle contained in the familiar cast-iron fronts, and in the oft-used method of increasing the bearing strength of a brick pier of too small an area safely to bear alone the load to be imposed, by placing an iron column in the center of the pier.

Obviously it is to the interest of an owner, as well as necessary for public safety, that an excessively high building shall be so constructed that in the event of fire the building itself shall not be seriously damaged, nor shall it imperil the safety of surrounding buildings. Laws regulating the construction of buildings in New York require all structures above a stated height (eighty-five feet) to be built fire-proof; that is to say, they must be constructed with walls of brick, stone, or iron, the floors and roofs of materials similar to the walls, and the stairs also must be of incombustible materials. Fire-proof floors are now commonly constructed of rolled iron or steel I-beams, with arches of burnt clay between the beams.

The first wrought-iron I-beams rolled in this country were made by Peter Cooper, at his mills in Trenton, N. J., about 1860. The Phœnix Iron Company, of Pennsylvania, began to roll them about the same time. Prior to that date there was a very limited number of fire-proof buildings in this country. Those which did exist chiefly belonged to the government. In the early fire-proof structures erected in New York City—the Cooper Union building, Harper's publishing building, and the Historical Library building—the iron floor-beams are of a shape known as deck-beams, being very similar in section to an ordinary rail, only deeper. The depths of I-beams have been increased from six and seven inches up to twenty-four inches, and mild steel has displaced wrought-iron. Eastern and Western rolling-mills yearly turn out an enormous quantity of rolled steel I-beams for use in buildings.

Before the time when rolled beams could be expeditiously procured and at moderate prices, cast-iron beams were used. When the openings to be spanned were of considerable width, bowstring-girders, or arch-shaped castings with horizontal wrought-iron tie-rods connecting the ends, were commonly used. It is admitted by all who are competent to judge that wrought-iron or steel is superior for use where the load tends to tear the metal asunder; and in course of time cast-iron for beams and girders became almost entirely superseded by rolled wrought-iron, and later on by rolled steel. The use of cast-iron beams, lintels, and columns in commercial buildings kept a number of large foundries in New York busy for many years. More than half a century ago the Jackson Architectural Iron-Works, now a corporation, were started, being practically the pioneer foundry for the manufacture of ironwork for buildings. It was in these works that the first entire iron front was made, from drawings furnished by the introducer, James Bogardus. Several firms that became quite renowned in the line of architectural ironwork—among them J. B. & W. W. Cornell—procured their cast-iron work for many years from the Jackson foundry. Iron fronts became popular, and New York supplied the demand from Boston, Philadelphia, Chicago, and St. Louis, until finally their manufacture was taken up in every section of the country. During the past ten years architects have shown a preference for fronts of brick with terra-cotta or stone for trimmings, and cast-iron fronts have largely gone out of fashion, perhaps later on to be revived, particularly for commercial structures, as cast-iron has in its favor unequaled advantages of lightness, strength, durability, economy, incombustibility, and ready renovation. John Roach, who became celebrated as an iron-ship builder, started in the foundry business in a small way in New York about the year 1840, making castings for builders' uses; but he veered off into ships' castings and machinery, and finally into building ships.

The Jackson foundry was started to manufacture grates and fenders, and during all the years of its existence has continued that as one of its principal branches. It was the establishment of a new industry in this country, for these things were all imported from abroad. While fireplace fronts can scarcely be included among "building materials," in the ordinary understanding of that term, yet they go to make up a permanent and necessary part of buildings. There are a number of other adjuncts to an edifice that cannot properly be included as building materials, but each of which makes progressive steps in providing useful, convenient, and comfortable structures. In a modern building electric light and steam-heat are looked for as matters of course; and mail-chutes, telephone and electric call service are developments of recent years. In dwelling-houses gas-stoves are supplanting coal-ranges for cooking; the old-fashioned pan water-closet has given way to the S trap-bowl; bath-tubs are of enameled iron, solid porcelain, or marble, instead of wood lined with copper or other metal; pneumatic or electric appliances open the street-door at will; locks that are unpickable and burglar-alarms secure reasonable

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safety from would-be intruders; and in a variety of ways the conveniences, comforts, security, and healthfulness of homes have been added to of late years by provisions made in the planning and construction of buildings.

Formerly French or English plate-glass was demanded for every good building. American plate-glass slowly but surely worked to the front rank in quality, and has become one of our great home industries. In art glass-work for windows, American manufacturers and American artists produce the equal of the best made in any other country, but the time was not long ago when everything in that line of art-work was of foreign make.

Marbles in great variety, sandstones in almost every color, and granite of various hues are quarried in all directions; and through cheap transportation by water or rail, every section of the country has an available supply of every kind and color of stone for architectural effect in buildings. Stone is planed and carved by machinery more accurately and quicker than by hand. The labor thus saved, and the consequent cheapening of molded and carved stone, have increased the consumption and given employment to a far greater number of workmen than would otherwise have been the case. The world's experience has shown, moreover, that while machinery increases production, it also opens new fields for useful labor, and the cheapening of the cost of manufactured products proportionately increases their consumption by bringing them within the reach of a greater number of persons. Not only in stone, but in every kind of material which enters into the construction and finishing of buildings, has machinery reduced the cost. The army of workmen is vastly greater in numbers, and wages are higher, than when hand labor had the field entirely to itself.

Wood moldings were laboriously worked out by hand in former years. Machinery changed all that, so that to-day a carpenter would as soon think of hewing out timber from the log by hand as to work out by hand the trim for a house. From the molding-mill the trim now comes all ready to be put in place. Hard woods, especially ash and oak, have largely taken the place of white pine for trim, and it is due to machinery that doors and architraves around openings can be obtained in hard woods at less cost than the same in soft woods could have been had a few years ago. Hard wood for mantels, of all grades from the simple and cheap to the elaborate and costly, has, to a great extent, taken the place of marble and slate. The advance in woodworking machinery and in carving by machinery enables very artistic and elaborate work in wood to be obtained at very reasonable prices, and architects and builders have not been slow in availing themselves of their opportunities. Improved fillers and varnish coatings for hard woods are on sale in every paint-store, and cabinet finish is easily and cheaply produced. Ready-mixed paints for interior and exterior uses are extensively used, the grinding being done by machinery, the mixing, therefore, being more thorough than by hand. Paint mixed with such ingredients that fire is repelled from wood or other materials coated with it is a comparatively new article of manufacture, but is being largely used for protecting frame factories and other buildings where the danger of burning is great. Wire cloth, in place of wood lath, is much used, not only because it keeps the plaster better and prevents cracks, but because it makes a good fire-resisting surface for ceilings under wood beams and on the sides of wood studs. A variety of solid, thin, light, and strong partitions of iron and plaster are used in place of the wood-stud, lath, and plaster partitions, so dangerous in case of fire. Mortar and plaster mixed by machinery are supplied to masons in any quantity required. The mixing being more perfectly done by machinery than by the hoe, the blisters so often seen on finished wall surfaces, due to bad mixing, are obviated. To ordinary plaster other ingredients are now added, these plaster mixtures being known in the market under several different names, but all having for their object hardness and durability. A few years ago American hydraulic cements were looked upon with extreme suspicion by engineers and architects, and imported Portland cements were demanded for use in important foundation-work. Now American cements are recognized as having equal strength with the English and German cements, joined with other good qualities, and are sold at lower prices than the imported brands.

In appearance the streets in our great cities are taking on a lighter hue, due to the light-colored brick so generally used for the fronts of new buildings. Twenty-five years ago, in New York, red was the universal color for front brick, the choice front brick being brought from Philadelphia and Baltimore. The clays of New Jersey give us brick in white, lemon, buff, mottled, and other hues, and these are used to the exclusion of red. Terra-cotta in a variety of colors and artistically executed enters largely into the ornamental treatment of the fronts of buildings. The extensive use of this material, and the erection of manufactories for its production, are of recent date in this country. In clay products alone architects have a chance to display taste and skill of which their professional brethren a decade or so ago never entertained a thought.

In the Post-Office building in this city, a little more than twenty years ago, hollow-tile flat arches between iron floor-beams were introduced for the first time in this or any other country. This was the invention of Mr. B. Kreischer, a manufacturer of fire-brick in New York. The flat-arch system provided a level ceiling at once, at a less cost and with much less weight of material than filling in between iron beams with segmental arches of common brick, and then furring down with wood or iron to obtain a level ceiling surface. The new system came into general use for fire-proof buildings all over the United States. A long litigation ensued over the patent, but under the crucial test of publications from all parts of the globe, the courts finally decided the Kreischer patent void for want of originality. Abroad the system of flat arches whose end sections abut against rolled iron or steel beams for floorings is recognized as an American invention, and at a meeting of the Royal Institute of British Architects, held in 1882, this method of constructing floors was commented upon, the chairman of that meeting going on to say that when a man in the United States brought out a good invention connected with building or anything else, it was straightway adopted all over the country, remaining in use until something better was provided, when that, in its turn, was taken up.

Another American invention whose merit has been recognized everywhere is illuminated tiles —the placing of small disks of glass in iron plates which form a walking surface and at the same time transmit light to a vault or room beneath the sidewalk. The name Hyatt will always be associated with this invention in America and Europe. Years of litigation ensued after the introduction and use of this invention, but fortunately for the inventor the court decisions were finally in his favor, by which he realized large sums of money.

Iron for the frame and bars of skylights has superseded wood in all large cities, in part because modern building laws will not permit the use of wood for any but very small skylights. Twenty-five years ago iron skylight bars were of solid rolled iron. An American inventor, Hayes, introduced skylight bars of sheet-iron, bent by machinery to a proper shape, and these light, strong, and cheap bars are now everywhere in use. Galvanized sheet-iron for cornices on the fronts of buildings has taken the place of wood in cities, and in the manufacture of them an enormous amount of sheet-metal is used annually.

In bank and safe-deposit buildings the burglar-proof work for vaults and strong rooms represents a very large manufacturing industry in providing what is deemed essential to the equipment of such structures. Bank vaults of chilled iron and steel were used a long time ago, but the increase in the demand for burglar-proof work resulted in improved methods of construction, and in the invention of better time-locks and alarm appliances to give warning of attempts at burglary.

Wood necessarily enters into the construction of buildings of every character. Hundreds of millions of dollars are invested in the work of handling this material, and several hundred thousand artisans are employed in preparing it for use from the time the logs are gathered in the forests until they are fashioned into the required shapes. This industry is among the most important in the United States, but there are no reliable data extant from which anything approaching an accurate estimate of the capital invested or the number of timber workers employed can be determined. Some idea of its magnitude may be formed when it has been estimated by builders of wide experience that out of some 12,000,000 dwelling-houses in the United States nearly 11,000,000 are built mainly of wood.

In the almost countless number of fire-proof buildings the stairs, of course, are made of incombustible materials—iron for the strings, risers, and railings, and slate or marble for the treads. Several large iron-works devote their attention solely to this class of manufacture. The variety of designs and the coating of the iron with other metals by electro-processes, or by a process that preserves iron against rust without paint, go to make up in extent and beauty a branch of iron manufacture that has developed from very small beginnings to extensive proportions. The inclosure of elevator-shafts in fire-proof buildings is generally of iron grille-work, which has the same characteristics as iron stair-work in points of design and workmanship.

In putting the different kinds of materials in place in the building a saving of time and labor is sought. Even in ordinary buildings brick and mortar are no longer carried on men's backs up a ladder. Hod-hoisting machinery has taken the place of manual labor in this respect. On important buildings power-derricks lift all heavy weights from the ground to the uppermost story—stone, iron, and everything else. It is not an unusual sight to see a cart-load of brick brought to a building, the horse then unhitched, the cart hoisted by the derrick to an upper story, and the brick dumped, after which the cart is lowered to the ground. The riveting of connecting parts of ironwork in important buildings is frequently done by machine instead of by hand. Foundations for high buildings, where the soil is uncertain or inadequate to bear enormous loads, are in some instances carried down to rock by means of cylinders of iron sunk to the required depth and then filled in with masonry. In other cases a framing of iron beams covering the whole area of the building, much like a raft, is laid and covered with concrete. Engineering skill in its application to building work has no limit, in reality; it can reach down deep into the ground or tower up high toward the clouds. But the opportunities to do the things that would have been considered marvelous a century ago have arisen only during late years. Possibly the same ability existed then, but the call for its exercise has come with a more recent date.

Architecture has played a most important part in the development of the modern building. Consequently a slight departure from the main thread of this subject may be allowable in order better to trace the progress of the century in the building line. The origin of architecture is wrapped in obscurity. Caves and huts of branches were the first buildings made by man. Examples of a second stage of development are found in the stone monuments of various islands in the Pacific and in the ancient monuments of America. The ruins of Mexico show no foreign influence in their artistic workmanship, and are therefore regarded as an independent national development. Some of these show an advanced and highly ornamented form of the pyramid. Of Oriental architecture the Egyptian examples are perhaps the most striking. The numerous monuments of India can be compared in extent and magnificence only with those of Egypt. China received its architecture from India. Grecian, Roman, and Gothic architecture furnishes high examples of the art, and many of its features are interwoven with modern architecture.

A new period in the development of architecture began about the close of the eighteenth century, when a reaction against the rococo style made itself felt. Important examples are the Mint in Berlin and the Brandenburg Gate, built at the close of the eighteenth century. The age and conditions of American civilization do not admit of an indigenous architectural development, as in older countries, and therefore we find in the United States examples of almost every known national style. The building operations of the settlers of the seventeenth century were modeled upon those of the countries whence they had emigrated.

Thus the early buildings of New England and Virginia are essentially English; those of New York and Pennsylvania are Dutch and German; while Florida shows thoroughly Spanish architecture, and New Orleans is practically a transplanted French city. With the beginning of the eighteenth century the increased intercourse between the individual colonies gave rise to a more homogeneous architecture. The more important buildings of the period are all the works of English architects, among them being King's Chapel, Boston (1749), by Harrison, and St. Michael's, Charleston, S. C. (1752), by Gibson, a pupil of Wren. To the same period belong Christ Church, Philadelphia, and the old State-houses of Boston and Philadelphia. The dwelling-houses of the colonial period were simple in style and usually of wood, depending for their external effect principally upon the use of columns, and with interiors of great plainness, the ornamentation being concentrated in the staircases, of which some artistic examples are still in existence.

The first and chief of the government buildings at Washington was the Capitol. In its present form the Capitol is a monumental edifice with a dome 135 feet in diameter rising 217 feet above the roof. The architectural effect is secured by the free use of porticos and colonnades, and by the striking approaches. The other government buildings are of a similar style. Since that period a style founded on the Italian Renaissance has been employed in nearly all public buildings, sometimes with great success. To this period, also, belongs the New York City Hall (1803–12), built of marble and freestone, which at the time of its erection surpassed all buildings here in material and conception. For a time Greek architecture became the fashion, and it was applied to many buildings. To this development belong the Custom-houses in Philadelphia and New York (with monolithic columns) and Boston, and Girard College, Philadelphia.

The first successful attempt of Gothic architecture was the erection, in 1839–45, in New York, of Trinity Church, by Richard Upjohn, which has since remained the accepted type of American church buildings. From the church the Gothic style was for a time carried to all other classes of buildings, but was soon abandoned. With the rapid growth of the country in wealth and ambition there succeeded crazes for various architectural styles. Egyptian, Moorish, Swiss, and other types were employed, but finally all of them were abandoned. Subsequently a revival of Gothic architecture, under the influence of Ruskin, produced some buildings of merit, among them the National Academy of Design, New York, largely in the Venetian style; the State Capitol of Connecticut, at Hartford; and the Harvard Alumni Memorial Hall, at Cambridge.

During recent years the prevailing style for municipal buildings has been that of the French Renaissance. Imposing examples of this style are seen in the new municipal buildings of Philadelphia and in the new buildings of the State and War departments at Washington. Many of the newer capitol buildings of the various States are of architectural merit, the most elaborate being the Capitol at Albany. In church architecture, New York, Boston, Chicago, Baltimore, Philadelphia, and some Western cities possess good examples of Gothic and other styles. The largest and most costly church edifice on the continent is St. Patrick's Cathedral, in New York. A notable departure from the Gothic style is seen in Trinity Church, Boston, where the Romanesque has been employed with great artistic success.

Much of the sameness and monotony in dwelling-houses which obtains in most of the older cities is giving way to a pleasing variety, especially in newer localities. This change is largely due to the formation of schools of architecture, which are turning out thoroughly equipped native architects. The American Institute of Architects, founded in 1867, with its local branches, assists in encouraging professional intercourse among its members, and the various architectural journals spread an increasing knowledge of the art. All these agencies combine to form a national educated taste which may originate a national type of architecture, thus rendering impossible the crudities of past generations, and developing refinement in the choice or combination of existing styles.

Every one of the group of subjects referred to occupies a relationship more or less intimate to the others. A modern building is something more than merely the walls and roof. It includes the products of trades that a century ago had no existence, others that have lived less than half a century, and still others that less than a quarter of a century ago were unknown. With the growth of population the number of buildings proportionately increases. In our great cities many families living independently of one another occupy together a single building, while the former rule was one family to a house. New conditions of living have arisen, not merely for the poor in tenement-houses, but for the well-to-do and affluent, in the aggregation of many homes under one roof. Increasing the size of buildings vertically instead of horizontally called for the working out of new problems not only in engineering, but in sanitary science. American ingenuity and skill have, however, kept pace with every requirement or necessity. The achievements and progress in every direction which have added so much to the welfare and greatness of our country during the past one hundred years have nowhere been more marked than in the materials used and the knowledge of their proper applications in the construction of buildings.

William H. Jackson

CHAPTER LIV

ELECTRICAL MANUFACTURING INTERESTS

THERE is no way in which the electrical industries of 1895 can be compared with those of 1795, for the simple reason that a hundred years ago electrical science was rudimentary and the electrical arts were all unborn. A few stray pieces of apparatus built by instrument makers under the vague directions of philosophical investigators constituted throughout the first quarter of the present century the bases from which all our later inventions and developments have dated. It was not until within the last fifty years that, the correlation of electricity and magnetism being fairly understood, and the ability to turn mechanical energy into current being fully perceived, the world enjoyed the benefits, in quick succession, of telegraphy, electroplating, electric lighting, telephony, electric power, electric traction, electric heating, forging, welding, and cooling, and the electric extraction of minerals and precious metals. These constitute a noteworthy fruition for five decades, yet have barely scratched the possibilities, and have so far been limited in their usefulness almost entirely to urban populations. Strange as it may seem at a time when dwellers in the city encounter electrical appliances on every side, there is not a single art that has been a direct boon to the agricultural sections of the country, despite the fact that America is a land of farms, and that here electricity has been more vigorously exploited, and in more ways, than anywhere else in the world. Electricity is, in fact, at the present moment, curiously associated with the intense and crowded city life that engages the thoughts of social and political economists; but indications are not wanting that it is the agency chiefly to be relied upon hereafter in the closer knitting together of city and country, the increasing of facilities for commerce, and the diffusion throughout remote districts of information that should be common to all.

The telegraph, representing a pioneer electrical development, has attained, it is believed by many, the magnitude of maturity, while its methods are pretty much the same as when Morse first operated his crude devices. Inclusive of allied and similar services to the public, the telegraph system of the United States reaches a capitalization of about $200,000,000, of which the Western Union and Postal lines may be credited with more than one half. The condition of the telegraph industry is portrayed in the following figures:

MESSAGES SENT BY THE WESTERN UNION TELEGRAPH COMPANY.

Year.	Messages.	Receipts.	Expenses.	Average Toll per Message.	Average Cost per Message.
1892	62,387,298	$23,706,404	$16,307,857	31.6	22.3
1893	66,591,858	24,978,442	17,482,405	31.2	22.7
1894	58,632,237	21,852,655	16,060,170	30.5	23.3
1895	58,307,315	22,218,019	16,076,630	30.7	23.3

Hence it will appear that there is no rapid expansion in telegraphy going on, nor can there be one without some very radical changes. If the population of the United States of America be taken at 65,000,000, it would appear that only one telegram per head per year is sent, and the ratio remains about the same through many years, without any variation that denotes a growing habit on the part of the people.

When we turn to telephony an explanation of this state of affairs is seen. The advent of Professor Bell's telephone in 1876 found capital quite averse to assuming any risk in it, and even in 1879 the Western Union Telegraph Company surrendered all its telephonic work to the American Bell Telephone

Company, on condition of being paid for a term of years twenty per cent. commission on the receipts in royalties from the telephone—an arrangement which has brought some $7,000,000 into the Western Union treasury without any expenditure. But the telephone has meantime gained ground so enormously that some observers believe the effectual supercession of the older telegraph to be well in sight. The American people now exchange yearly 750,000,000 telephonic talks; that is, they use the telephone ten times as much as they do the telegraph, at infinitely less cost. Each telephone talk through an exchange costs the subscriber less than five cents on the average. Every twenty-four hours the telephone is used more than 2,000,000 times, so that, broadly, 4,000,000 people, or twenty-five per cent. of the adult population, resort to it daily, chiefly for commercial purposes. As an actual fact, hand-written letters are only four times as numerous; and thus, if both telegraph and telephone were out of existence, the number of sealed pieces of mail matter, on the same calculation, would be increased by 800,000,000. New York City alone would require 40,000 district messenger-boys to carry around its communications that are now sent in a single day over its telephone wires.

The total investment in telephony, however, in 1894, was only $77,500,000, although it is rapidly increasing. One of the most important commercial branches of it is the long-distance work, which, begun in 1885, is done with a ramification of 55,000 miles of pole-line and 265,000 miles of wire, connecting together no fewer than 2000 towns and cities by double or "metallic" circuit, any one of which places any telephone subscriber in New York, for example, can reach; while the public can do the same in this city by using some 1200 scattered pay stations. The rate to Chicago from New York is $9 for five minutes' talk, or $4.50 at night. The recent expiration of fundamental patents has also greatly stimulated telephonic work.

In view of these and other conditions, Mr. P. B. Delany, a well-known electrician, has worked out a plan that would render the telegraph remarkably valuable, and popularly rehabilitate it. He proposes that letters shall be telegraphed instead of carried by trains. There are 40,000 letters exchanged daily, for instance, between New York and Chicago, and the perfection of methods now is such in "machine telegraphy" that with two good copper wires he would carry 28,000 messages of fifty words each daily between the two cities. The contrast with old methods is seen in the statement that with a single copper wire of only 300 pounds to the mile, thus machine-worked between New York and Philadelphia, Mr. Delany proposes to handle 3000 words per minute; whereas by the present key system in vogue, for the same quantity of matter, thirty-eight wires must be worked quadruplex, or 152 circuits, at about twenty words per minute. Here certainly lies a great future, with great benefit, if the plan is feasible, to commercial and social intercourse.

Although this country ranks with England in its patronage of the submarine cable, and is proud of the indomitable New York merchant, Cyrus Field, it has no cable industry and a very small cable ownership. Vast as are the quantities of fine cable made in America for telegraphic and telephonic work along its rivers and lakes, the American cable is still unknown to the deep seas. There has been no period, apparently, since the New World was electrically moored alongside the Old, when our manufacturers could, in this branch, compete on equal terms with those of England and Germany.

The fire-alarm telegraphs have been an important item in this field of manufacture, and there are over 600 places equipped, generally with the Gamewell system, which is, perhaps, the best known. In 1890, the last year for which definite statistics are available, a group of fifty cities had no fewer than 8400 fire-alarm boxes in use by their fire departments. A system for a small city costs about $1000. Every city has now its police telegraph also, many combining with it a telephonic patrol system that brings a squad to any point within five minutes after the call is sent in. The district messenger system has become familiar in most American cities, as an auxiliary to the telegraph. In New York City the average number of boys employed for this work is 1200, who run some 2,500,000 errands in a year. That the boys loiter is obviously a calumny.

As an offset, perhaps, to the European preëminence in the one department of submarine telegraphy, we may turn to the generous figures of the growth of electric lighting in the United States. There are barely one hundred central stations in all Great Britain; there are 2500 local electric-light companies here, and some 200 municipal plants. The investment there has reached $35,000,000; in such work in this country the total is placed at $300,000,000, New York alone approximating the figures for all England. Of isolated plants for arc or incandescent lighting in mills, mines, stores, halls, docks, etc., the number in the United States has reached probably 7500; there were in 1893 no fewer than 3500 such isolated incandescent plants, with a capacity of 1,500,000 lamps. The value of the total arc and incandescent outlay, independent entirely of the central stations, is placed at $200,000,000. All this is the outcome of the inventions of men like Edison, Brush, Elihu Thomson, Weston, Wood, Hochhausen, and, in the new era just beginning, Nikola Tesla, Stanley, Bradley, and Steinmetz. At one time some forty or fifty manufacturing companies competed for the sale of the plant; but the art has in many respects become specialized, and the leading survivors are the General Electric, Westinghouse, Fort Wayne, Excelsior, Brush, Standard, and Western Electric companies. The General Electric Company, for example, had its arc apparatus operating in 957 central stations, in May, 1895, supplying 130,000 arc-lights. This is a typical "parent" company, which now has a total capital of about $44,000,000, employs some 7000 men in its factories, and has an annual output ranging from $10,000,000 to $15,000,000. A typical "local" suborganization is the Chicago Edison Company, with a capital of $7,000,000, and four central stations supplying current daily for 161,000 incandescent lamps, 4000 horse-power of electric motors, and 3600 arc-lamps, using about 500 miles of underground tubing and cable to reach its customers. A typical isolated plant is that in the Auditorium, Chicago, with 17,000 incandescent lamps; or that in the new Carnegie Steel-Works, at Duquesne, Pa., where 3000 horse-power is used for electric light and power.

The practical incandescent lamp was brought to commercial perfection by Edison less than twenty years ago. The dynamo capacity in this country to-day for incandescent lighting is estimated at over 8,000,000 lamps of sixteen candle-power, while the number connected to the circuits is from 12,000,000 to 15,000,000. The number of lamps produced by about a score of factories is from 50,000 to 75,000 daily. Ten years ago an incandescent lamp cost the consumer not much less than one dollar, while excellent lamps are now bought at about twenty cents apiece. The average life of lamps is 600 to 800 hours. Equally remarkable is the reduction in the cost of carbon-points for arc-lamps. In 1876 they were imported from a French maker, a dozen or two in the batch, at forty cents each. The American manufacture began in 1878, with over thirty hand processes, and at prices of $80 per 1000. The carbon art to-day recognizes only four hand processes, and prices are in the neighborhood of $10 per 1000. Within the past fifteen years some seventy-five factories have been started to supply the annual consumption of 200,000,000 carbon-points, and their capacity has reached three times that figure. There are to-day twenty-five factories in the world, with a capacity of, say, 350,000,000 per annum. The largest of these factories is in Cleveland, O., owned by the National Carbon Company, comprising fourteen large buildings on seventeen acres of ground, with a capacity of 250,000,000 per annum.

All these seem large figures, but as a matter of calculation it will be found that they would need a tenfold multiplication if electric light were entirely to replace gas. The process is, however, going on, with the effect at the same time of raising the standard of illumination everywhere, and greatly cheapening gas production. In 1890 no fewer than 278 American cities, with a population of 7,000,000, had entirely given up gas for electricity in lighting their streets. Although no municipal gas-plants are now erected, the number of electric-lighting plants built by municipalities is strikingly on the increase all over the Union.

Associated closely with electric light is electric power, the motors being placed on the same circuits as the lamps. All the concerns building electric-light apparatus also build motors; but there are about a dozen factories, such as the Crocker-Wheeler, and Eddy, that devote themselves exclusively to motors, of which it is estimated that 500,000 are now in use, the bulk of these being the small fan-motors for ventilation, costing, on an average, $15 each. Motors of fifty horse-power and upward are, however, by no means uncommon; while the tendency in all new factories, machine-shops, etc., is to distribute power by such motors, instead of using long lines of belt and shafting. At the Homestead, Pa., Steel-Works, for example, power is thus furnished to electric motors aggregating 4000 horse-power; at Bessemer, Pa., to about 2000 horse-power; and a third metal plant has thirty electric cranes, three electric traveling bridges, six motor freight conveyers, fifteen motor-cars, and a score of motors for miscellaneous purposes.

The use of electric elevators in cities, furnished with current from both central stations and isolated plants, is a distinct class of work. In New York there are several hundred of these elevators, requiring a total of upward of 5000 horse-power daily for their operation. For the Parrott Building in San Francisco Mr. F. J. Sprague is furnishing fifteen of his electric elevators. At present to be found chiefly in office buildings, they have already made their way into apartments and into private dwellings. Electric heating and cooking apparatus, fed with current from central stations, is also becoming familiar, especially in laundries, restaurants, canneries, and hair-dressing establishments.

A few years ago the dynamos in central stations were large that would operate 500 lamps; to-day machines of from 5000 to 25,000 lamp capacity are not unusual. These are now driven directly by huge steam-engines of the vertical triple-expansion marine type. In the same manner arc-dynamos were usually able to energize twenty-five or thirty arcs of 2000 candle-power each; but their place is being taken by machines that will feed 150 to 200 such lamps on circuits thirty and forty miles long. It is evident that great economy is thus effected. Arc-lighting, which at its introduction cost seventy-five cents or more per night per lamp, now averages from thirty to thirty-five cents. Incandescent lamps cost about one cent an hour each for current, and motors obtain their supply at less than ten cents per horse-power per hour. Whereas it was once the well-nigh universal custom to sell a current at a "flat rate," it is now the more scientific custom to meter it. Indeed, one of the most significant developments of late years has been the perfection of American electrical instruments of measurement and precision devised for lighting and power circuits. Those of Edward Weston have won a reputation that has gone around the world.

Very early indeed were the efforts made in electric railroading. The work of Thomas Davenport, a Vermont blacksmith, fifty odd years ago, embodied many of the elements familiar in the street-railway of to-day; but no progress was made, because the primary battery was then the sole source of current. It was not until within the last ten years that the electric railway industry became established. The present writer collected the first American statistics on the subject in 1887. There were then but thirteen small roads. This year the trolley roads in the United States have reached the imposing total of 900, with 11,000 miles of track, 25,000 cars, and a capitalization of fully $750,000,000, which in spite of frequent inflation has a notable dividend-earning capacity, rarely falling below six per cent. for the bonds, and the common stock receiving as much. The ability of electricity to increase the traffic of a street-railway has hardly ever been less than forty per cent. in the year of its adoption, and has frequently exceeded one hundred per cent. In all Europe the number of electric roads is below 100. The annual increase here is at least that number, representing a purchase of some $100,000,000 worth of rails, cars, motors, wire, engines, boilers, poles, etc.

The electric railway industry has endless aspects. In New York, Washington, and Chicago, underground trolley conduit roads are being adopted instead of the overhead trolley type, with fair success. In Chicago, at the World's Fair, an elevated electric road carried 8,000,000 passengers, and there is now a similar road in regular operation in that city. For New York City is proposed a tunnel electric railway system, to cost the metropolitan taxpayers $50,000,000, on the plan so successful for some years past in London.

Nor is this all. As far back as the summer of 1894 there were sixty-two street-car lines carrying United States mail; thirty-five lines had gone into the express business, and fifty-five were hauling freight. These figures have probably been doubled in the past twelvemonth. More interesting still is the interurban extension of the trolley system. Within a year as many as 190 electric railway companies have been projected to ply across country, with 3457 miles of track. Many of these have been built and are already running. They range from four miles up to seventy-five in length. The competition of these roads and the regular street trolley railways with steam railroads has begun to revolutionize the latter, if only for the reason that ten miles for five cents is an ordinary car trip, while the steam train needs ten cents for five miles for its maintenance. On some steam roads the suburban travel has been practically wiped out, and a great many schedules have been abandoned. To meet this serious condition of affairs the Pennsylvania, and the New York, New Haven, and Hartford Railroads, as well as others less well known, have adopted electricity for some of their branches with marked success; and the intention is to carry this change much further at once.

Additional to this is the use of heavy 1500 horse-power electric locomotives by the Baltimore and Ohio Railroad Company for freight haulage in its Baltimore tunnel. These locomotives haul trains of 1400 tons, and make, when necessary, a speed of sixty miles an hour. The same method is to be adopted for the Grand Trunk Tunnel under the St. Clair River. In short, the steam railroad system is at the point of a new departure, and is everywhere being prepared for the greater utilization of electricity.

An art allied to electric locomotion is that of electric navigation. At the World's Fair in Chicago in 1893, 1,003,500 passengers were carried on the lagoons by a fleet of fifty electric launches; and these boats, scattered all over the country, have become nuclei for a number of smaller busy fleets

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employed by trolley railways, park boards, police departments, and private owners. These boats are operated by means of storage batteries charged from time to time, and able to run them continuously for forty or fifty miles. A boat of such a character, making ten to twelve miles an hour, thirty-five feet in length and six to eight feet beam, is obtainable complete for about $1600.

The storage battery has been far more successful afloat than in street-car propulsion, but it is now in swift adoption for isolated plants and central stations, as a reservoir of current when the machinery is not in operation. The Edison Company in Boston has recently erected and equipped a five-story building as a storage-battery adjunct, which supplements an earlier annex of the same kind, the two together being by far the largest in the world. They have a capacity of 30,000 amperes of current, or 60,000 lamps; and have taken care of all demands on the company for current during periods of fifteen hours. It is becoming the practice, also, to equip fire-alarm departments with storage batteries in place of the old primary batteries.

Electric mining is one of the latest of the industries to be developed by the electrical engineer, and bids fair to surpass the electric railway in magnitude. The demand for apparatus in it is estimated to have reached already the sum of $100,000,000, for hoists, crushers, drills, pumps, ventilators, cars, etc., all driven electrically. The adoption of this machinery, furnished with current from dynamos driven by water-power, has enabled scores of mines to pay expenses that were unable to do so with fuel as high as $15 a ton. Some of these plants are being operated at altitudes of 12,000 feet above sea-level, and exemplify the beauties of long-distance electrical power transmission, which in itself is even now constituting a separate field of endeavor.

By all odds the most important long-distance electrical power enterprise is that of the Niagara Falls Power Company, in the utilization of part of the energy of the great cataract. By means of its plants on both sides of the Niagara River this company will develop 350,000 horse-power; and its power-house, canal, and tunnel on the American side are adequate to the production of 100,000 horse-power of electrical current, generated by the Tesla two-phase system. An expenditure of $3,000,000 has been made, and is now yielding an income. Part of the current is being used in the electrical manufacture at the falls of aluminium and carborundum, and a large manufacturing city is beginning to form about a mile above the falls, free from smoke, dust, and gases, all the energy being distributed silently over hidden wires. Arrangements have been made by which Buffalo, twenty-two miles away, is to receive this current in large quantities, the price being $18 per horse-power at the Niagara end of the line; while it is estimated by experts that the current can even be delivered 300 miles away in Albany, to compete on equal terms with the power of steam-engines on the spot, using coal at $3 per ton. The boats on the Erie Canal are also to have this power, at a rate of $20 per horse-power per year, and vital improvement in canal haulage is expected. The first trials in this direction have been made, with notable success. All over the United States the example at Niagara is being imitated, and millions of dollars are pledged for similar water-power utilizations, while a great many such plants have gone into commercial operation.

Incidental reference has been made to the use of American electrical measuring instruments abroad. But for the fact that our own markets have had so large a capacity of consumption, an enormous export trade would long ago have grown up. As it is, the demand from foreign countries in certain lines is already respectable. Throughout Mexico, the West Indies, Central America, and South America, our dynamos for light, and motors for power, are in use on an extensive scale; and many are also found in Canada, although it is the practice there to manufacture under patents of American electrical inventors. A considerable part of the new gold-mining work in South Africa is done with American electrical plant; and Buluwayo, which but two years ago was the bush capital of savage Lobengula, is lit every night from a central station whose machinery was made in New York State. Japan and China have taken large quantities of electric-lighting apparatus from us; the royal palace of Corea is illuminated by our incandescent lamps; American telephones are thickly strung in the Sandwich Islands; and electric railway plants from Ohio are in successful operation in Indo-China. Even England has not disdained to take electric motors and electric railway apparatus from us, and some of her most important electrical manufacturing corporations bear famous American names and employ many American inventions and methods. Indeed, if the remark of Emerson be true, that steam is half an Englishman, we may with equal felicity assert that electricity is nine tenths an American.

The above are to-day the main lines of American electrical manufacturing and supply, reaching toward a capital of $1,500,000,000; but they are not all, and they draw their material from a swarm of subsidiary industries; while they throw out every year new commercial tendrils and employ thousands of intermediaries in order to gain access to the public. The electric refining of metals is a growing department, in which millions are invested annually. There are 392 electroplating establishments in the United States, with a capital of $38,000,000, employing 2700 hands; and there are also no fewer than 300 electrotyping firms, besides large numbers of etching and jewelry houses using current in their work. The insulated wire and cable factories number a dozen. Their output mounts into countless millions of feet of wire annually, while the practice of running interior wires through tubes has necessitated the production of some 15,000,000 feet of insulated conduit annually. Merely placing wires underground is estimated to have required $150,000,000 for cables and subways. Every hotel in the country has its annunciator system, and every private residence of any pretension has at least its electric bells. In medicine, electrotherapy is so well recognized that a score of large manufacturers are busy turning out galvanic and faradic apparatus for practitioners of all schools. The production of disinfectants electrically has assumed large proportions, and their use is growing. The place of electricity in education may be gauged by the fact that 1500 students take up electrical engineering in a single year as a special study at leading colleges. It is seen clearly to-day that the future of all the electrical arts depends upon a reduction in the cost of current, and to this end Mr. Tesla has devised his oscillator, combining steam-engine and dynamo in an integral mechanism which shall create and distribute power at half or one quarter the present cost. Others are working at the problem of obtaining electricity directly from heat; and if there be one thing that is clearly written upon the face of mechanical and industrial advance, it is that the succeeding century, no less than the present has been that of steam, will be emphatically the age of electricity.

T. C. Martin

CHAPTER LV

THE PACKING INDUSTRY

THE packing industry may be considered as applying more particularly to the curing and packing of hog products; but no review of this business would be complete which did not take into consideration the slaughtering, dressing, and shipping of cattle and sheep. The American packing-house of to-day is usually found combining the two branches of business, although it is true that only a small percentage of the product from the cattle and sheep is "packed," using the term in its most literal sense.

The information available does not make it plain as to where and when the packing industry, as distinct from butchering operations and incidental curing of meats, had its origin. It is said—although I cannot find satisfactory proof of the statement—that pork was cured and packed in barrels in Salem, Mass., in 1640, and it is certain that, about 1690, Boston did quite a trade in that line; but the paternity of the Western packing business, as we understand it to-day, belongs, I think, to Cincinnati. In 1818, one Elisha Mills, a "down-easter," was established as a packer in Cincinnati. The first drove of hogs ever received in Chicago was in 1827, but no attempt at packing seems to have been made until 1832. In that year George W. Dole packed some pork for Oliver Newbury, of Detroit; but Chicago does not figure in the statistics of packing points until 1850. It is claimed that 9600 hogs were packed there in 1834. It was not until the season of 1832–33 that a definite attempt was made to obtain statistics covering such operations. In that winter Cincinnati was credited with slaughtering 85,000 hogs, several houses being engaged in the business.

The development of the agricultural resources of the Western States, especially from Ohio to the Mississippi and Missouri rivers, cheapened the cost of producing animals, particularly hogs; and attention to their production was stimulated and encouraged by the demands from Southern and Eastern dealers for product for their markets. Packing operations naturally followed in many places west of Cincinnati, more or less directly in communication with the transportation facilities afforded by river navigation. The movement of the product was by way of the Ohio and Mississippi rivers to New Orleans, and a great deal was shipped thence by vessels to Baltimore, Philadelphia, New York, Boston, and other cities on the Atlantic coast.

In the early days of Western pork packing the slaughtering was, to a large extent, a distinctive business from the curing operations. The packer confined himself largely to the cutting and curing of dressed hogs. The farmer in those early days slaughtered his own hogs on the farm, in the months of December and January, the neighbors usually assisting; and he sold whatever he could spare over and above the needs of his own family to the nearest storekeeper, or to the small packer, who, located at some convenient point, cut up the dressed hogs, cured the product, and shipped it South, as I have already mentioned. Sometimes, indeed, the packing-house took the form of a flatboat on the river, the curing, such as it was, being done on board. When the spring "break-up" came the flatboat was floated down the river, and the product exchanged at Cincinnati, Louisville, St. Louis, and New Orleans, for sugar, molasses, rice, and other merchandise.

Chicago's place in the packing business is preëminent to-day, but it was not always so. In 1845 a Cincinnati journalist published the following statement:

"The putting up of pork has been so important a branch of business in our city for five and twenty years as to have constituted its largest item of manufacture and acquired for it the soubriquet of 'Porkopolis.' . . . Our pork business is the largest in the world, not even excepting Cork or Belfast, in Ireland, which country puts up and exports immense amounts in that line; and the stranger who visits Cincinnati during the season of cutting and packing hogs should on no account neglect making a visit to one or more slaughter-houses and pork-packing establishments in the city.

"It may appear remarkable, in considering the facility for putting up pork which many other points in Illinois, Indiana, Ohio, and Kentucky possess, in their greater contiguity to the neighborhoods which produce the hogs, and other advantages which are palpable, that so large an amount of this business is engrossed at Cincinnati. It must be observed, however, that the raw material in this business—the hog—constitutes eighty per cent. of the value when ready for sale, and, being always paid for in cash, such heavy disbursements are required in large sums, and at a day's notice, that the necessary capital is not as readily obtainable elsewhere in the West as here. Nor, in an article which in process of curing runs great risks from sudden changes in weather, can the packer protect himself, except where there are ample means in extensive supplies of salt, and any necessary force of coopers or laborers to put on in case of emergency or disappointment in previous arrangements. More than all, the facilities of turning to account in various manufactures, or as articles of food in a dense community, what cannot be disposed of to profit elsewhere, render hogs, to the Cincinnati packer, worth ten per cent. more than they will command at other points in the Mississippi Valley."

In the Cincinnati "Price Current" of November 16, 1844, it was mentioned that a large pork-packing house had been established at Louisville, and the Louisville "Journal" was quoted as saying: "Heretofore all the pork killed here has been packed at the slaughter-houses, and the purchases have been in gross; but the packing-house on Pearl Street will now enable dealers to purchase the net pork at the slaughter-houses and have it packed in the city, precisely as this business is done in Cincinnati."

The "Price Current" in the same month said: "The number of regular packing-houses at Cincinnati is found to be twenty-six, the most of them prepared to do a pretty extensive business, as far as the necessary conveniences are concerned; but only a small proportion of them will pack to any considerable extent on their own account." In 1853–54 the number of packing-houses there was forty-one; in 1855–56, forty-two houses. Among the various points in the region of the Ohio and Mississippi rivers where hogs were packed in considerable numbers in the forties were Columbus, Chillicothe, Circleville, and Hamilton, in Ohio; Lafayette, Lawrenceburg, Madison, Terre Haute, and Vincennes, in Indiana; Alton, Beardstown, Pekin, Peoria, and Quincy, in Illinois; and many places of minor importance. The greatest number of places engaged in the hog-packing business was reported in 1873–74, 397 places being included in the official reports; and since that time the number has steadily declined, the process of concentration in the large centers going steadily on, the number in 1894–95 being only 76.

The first effort at a definite statement of pork packing in the West was instituted by Charles Cist, of Cincinnati, in the winter of 1832–33. The "Price Current" of that city, which was started in January, 1844, by A. Peabody, inaugurated a more complete system of investigation, and this publication has continued such statistical work, with a very greatly widened scope of investigation in recent years, the trade now relying upon its weekly and annual statements for information concerning this industry. I am indebted to my friend, Mr. Charles Murray, the present editor and proprietor of the "Price Current," for most of the statistical information incorporated in this article.

The first season in which the Western packing reached a total of 1,000,000 hogs was in 1843–44, the number falling below this point during the next three years. The following table shows the number of hogs packed in the West up to the beginning of summer slaughtering operations:

HOGS PACKED.

Year.	Number Packed.	Year.	Number Packed.
1842–43	675,000	1857–58.... .	2,211,000
1843–44	1,245,000	1858–59	2,465,000
1844–45	790,000	1859–60......	2,351,000
1845–46	940,000	1860–61.....	2,156,000
1846–47	825,000	1861–62......	2,893,000
1847–48	1,710,000	1862–63....	4,069,000
1848–49	1,560,000	1863–64......	3,261,000
1849–50	1,652,000	1864–65......	2,423,000
1850–51	1,333,000	1865–66.....	1,788,000
1851–52	1,183,000	1866–67......	2,401,000
1852–53	2,201,000	1867–68......	2,781,000
1853–54	2,535,000	1868–69......	2,500,000
1854–55	2,124,000	1869–70......	2,635,000
1855–56	2,490,000	1870–71......	2,695,000
1856–57	1,818,000	1871–72......	4,831,000

Prior to 1872 summer slaughtering had not reached proportions of importance. In that year 500,000 hogs were killed during the season, and subsequently, with the introduction of chilling processes, summer killing developed into large proportions, as is shown by the following comparison

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of yearly totals for the summer and winter seasons, and the aggregates:

HOGS PACKED.

Year.	Summer.	Winter.	Twelve Months.
1872–73	505,000	5,410,000	5,915,000
1873–74	1,063,000	5,466,000	6,529,000
1874–75	1,200,000	5,566,000	6,766,000
1875–76	1,262,000	4,880,000	6,142,000
1876–77	2,308,000	5,101,000	7,409,000
1877–78	2,543,000	6,505,000	9,048,000
1878–79	3,378,000	7,480,000	10,858,000
1879–80	4,051,000	6,950,000	11,001,000
1880–81	5,324,000	6,919,000	12,243,000
1881–82	4,803,000	5,748,000	10,551,000
1882–83	3,211,000	6,132,000	9,343,000
1883–84	3,781,000	5,402,000	9,183,000
1884–85	4,059,000	6,460,000	10,519,000
1885–86	4,964,000	6,299,000	11,263,000
1886–87	5,644,000	6,439,000	12,083,000
1887–88	5,611,000	5,921,000	11,532,000
1888–89	5,315,000	5,484,000	10,799,000
1889–90	6,881,000	6,664,000	13,545,000
1890–91	9,540,000	8,173,000	17,713,000
1891–92	6,696,000	7,761,000	14,457,000
1892–93	7,757,000	4,633,000	12,390,000
1893–94	6,721,000	4,884,000	11,605,000
1894–95	8,812,000	7,191,000	16,003,000

The summer season covers the period of eight months, from March to October inclusive, and the winter season four months, November to February inclusive, in these exhibits. For the past ten years the summer packing represents nearly fifty-two per cent. of the aggregate. It is here shown that from a business of about 1,000,000 hogs, as the yearly extent of Western packing operations fifty years ago, the growth of this industry brought the annual average for the following decade to 1,606,000, during which period the largest total was 2,535,000, in 1853–54; for the next decade, 1855–56 to 1864–65, the annual average was advanced to 2,613,000 hogs, the largest number being 4,069,000, in 1862–63; for the following decade, 1865–66 to 1874–75, the annual average reached 3,993,000 hogs, with 6,766,000 as the largest number, in the last year of the period; for the next decade, 1875–76 to 1884–85, there was a more striking advance, the annual average representing 9,015,000 hogs, with 12,243,000 as the largest yearly number, in 1880–81. Again a large increase is shown for the past decade, ending with 1894–95, for which the annual average is 12,139,000, and 17,713,000 the largest yearly number, in 1890–91.

For the ten years ending with 1851–52 the packing at Cincinnati represented twenty-seven per cent. of the total for the West, that city reaching 475,000 hogs in 1848–49. At that time the industry had scarcely been inaugurated at Chicago, and was of unimportant proportions at St. Louis, while Milwaukee, Kansas City, Omaha, and other towns were unknown in the packing lists. Railroads penetrated the West in 1852, and by 1855 several roads were in operation. This influence, tending, as it did, to open up the country to settlement, and facilitating the exchange of commodities, had a marked effect on the extension of the packing business, and in changing its geographical position and its character. At Chicago about 20,000 hogs were killed in 1850–51, and the increase at this point from that time on was rapid. In 1858–59, 99,000 hogs were killed in Chicago; 505,000 in 1861–62; 1,225,000 in 1871–72; 4,009,000 in 1877–78; 5,752,000 in 1880–81; and in 1890–91, 6,071,000, by far the largest yearly total for one city in the history of the industry, Kansas City coming second with 2,398,764 in the same year.

Until 1861–62 Cincinnati continuously maintained its position as the leading packing point in the country. In that season the distinction passed to Chicago, where it has remained, and is likely to continue for a long time. Of the aggregate of 131,000,000 hogs handled by Western packers in the past ten years, Chicago represents 46,000,000, or thirty-five per cent. During the past ten years Western packers have paid out $1,429,000,000 for hogs, or an annual average of about $143,000,000, reaching $172,679,000 for the year ending March 1, 1895. These figures relate only to the manufacture of hog products, and to the business in the West prosecuted for commercial purposes.

While curing operations were carried on in Eastern markets at an earlier period, what may be termed regular packing establishments probably were not established there until after the industry had been developed in the West. The following is a statement of the reported sales of beef-cattle, sheep, and hogs at Boston, New York, Philadelphia, and Baltimore, in the year 1844, most of these animals being undoubtedly slaughtered for local consumption in a fresh state:

ANIMALS SOLD IN FOUR EASTERN CITIES IN 1844.

	Cattle.	Sheep.	Hogs.	Total.
Boston	43,530	98,820	43,060	185,410
New York	49,002	75,713	13,478	138,193
Philadelphia	37,420	91,480	22,480	151,380
Baltimore	33,500	90,450	24,000	147,950
Total	163,452	356,463	103,018	622,933

The aggregate value of the 623,000 animals marketed in the four large cities in one year, fifty years ago, was $7,500,000. For the year 1894 the receipts of cattle, sheep, and hogs at Boston, New York, Philadelphia, and Baltimore were as follows:

ANIMALS SOLD IN FOUR EASTERN CITIES IN 1894.

	Cattle.	Sheep.	Hogs.	Total.
Boston	182,276	688,334	1,664,671	2,535,281
New York ...	564,932	2,436,842	1,656,435	4,658,209
Philadelphia..	176,960	591,985	363,671	1,132,616
Baltimore	154,958	361,722	602,996	1,119,676
Total	1,079,126	4,078,883	4,287,773	9,445,782

The total value of the 9,445,000 animals represented in the foregoing exhibit for 1894 was approximately $140,000,000. There were exported 421,000 live cattle, valued at $38,963,000, leaving approximately 9,000,000 animals for local slaughtering establishments at the seaboard, and representing about $100,000,000 in value.

For many years a number of large packing establishments have been in operation in Eastern cities, notably at Buffalo, Boston, Providence, New Haven, and Springfield. At about fifty establishments in New England, New York, and Pennsylvania from which returns of packing have been obtained, the total packing for the year ending March 1, 1895, was 3,098,000 hogs. The total of these establishments ten years ago was 1,550,000, which exceeded any previous year. The hogs slaughtered the past year at the seaboard and other Eastern localities represented a value of about $60,000,000, which with the amount paid out by Western packers makes a total of $232,000,000 for the year's outlay for hogs, or an average of about $750,000 daily.

These statistics indicate in general terms the significant progress of the pork-packing industry in the United States, which we may say really had its beginning about seventy-five years ago. The limits of this article will not permit me to explain in detail how this vast quantity of meat is to-day handled and prepared for market. Naturally, labor-saving devices have been adopted as pressing needs demonstrated their necessity. The killing is done by hand, no mechanical means of wholesale slaughter having been evolved; but in the manipulation of the carcass many ingenious contrivances are utilized. The scalding and the scraping of the hog used to be a slow and tedious job; but to-day as soon as life has left the animal he is hooked by the nose to an endless chain, passed through the scalding-vats, and through an automatically adjustable scraper, where he is deprived of his hair and bristles in a few seconds; he is then hoisted, head down, upon an inclined rail; and is disemboweled, beheaded, washed, trimmed, and whirled off to the chill-rooms at the rate of twenty hogs a minute. The cutting and curing of the hog, too, is different from the custom of early days. Hams, shoulders, sides, or barreled pork, comprised the selling list of thirty years ago. To-day the variety of cuts is bewildering to an outsider. The world is to-day the packer's market, and he has to study the peculiarities and preferences of each country, and even each county. The influence of English county idiosyncrasies in the cutting and curing of home-killed bacon is reflected to-day in our cuts. Wiltshires, Cumberlands, Staffordshires, Yorkshires, etc., are only a few of such distinguishing styles.

No one factor has done more to render possible the development of the last twenty years in the slaughtering, curing, and packing of meats than the discoveries securing and improving artificial refrigeration. At the bottom of all successful meat curing lies the proper and thorough chilling of the carcass. The packing season is now twelve months long, and summer-cured meat differs in no material respect from that cured in winter.

Beef packing was among the earliest of operations in the curing of meat for transportation to other localities, as well as for preservation for home demand. Barreled beef was put up in the West in considerable quantities as early as pork, and probably earlier, and transported by water to the Eastern markets; and beef packed at Boston, New York, New Haven, and other Eastern cities found its way all over the world on shipboard.

The canning of beef was attempted in Chicago in the sixties, and enjoyed some little growth; but it was not until the year 1879 that the beef-canning business was taken up on a large scale by the packers. Mechanical ingenuity, in discovering a sure and practicable method of hermetically sealing tins, rendered possible the preservation of food in this way on a large scale; and the facilities already secured by the large packers for disposing of every part of the animal placed the business entirely in their hands. The convenience of canned beef, tongues, potted meats, and soups, and the fact that they could be guaranteed to keep sound in any climate for years, combined to steadily increase this branch of the industry. In 1890, 111,000,000 pounds of canned beef were exported.

The dressed-beef trade, which now forms so large a part of the packing business, had little importance prior to 1875. The settlement of the West, and the rapid increase in the numbers of cattle on the Western ranches and farms, afforded a new and bountiful addition to the world's food-supply; but it was not until the invention and development of refrigerator-cars that the food which the world lacked was brought in quantity, and in good condition, to its table. The exportation of fresh beef had its beginning in a moderate way in the early months of the year 1876, and was enlarged with the later months, making a total of 19,838,000 pounds for the year. For five years, ending with 1880, the average was 59,000,000 pounds, reaching 100,622,000 pounds in the last year of the period. For the next ten years the annual average was 113,000,000 pounds, reaching 182,500,000 in the last year of the period. For the past four years the average was 203,000,000 pounds, reaching 233,000,000 pounds in 1892. At first the cattle were transported on the hoof, and handled in the Eastern cities by the local abattoirs; but the long and tiresome journey was bad for the beef, and this method had to give place to something less wasteful and more humane. The large hog-packing establishments which had already grown to prominence in Chicago afforded the necessary means of effecting the revolution. There the offal could be manipulated to better advantage than elsewhere. Mechanical skill, as I have said, provided the refrigerator-car, cold-air machines, and a number of other devices. The packer to-day slaughters thousands of head of cattle daily, chills the carcasses at a uniform temperature, whether in midwinter or in the "dog days," loads the beef, after thorough chilling, into his own refrigerator-cars, in which a uniform temperature is maintained between Chicago and the Eastern markets, delivers the beef into his own cold-storage warehouses in the large Eastern centers, and distributes the carcasses to the local butchers at a lower price and in better condition than the local beef slaughtered by themselves, and in vastly better condition than the meat which they previously obtained from cattle shipped on the hoof 1500 or 2000 miles by rail. If the meat is intended for export the packer runs his refrigerator-cars alongside the ocean-liners, and transfers the meat to the specially constructed chill-rooms of the steamers, and lands the beef in London, Liverpool, and Glasgow in prime condition and at a low price. There is good ground for the view that the cattle-raising industry of the West has been greatly benefited by this extension of slaughtering through the development of the dressed-beef trade.

Definite figures illustrating the growth of the slaughtering of cattle for commercial dressed beef are unfortunately very meager; but the general purpose of such information is served by the introduction of statistics indicating the number of cattle killed at prominent Western markets where this industry is prosecuted. The following compilation shows the average annual number of cattle killed in periods of five years, from 1871 to 1890 inclusive, and the average annual number for the four years ending 1894, at the places named:

CATTLE KILLED IN FOUR WESTERN CITIES.

Period.	Chicago.	St. Louis.	Kansas City.	Omaha.
1871–75....	190,000	104,000	37,000	......
1876–80....	411,000	165,000	60,000	......
1881–85....	864,000	182,000	82,000	10,000
1886–90 ...	1,696,000	210,000	341,000	170,000
1890–94 ...	2,223,000	303,000	756,000	460,000

The killing of cattle for supplies of commercial product has also been prosecuted at various other points in the West, including Milwaukee, Sioux City, Indianapolis, Cincinnati, and Cleveland.

The following is a comparison of the number of cattle killed in 1871, 1880, 1890, and 1894, at the large Western markets mentioned, with the total receipts at Boston, New York, Philadelphia, and Baltimore for the same years, with totals for Western and Eastern markets mentioned:

CATTLE KILLED AND CATTLE RECEIVED.

	1871.	1880.	1890.	1894.
Chicago........	141,000	496,000	2,224,000	2,023,000
St. Louis........	69,000	196,000	227,000	492,000
Kansas City	20,000	50,000	549,000	925,000
Omaha	......	.....	323,000	518,000
Four Western centers	230,000	742,000	3,323,000	3,958,000
Seaboard	745,000	1,268,000	1,280,000	1,079,000
West and East........	975,000	2,010,000	4,603,000	5,037,000

The aggregate value of the 5,037,000 cattle in 1894 in the several markets where they were killed, including the number exported alive (421,000), was approximately $235,000,000.

Incident to traffic in dressed beef, the mutton trade has assumed important proportions in late years, this product being largely distributed in the refrigerator-car shipments of meats. The following figures show the number of sheep killed in the four Western centers and received at the seaboard cities in the years 1871, 1880, 1890, and 1894:

SHEEP KILLED IN FOUR WESTERN CENTERS AND RECEIVED AT SEABOARD CITIES.

	1871.	1880.	1890.	1894.
Sheep, West . .	261,000	405,000	1,621,000	3,564,000
Sheep, East . . .	2,793,000	3,005,000	3,274,000	4,079,000

The published records of the Census Office do not give figures showing the capital invested in the packing business earlier than 1870. The official figures for 1870, 1880, and 1890 are as follows:

1870	$22,124,787
1880	49,419,213
1890	116,887,504

Even after the packing business had assumed fairly large proportions, the packers were not aware of, or did not appreciate, the value of the offal, and the problem of how to get rid of it at the least expense was ever present. So recently as twenty-five years ago, in Chicago, the blood was allowed to run into the river, and men were paid five dollars a load to cart the heads, feet, tankage, and other waste material out upon the prairie and there bury it in pits and trenches. Instead of being a source of profit, the offal, in this respect, was a distinct source of expense. Gradually there grew up in the vicinity of the packing centers subsidiary enterprises having for their object the utilization of some or all of this waste material. Such concerns turned out glue, oil, tallow, and crude fertilizers. In time, however, the necessities of the business, and the growing competition, forced the progressive packer to include these industries in his own establishment. It became less profitable to pack in a small way, and to-day a large packing plant depends largely for its profit on the intelligent utilization of those so-called waste materials which in the early days of the packing business were not only thrown away, but the removal of which was, as I have shown, an actual source of expense.

In all this packing business, whether it is in beef or hogs, the waste which previously prevailed when the animals were handled one by one by local butchers, or were handled on even a slightly larger scale by the numerous small packers that were scattered over the States of Ohio, Indiana, Illinois, Iowa, and Missouri, or in the East, is, by the present methods, entirely obviated. It is the aim that nothing shall be wasted. The large packing establishments of to-day manipulate their own horns, hoofs, bones, sinews, hide-trimmings, etc., in their own glue-works. The sweet fat of the cattle forms the basis of butterine, made in their own butterine factories; the sheep pelts are scoured, and the wool removed in their own wool-houses, cleansed, and sold direct to the large Eastern cloth-mills. The intestines are cleansed and salted and used for sausage casings in their own sausage factories. The blood and all animal refuse are treated by their chemists in their own fertilizer factories, with a view to the scientific preparation of fertilizers to suit different soils; and in one or two packing houses there has been established a laboratory where the inner lining of the hog's stomach is made into pepsin of greater purity and activity than was possible when the sensitive material had to be transported in a raw state, and subjected to all the risks of decomposition and consequent loss of digestive power.

I do not know of any business in which the development has been so marked in the same length of time as in the packing business. It seems a "far cry" from the packing-house which consisted of a flatboat on the river to the packing-house of to-day, which owns and operates, as part of its equipment, 6000 refrigerator-cars; but the distance as measured by the lapse of time is only fifty years. I do not care to venture a prophecy as to the future. I shall leave that to the genial editor who writes, I understand, on the "Next Hundred Years." The population of the United States in 1871 was about 39,500,000; in 1880, 50,155,000; in 1890, 62,622,000; in 1894, about 68,000,000. The population in 1894, as compared with that of 1871, was as 172 to 100. The total number of animals marketed in 1894, as compared with 1871, was as 306 to 100. The fierceness of competition may force the packing-house of twenty-five years hence to include a tannery, a boot and shoe factory, a cloth-mill, and a mammoth tailor-shop, and the tendency to concentration may be still further intensified; but the packing business as a whole seems destined for greater development, and should grow with the country's growth.

Philip D Armour

CHAPTER LVI

AMERICAN FISH FOODS

IT is conceded that the search for gold was in a measure one of the propelling forces of discovery; but the quest for food, and particularly for fish food, must also be considered as a reason for the love for wandering. This double incentive was conspicuously shown in 1614. Captain John Smith, in describing "New England, a part of America, at the Isle of Monahiggin," writes, "Our plot was there to take whales and make trials for a mine of gold and copper. If this failed, fish and furs was then our refuge, to make ourselves savors howsoever."

The earliest knowledge that edible fish of the kinds known in the old world were to be found in abundance in the waters of the new dates back to the time of John Cabot and his son Sebastian. Under a charter granted by Henry VII., John and Sebastian Cabot reached, in June, 1497, what was probably the coast of Labrador. We find on a map of somewhat later date (the authenticity of which cannot be questioned) a land which bears the name "Tierra de los Bacallaos," which, in English, is "the Land of the Codfish." Philologists are often struck by what may be called the resistance of a word to all changes. J. Carson Brevoort has shown in the most convincing manner that the Greeks, the Latins, the Iberians, the English, and the Dutch all derived the name "cod" from the small stick, gad, or rod used in drying the gadus, and baculeum in Iberian is a small stick, hence the Spanish baccalaos or dried cod.

In 1415, as stated by Prof. G. Brown Goode, English vessels frequented the fishing-grounds of Iceland, and it is not impossible that these ships sailed further westward in search of the cod. If tradition is worth anything, the probabilities are strong that the hardy Basques reached the northern coast of America centuries before Columbus did. "The banks of Newfoundland were among the principal inducements which led England to establish colonies in this country, and in the records of early voyages are many allusions to the appearance of cod." (Goode.)

Less than a century later, an adventurer petitioned Queen Elizabeth (1577), offering to "destroy the great Spanish fleet which went every year to the banks of Newfoundland for fish for their fasting days." Eleven years later (1585), when war was imminent between England and Spain, Barnard Drake was commissioned to proceed to Newfoundland to warn "the English fishery there of the trouble." In 1600 there are records which show that England employed 200 vessels and 1000 men and boys in the New England fisheries. With the settlement of Virginia the excellence of the fish on the southern coasts was cited. "A bold channel so stored with sturgeon and other sweet fish as no man's fortune has ever possessed the like" (1607). George Percy wrote to England of "the good mussels and oysters of Virginia" (1606). There is a record of the same time describing an encounter with the Indians of Virginia, who, having been driven off, "fled, leaving many oysters in the fire." The presence of salmon (sallos) in Virginia is indicated by a document found in the Simancas archives. There is a curious fragment of verse which has come down to us, written by Drayton (1619–20), entitled "An Ode to the Virginia Voyage," where the adventurers are "to get the pearle and gold."

In the study of fish as food, comparing the long past with the immediate present, one marked difference is in the method of preservation. Among aboriginal races, more particularly those living in the far North, climatic conditions permitted conservation of fish by the simplest methods of drying, but such measures were not possible in warmer zones. The method of salting and drying fish, as practised in Scandinavia, is of the most remote antiquity. Smoking fish in order to prepare them for eating, it is believed, is of a later date. In the earlier times it must have been necessary that a catch of fish should be at once landed so that it could be marketed. Later came the preparation of fish for future use by salting and drying. If the port of final destination were far distant, a convenient shore in the proximity of the catch had to be found, so that the fish might be cured. The early Norseman or Basque of the twelfth and thirteenth centuries, or the English, French, or Spanish fishermen of the sixteenth and seventeenth centuries, must have sought such curing-grounds, so that fishing interests had much to do with the early founding of colonies.

Modern methods of preserving fish are refinements of older processes, the result of a better scientific acquaintance with the composition of food. If there always must exist a demand for cured fish, because it can be kept over, and has the advantages of small bulk and high nutrient quality, nevertheless the demand for the more natural fresh fish remains constant. The first use of ice on board of fishing-smacks, it is believed, was by the fishermen of the American colonies, the practice always having been in vogue among the New England fishermen. The reason for it is plain; the low temperature of New England furnished an abundance of ice during the winter, but in summer the heat was excessive, and fish would spoil. In England and France ice always has been, in the past as in the present, an expensive luxury.

The credit for the refrigerating of fish on a large scale is to be accorded to Enoch Piper of Maine, who first perfected it in the British Provinces. This method is now general in all the large cities on the American seaboard. The advantages of the refrigerating process are evident. In former times, when there was a glut of fish, it often had to be destroyed, because the expense of handling amounted to more than the price offered. To-day, no such waste is possible. Whenever fish is landed at the large cities, and is low in price on account of catches in excess of immediate demand, such fish are bought at a fair price and stored in refrigerators. In this way the labors of the fishermen are not lost, and the stock of food is increased.

Sometimes the idea has been advanced that co-operative methods, such as are successfully carried out by dairymen, should be used by fishermen. It has been proposed that desiccating establishments should be organized in the neighborhood of fisheries, where the excess of fish might be dried by means of approved apparatus.

An important factor in the extensive use of fish is a more expeditious method of transportation. By means of rapid transportation, fish from all portions of the United States reach in a short time the main centers, and distribution on a large scale becomes possible. By actual comparison, it is found by looking over the list of fish offered for sale every day in New York, Philadelphia, Boston, and Chicago, that the variety offered far exceeds that to be found in London, Paris, or Berlin. The large centers of European population require fish, but those living at some distance from the capitals have it only in sparse quantity. This arises from want of a better system of distribution, or from indifference on the part of those who supply the markets. In the New York fish markets, as in those of other great centers of the United States, fresh fish may be found at all times in excellent condition, coming from every portion of the country. There are no waters, salt or fresh, from Alaska to the Gulf of Mexico, which do not contribute their fish to the general markets. Even salmon from Kamtschatka, via Bering Strait, have been found in Fulton Market, New York.

The natural increase of any population requires a larger supply of all kinds of food, but there is another factor to be considered in this—a brief study of fish alimentation in the United States. In proportion to the flesh of domestic animals eaten in this country, the quantity of fish consumed per capita is larger than elsewhere. If there should be the least decrease in any staple article of food, no matter whether derivable from an animal or vegetable source, such diminution would be at once attended with the gravest consequences. Has, then, the supply of fish been equal to the demand?

For the elucidation of a question of this character, not a general but a special area of water, with reference to the catch, should be studied. As has been before presented, the fishing-banks of Newfoundland, first discovered by the Cabots, gave abundance of fish during the sixteenth century. Though statistics of fishermen cannot be presented with precision, since we learn that in Queen Elizabeth's time there were "a thousand English men and boys" fishing there, we may safely believe that, counting the Spanish, French, and Dutch fishermen working over the same grounds, there were some 5000 men employed. For almost 400 years these same waters of the Atlantic have been fished,—and by an array of fishermen ever increasing,—who have employed for the last century very much improved methods of taking fish; yet it cannot be said that in these waters the staple fish, the cod, has shown any appreciable diminution. A vastly increasing quantity of fish only could have sufficed the business demands of the more numerous fishermen. This constant presence of fish is not singular to American waters. The same conditions of perennial abundance occur in European waters. The European herring, or other fisheries, are of the remotest antiquity, yet they still bear the stress of the vast requirements of to-day.

It may then be laid down as a general rule, that so far as pelagic or deep-sea fish are concerned, in contradistinction to the capture of fish living in close proximity to the coast, the supply of such deep-sea fish is well-nigh inexhaustible, as man's effort to diminish their number has so far been without appreciable effect. This was the conclusion arrived at by the late Professor Huxley in his exhaustive study of the English fisheries. It is not, however, to be questioned, that from causes beyond our comprehension certain kinds of fish are in abundance one year and scarce the next. This may be the case of one special fish, but not of all the fish frequenting known areas of water. The error made by the superficial observer is to give too great prominence to the absence of special fish in a particular year. When systematic research is made, extending over periods of twenty or fifty years, the average quantity of pelagic fish is found to be the same. A particular fish may be scarce in certain waters while abundant in others. Fishermen, when the catch is poor off the coast of Massachusetts, naturally complain, but are ignorant of the fact that north or south of them these same fish are in abundance.

There are exceptions to this general rule as applicable to the constancy of certain pelagic fish. In former years what was known as the shore cod were in abundance near our coasts. These fish have become comparatively scarce to-day. Whether too many have been caught, so that reproduction became difficult, or for the reason that the sources of food for the fish have been diverted, is not now known. As far as relates to one fish, the halibut, its absence from its former grounds is a well-ascertained fact. That the halibut is scarcest to-day in eastern waters of the United States cannot be questioned. The possibility is that the old halibut grounds have been over-fished.

It is this ignorance on the part of our legislatures of the inexhaustible natural supplies of pelagic fish, which has brought about numerous acts which have only resulted in hampering the fishing interests of the country. The laws of nature are indifferent to human laws. "As early as 1670 laws were passed by the Colony of Massachusetts prohibiting certain instruments of capture, and similar ordinances have been passed from time to time ever since. The first recourse of our State governments has always been in seasons of scarcity to attempt to restore fish to their former abundance by protective legislation." (Professor G. Brown Goode.) In a careful study made of the mackerel, extending over three quarters of a century, there were found periods of abundance and scarcity. "These alternated without the least reference to the alleged causes of over-fishing or any particular cause." If, then, useless laws were made in what was certainly the infancy of American fishing, a better acquaintance with ichthyology should preclude the formulating of any such restrictive acts to-day, so far as deep-sea or free-swimming sea fish are concerned.

So far the subject of fish as a food-supply derived from the sea or ocean has been presented, and an endeavor has been made to show how unwise and useless it is to place any restrictions on the taking of pelagic fish. With fish found in the rivers or lakes the conditions are entirely different. If it is beyond man's power to exhaust the food derivable from the sea, this is by no means the case with fresh-water fish. There are many fish called anadromous, or those which return periodically from salt to fresh water, as the salmon and the shad, and these species would be absolutely exterminated if man so willed it. These fish, born at the source of a river, go down to the salt water at certain periods during their existence, remaining there till, later on, urged by the instinct of reproduction, they return to their places of origin in the same rivers. The period of their return from salt to fresh water, in order to lay their eggs, is when these fish are caught. It is precisely at this time that these fish are of service to man, being in their best edible condition. It can thus be understood how a river could be so cross-barred, by means of nets, as to catch almost every anadromous fish ascending the stream. A practical example of this may be found in the Columbia River, once the finest salmon river in the world. The Columbia has supplied canned fish during the last quarter of the century, and now, from over-fishing, the river is almost depleted of salmon.

The presence of dams for manufacturing purposes may or may not have been an industrial necessity, but such dams have in the past brought about the entire disappearance of salmon and shad in certain New England rivers, for the reason that the fish could not ascend the streams to lay their eggs. It is therefore wise and proper that State legislators should pass laws regulating the character of the nets to be employed in catching such anadromous fish, and fixing certain periods when fish could or could not be caught, or establishing what are known as close seasons.

Our great North American lakes, when compared with the vast extent of the sea, are restricted areas of fresh water. The range of fish in these lakes is limited, and their habits can be readily determined. If no heed were to be taken as to the seasons of spawning of these lake fish, and their indiscriminate capture were carried out, the inevitable result would be their complete destruction. It is a salutary and just provision, that laws should be passed restricting fishing in the lakes to certain seasons, and regulating the size of the meshes of the nets.

It is therefore evident that with certain fresh-water fish, forming a large proportion of our food, their present or future abundance must depend upon protective legislation. But even then the legitimate supply, bearing in mind the constantly increasing demand, would be notably decreased if it were not for the intelligent methods devised for restocking with fish depleted rivers and lakes, and even in some cases the seas.

Here the newer science of fish-culture becomes important. Fish-culture does not create fish. What it does is to study particularly the spawning habits of fish. It secures the fecundated eggs, hatches them artificially, rears the young fish, cares for them up to the period when they are able to provide for their own wants, and, lastly, introduces the young fry in quantity in those rivers or lakes where, from over-fishing or other causes, the fish are wanting. Fish-culture has to do with our future supply. It plants the fingerling to-day, so that in the years to come the little fish, grown to full size, may furnish wholesome food.

In studying the advance fish-culture has made in the United States it is highly flattering to signalize the practical good sense and enterprise of a private body of citizens, the American Fish Cultural Association, which first directed public attention to the restocking of our rivers and lakes. It was through the influence of this association that the attention of the government was called to the matter, with the result of creating the United States Fish Commission (1871), with that most distinguished man, the late Spencer F. Baird, at its head. With the fullest appreciation of the exigencies of the case, Professor Baird endowed the study of American fish-culture with all the treasures of his scientific and, above all, practical mind, and our country will always be indebted to him for the many benefits he has bestowed upon it.

It is evident that preservative measures will always be necessary in order to keep up the average stock of useful fish in our rivers and lakes, but when we study the condition of the oyster a more serious problem is presented.

The oyster is a type of immobility. If in its embryotic state it is endowed with motion, in its subsequent condition it becomes forever fixed. If the oyster were taken in an indiscriminate manner, in time it would be exterminated. In England and France the supply would have failed long ago had not stringent measures been carried out looking to their preservation. In France efforts were directed toward restocking old beds and the creation of new ones.

The oyster-beds of Maryland and Virginia were at one time deemed inexhaustible, but constant dredging for oysters, the quantity desired being on an ever ascending scale, showed that the beds of Chesapeake Bay were unable to stand the demands made on them. Legislators finally directed their attention to these oyster-grounds, and to other oyster-beds on our North Atlantic seaboard, and with good effects. Grants were established in some cases, making a title to oyster-beds, or municipalities rented oystering privileges. The planting of oysters was encouraged, and laws were formulated regulating the dredging. The chaotic conditions of some fifteen years ago have been changed. Even with the many precautions used it is to be feared, such is the demand for oysters, that our time of plenty has passed, and that the price of the oyster will be increased in the years to come. Methods of establishing new beds by means of oyster-culture have been successfully carried on in France, but do not seem to have been available in the United States. This arises not from any want of knowledge or skill on our part, but because the spat of the American oyster has certain peculiarities in which it differs from the French oyster. The clam is still abundant, nor does there seem to be any reason why for many years to come it will not meet the demand.

Lobsters are becoming scarce. This is caused by their having been over-fished in the first place, and, secondly, because of the indifference of the captors as to the size, condition, and consequently the age of the lobster. In a general taking of lobsters, the small females having been captured, natural chances of reproduction were destroyed. At one time lobsters were fairly abundant in the waters of New

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York. To-day, few, if any, are caught. The absence of lobsters from their former grounds upon the North Atlantic seaboard must be noted. Methods of fish-culture applied to lobsters have not as yet been successfully operated. Legal restrictions in regard to the indiscriminate capture of the lobster have been exceedingly difficult to carry out. The demands of the lobster canneries in certain seasons are always on the increase, and supervision is apparently impossible.

Terrapin of the finest variety is becoming very scarce. This is due to the overcapture of the Northern terrapin. In the South terrapins of not so high a quality are still moderately abundant. Fish on our American coast are not taken to serve as food alone. The menhaden is among our valuable fish, as a source whence oil and fertilizing material are derived. With a very much increased force of fishermen, and with more approved methods of capture, the catch of the menhaden is still large. The menhaden shows, as do other pelagic fish, that in certain years they are more abundant than in others.

Looking over a list of fish offered in the New York markets in 1804, it will be found to be made up of some fifty-seven varieties. Deducting from this list two which are rather unusual and not salable to-day, we have fifty-five kinds. To-day seventy-five different kinds of sea products may be seen in any of the wholesale or retail fish markets in the American cities of the seaboard, according to the season. A notable change is to be found in the places from which the fish are obtained. Our great-grandfathers who were captains of fishing-smacks caught the general run of pelagic fish in about the same areas of water as do their great-grandsons, the skippers of the Gloucester or New York fishing fleets of to-day. By means of transportation other sources of fish further north or south furnish the present additional supply.

The greatest exception among the deep-sea swimming fish, as has been before stated, would be the halibut. In 1804 Nantucket shoals, or localities even nearer to New York, furnished the halibut. As time went on halibut was fished for near Labrador; then the waters near Iceland were sought by our adventurous Gloucester fishermen. At present fresh halibut comes in good quantity from Alaska and the far northern Pacific. To-day all the ordinary fish marketed, taking New York as a center, is derived, not only from adjacent seas or rivers, but from waters 800 miles north or 1000 miles south on the Atlantic sea-board.

In presenting such figures as are available, showing the weight and value of the American fisheries for 1870, 1880, and 1890, those of 1870 are not considered by the United States Fish Commission as absolutely trustworthy. The census of our fisheries had not, in 1870, the advantages of the careful supervision of the Commission. Unfortunately, too, that of 1890 is wanting in some details, the work not having been entirely concluded. If, however, errors have been made, experts believe that the statements as to values are rather under than overestimated.

PRODUCTS OF UNITED STATES FISHERIES IN 1870, 1880, AND 1890.

Kinds.	1870.		1880.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
General fishery products..	....	$11,096,522	1,771,822,000	$36,692,200	2,026,020,900	$42,141,411
Mammalian products.....	....	4,529,126	....	4,613,756	....	2,136,103
Total............	....	$15,625,648	1,771,822,000	$41,305,956	2,026,020,900	$44,277,514

FISHERY PRODUCTS EXPORTED IN 1870, 1880, AND 1890.

Products.	Fiscal Year 1870.	Fiscal Year 1880.	Fiscal Year 1890.
Fish and shellfish....	$1,380,601	$4,028,626	$6,040,826
Oils and spermaceti..	1,049,882	881,131	682,131
Whalebone	343,937	255,847	705,500
Total	$2,774,420	$5,165,604	$7,428,457

In 1875 the value and extent of the fisheries carried on by the port of Gloucester alone was estimated at $4,059,500. In 1876 it was worth $4,648,000. This was one only of many towns which kept out fleets on the Atlantic and in the bays and sounds of New England. For this same year (1876) Professor Baird estimated that the yield of the fisheries prosecuted in vessels and from the ports of the United States amounted to:

Kind.	Pounds.
Codfish	71,373,900
Mackerel	30,542,500
Herring	22,328,700
Other fish	11,503,540
Fresh fish not cured	99,677,911

It must be borne in mind that twenty years ago the fisheries of the North Pacific were in their infancy.

It has been possible for the United States Custom House to determine, with a fair amount of accuracy, the total tonnage of vessels employed in the cod, mackerel, and whale fisheries for a series of years. In 1800 the total tonnage was 35,626 tons; in 1820, 1,108,464; in 1840, 241,232; in 1860, 329,605; and in 1880, 115,946. The diminution of tonnage is due to the withdrawal of the large vessels employed in the whale fisheries.

The abstract taken from the last census presents many remarkable features. In 1890 there were 163,348 persons employed, with a capital invested of $43,602,123, returning products worth $44,277,-514. There were 7257 vessels, with a net tonnage of 174,020, worth $11,133,265. Maryland, with her oyster fisheries, had the most men, 36,436; Massachusetts was the next with 16,250 men. New York had 9321 employed. California had 3094 men. Dividing the value of the products, the general fisheries were worth $26,747,440; the whale fisheries $1,697,875; the seal fisheries $438,228; menhaden fisheries $1,817,878; oyster fisheries $13,-294,339; and the sponge fisheries $281,754.

The latest statistics of the fishing business of the States of New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia (1894–95) show 91,000 people employed. The value of the oyster product alone was $12,400,000. Shad was worth $1,216,000. In the oystering business the investment in Maryland was $7,649,904, and the oyster product represented $5,-259,865. The total weight of the product from the water was 590,454,369 pounds, worth $19,023,474.

The weight of fish caught was:

Years.	Pounds.
1874	295,726,800
1880	465,600,000
1890	332,211,600
1894	324,217,200

The oil exported in 1894 was 430,389½ gallons.

The particulars of the menhaden industry are of great interest, because they are carried out upon the Middle Atlantic seaboard in a more systematic way than any other fishery. The catch, it will be noticed, was the lightest in 1874, and the heaviest in 1880; but the takes in 1890 and the last year far exceeded that of 1874, which tends to prove that with fish having powers to move as they please, man's efforts to lessen their numbers materially by capture become impossible.

A statistical study of the weight and values of fisheries on the Pacific coast, from the waters of San Francisco Bay to Alaska, is not yet possible. On the Columbia River the canning of salmon began in 1866, with 4000 cases, and in 1889 reached 309,885 cases. Then came the exhaustion of the Columbia River. In 1883 the salmon of Alaska were first canned, and in that year 6000 cases were marketed. In 1890 the enormous total was 610,717 cases. In the seven years from 1883 to 1890 this would have meant a consumption of 27,706,958 salmon. There can be no question as to the speedy extermination of the salmon in some of the Alaskan rivers.

As to the cod and other pelagic fish of the Northwestern Pacific waters of the United States, there is no reason to suppose that they are in less quantity than on the Atlantic seaboard. With each succeeding year, these fish from the Pacific will find their way all along the great lines of railroad from the West to the East, and in increasing quantities.

Extensive canneries, many of them devoting their attention to the herring and lobster, are found on the eastern coast of the United States, and they contribute largely to our stock of food. On the California coast the presence of the true sardine has been noted. When there shall be olive-culture in California, sardines, as they are put up in France, will unquestionably be added to our home fish food.

MENHADEN INDUSTRY—SEASONS 1874, 1880, 1890, and 1894.

Year.	Factories.	Sail Vessels.	Steamers.	Men Employed.	Capital Invested.	Number of Fish Caught.	Gallons of Oil Made.	Tons Scrap.	Tons dry Scrap.
1874	64	283	25	2,438	$2,500,000	492,878,000	3,372,847	50,976	......
1880	79	366	82	3,261	2,550,000	776,000,000	2,035,000	19,195	25,800
1890	28	27	52	4,368	1,750,000	553,686,156	2,939,217	21,173	20,339
1894	44	30	57	2,560	1,737,000	540,361,900	1,999,505	27,782	20,332

Fish-culture has been of great benefit to California. The shad, at one time unknown in the Pacific rivers, is now to be found there in abundance, its original progenitors having been taken thither from the Atlantic seaboard. California shad exceed ours in size, and from their abundance are cheaper. The striped bass (*Roccus lineatus*), now abundant in California, is also due to fish-culture.

There is no reason to suppose that there will ever be any diminution in the supply of fish. There is no limit as to the area of American waters where edible fish are to be found. And, as has been shown, there can be no reason why our stock of anadromous fish should ever be sensibly diminished. The only exception recorded so far, as to the constancy of our North American pelagic fish, was the absence of the tilefish. It disappeared some time in 1882, due, it is believed, to a sudden change of temperature in the deep waters. After ten years of absence, the tilefish (*Lopholatilus chamæleonticeps*) has again put in an appearance.

It is needless to dwell further on the present facilities of transportation, which will undoubtedly be increased in the immediate future, nor comment on the very much more perfect means which are applicable to the preservation of all perishable products. The catch of 1895, it is considered, has a value of $46,000,000.

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CHAPTER LVII

AMERICAN CANNING INTERESTS

THE development in this country of the practical arts pertaining to the hermetical sealing of food, now so well known under the generic title of canning, is an interesting feature of the commercial growth of this country. Evolved from the studious and observant brain of an humble Frenchman, and tested through years of his plodding experience, the new method came amidst the throes of the French Revolution, in the year 1795, a veritable offspring of the First Republic. About fourteen years later the French government, under Napoleon the Great, awarded the discoverer the prize of 12,000 francs, which long before had been offered for a method that would preserve alimentary substances without robbing them of their natural qualities and juices. Nicholas Appert, born in 1750, spent his life in brewing, wine-making, pickling, and the making of confectionery, living over ninety years, and continuing to the last to invest all funds he could obtain in the prosecution of his investigation in these different lines. He died, in 1841, neglected and alone. His children have received some benefit from his labors, the title of Chevalier being borne by a descendant of his to-day, indicating that the cross of the Legion of Honor had been awarded to him in recognition of his merits. This industry, which has now become essentially American, begins, therefore, exactly within the century to which this work applies. Appert had obtained financial assistance from English sources, and as a result we find that, about 1810, his method was being used in the factories of an English firm of purveyors.

In that year, a patent was granted in England to one Peter Durand, for a can, made of tin, to be used in hermetically sealing food, the patent also covering the use of glass, pottery, and other fit material. In the letters patent, it is stated that the new method was communicated to him by a foreigner residing abroad. Ezra Daggett, who was in the employment of this English firm, brought the secret, it is believed, to America between 1815 and 1818. In 1819, he was engaged in the packing of hermetically sealed food by this process in New York city, in company with his son-in-law, Thomas Kensett. The descendants of Mr. Kensett still have some cans of these goods in their possession which were put up in 1822, as the labels show. Salmon and lobster were among the earliest goods packed, and oysters also were preserved, according to these labels. In 1825, a patent was granted to Ezra Daggett and Thomas Kensett for an improvement in the art of preserving. The can was then called a "case," the label containing directions for opening it.

About the same time that Daggett came to America from England, Charles Mitchell arrived in Boston from Scotland. He was born in London, there learning the canning business as an apprentice. He left London in 1820, and on reaching Boston almost immediately entered the employment of William Underwood, who established the firm of William Underwood & Company, in 1822, to hermetically seal food. There is a lack of information concerning the development of the industry during the next twenty years, but it was throwing out roots from the New York and Boston plants. In 1843, the firm of Treat, Haliday & Company were canning lobsters in New Brunswick, and salmon in Maine. There is a supposition that Haliday brought the process from Scotland and joined Treat about 1840. Already there was a known distinction between the French (or Appert) process and the Scotch method. Appert used glass vessels only, but the Scotch method required the puncturing of the tin after the first cooking, and then recooking after the hole was soldered. About 1846, Wells, Miller & Provost had a packing-house in New York, on Front Street, near Peck Slip.; W. R. Lewis & Bro. established a factory at Portland, Me.; and E. C. Wright began packing oysters in Balti-

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more, having obtained his knowledge of the process from Thomas Kensett the first. At this time cans were made by the regular tin-workers, but cappers were becoming a regular branch of the business.

Henry Evans, Jr., a tin-worker by trade, learned the process while working as a capper for Wells, Miller & Provost. In 1848, he went to Eastport to pack lobsters for that firm; in 1851 going to Baltimore and later engaging with Thomas Kensett the second, who had formed a partnership with Ira Wheeler in New York. In 1849, Evans had a factory at Newark, N. J., for Kensett & Company, and here were packed supplies of fresh vegetables for Dr. Kane's Arctic Expedition. These included tomatoes, onions, potatoes, and cabbage. Some time after this Evans went to the West Indies, where he packed for Kensett & Company the first pineapples ever packed in that way in those islands.

About 1850, the business began to develop rapidly, and its history is difficult to follow. The oyster business of Baltimore and the lobster and sardine fisheries of Maine were the principal bases of extension. William Numsen & Sons began work in this business in Baltimore in 1847; in 1849, they were packing cove oysters. Tomatoes, peaches, pears, and other articles were put up about the same time, the process being applied to nearly all the fresh foods in the different canneries. A number of active New Englanders located in Baltimore, embarking in the raw-oyster shipping business, and in time many of them began hermetically sealing oysters. The widow of Thomas Kensett the first sold the secret to Holt & Maltby and others, and thus they got into the cove-oyster packing. This title of "cove oysters" has come to be recognized as the specific name for hermetically-sealed cooked oysters. "Cove" oysters were from coves famous for the size and quality of their oysters, which were located on the west side of Chesapeake Bay, above the Potomac. The canning business has given them immortality.

For the first half of the century the industry was obliged to produce all the supplies it needed by hand-labor, and even after canneries multiplied, the output was necessarily restricted, because of the number of hands required and the cost of the goods, based entirely on hand-labor. This industry is the connecting link between agriculture and manufactures, the can being an essential to the foods in this condition; and the food is the *raison d'être* of the can — useless each without the other. The manufacturing lines that have received an impulse from the introduction of this industry are those that unite in the production of the can, the cases, labels, and canning machinery.

Previous to 1850 the cans were made by hand, usually by cutting out the tin blanks with shears, beating the ends into shape with a mallet over a former of some kind, and cutting the opening with a hand-punch and mallet. Originally the opening was covered on the flat top by a flat circular piece of tin, well soldered down. The first can-making machinery we have any authentic record of was naturally adapted from such as tinsmiths used, they being the first providers of cans for the packers, but in 1849 Evans, at Newark, N. J., introduced the use of the "Pendulum" press, for making can-tops. This same press came to Baltimore in 1851. With this press Evans introduced the crease and convex cap.

The California gold-fever gave a great impetus to the canning industry, and the list of the new firms that entered the business during the ten years from 1850 to 1860 would be too long to insert here, even if it could be made up with accuracy. Two historic firms arose just previous to the close of the first half of the century — Rumery & Burnham of Portland, Me., and Louis McMurray of Baltimore. The former was merged at the close of the war into the firm of Davis, Baxter & Company, a firm then well established. Later, this became the famous Portland Packing Company.

The Civil War gave another impulse to the industry, many of the established firms canning meat on government contracts. The canning of milk, under the title of condensed milk, resulted in a wide extension of the industry as previously carried on. Condensed milk, produced by evaporation and preserved with sugar, became a regular article of commerce; large quantities of it were used by the commissariat of the United States army. In 1860, the New York Condensed Milk Company of New York was in full operation, Mr. Borden being a stockholder of the company. In 1863, William Numsen & Sons of Baltimore were handling such large quantities in this same line that they formed the Baltimore Condensed Milk Company, in which Mr. Borden was also interested. On November 4, 1856, a patent was issued to Gail Borden of New York for this method, and under the same date another for an improved method that dispensed with the boiling.

On April 8, 1862, a patent was issued to I. Winslow of Philadelphia for a new method of preserving green corn, which was the regular Appert process for hermetically sealing goods. Winslow assigned this to J. W. Jones, of Portland, Me. It is understood that Winslow learned this art in France, when on a visit there in 1840. Nathan Winslow of Portland, Me., is said to have been the first who commercially canned sugar corn, and the Winslow Packing Company has ever since been famous for its canning of this vegetable. There is reason to believe that the industry was first carried into the Mississippi Valley by the same Henry Evans, Jr., who was in Baltimore with Thomas Kensett the second. Evans, who was at that time a member of the firm of Evans, Day & Co., was returning East in 1873, when he happened to lie over at Circleville, Ohio. There he met Mr. C. E. Sears, who was engaged in drying sugar-corn, such as is known as shaker corn. He found he could purchase cut corn, fresh and sweet, at a price per can far below the cost of the corn in the husk at Baltimore. His firm bought largely of it that season, besides fitting up a cannery at Circleville to can it there. The next year, however, the cannery was sold to Mr. Sears. This same factory, greatly extended by Mr. Sears, is now owned and operated by his widow, Mrs. C. E. Sears, so successfully that in 1894 she packed the largest output of sugar-corn of any factory in the West, if not in the world.

In the spring of 1864, the business of canning salmon was begun by the firm of Hapgood, Hume & Company, at Washington, Yolo County, Cal., on the Sacramento River. In two years, salmon became scarce there, and after an inspection tour the firm built a cannery at Eagle Cliff, on the Columbia River, Washington. This factory began operations in 1867. The development of the Pacific Northwest was due more to the salmon industry than to any other single influence.

In 1866, Mr. G. C. Van Camp, of Indianapolis, Ind., began packing all kinds of fruits and vegetables in six-gallon cans, the goods being sold in the city markets by the pint or quart. In 1868, he went into the regular canning business, mostly in No. 2 cans. Mr. G. W. Baker began the canning of sugar-corn in Aberdeen, Harford County, Md., in 1866, and several of his sons still continue in the business.

Between 1877 and 1885 canneries developed in great numbers, Harford county, Md., alone having over 400. At the same time firms spread through all the States of the West, mainly packing sugar-corn and tomatoes. There had been many efforts to introduce machinery into the packing-houses, but it was generally resisted by the employees, led by the cappers, on whom depended the proper sealing of the cans. This important function had been organized into a regular system, one boss capper taking the capping of an entire factory and, in some places, of several factories. For the sake of having experienced cappers in season the firms would keep them employed in making cans during the winter months, so even the making of cans was largely governed by these employees. Machines to do capping had been invented, but proved to be unpractical until, about 1883, Mr. I. H. Cox, of Bridgeton, N. J., introduced a hand-capper which proved a success. Very soon thereafter machines for all kinds of operations in the business were introduced. As machinery multiplied, country canneries increased in number because it supplied the place of hands, which the rural sections lacked. By 1892 the variety of machinery special to this industry had increased to such an extent that in that year, at an exhibition of canners' supplies held in the city of Chicago, in connection with a convention of the Western Packers' Association, Mr. Buchanan, Chief of the Department of Agriculture of the Columbian Exposition, who had been invited to see it, stated to the Chief of the Department of Machinery that it was extraordinary and novel. Almost every operation was done by machinery, and the business of "packers' supplies" has become a large one. The introduction of machinery greatly reduced the price of goods and increased the output. Meantime the old, original method of cooking (or processing, as it is called) the goods in open kettles in plain boiling water was improved upon by adding salt to the water to increase its density and thus gain greater heat and quicker results. About 1858 this was further improved by substituting chloride of calcium for the salt; and later, steam-kettles, having a cover and containing a coil of steam-pipe, were patented by A. K. Shriver and G. W. Fisher, both of Baltimore, and these have superseded all other methods for processing foods. Machinery likewise revolutionized the making of cans, until at present they are made by hundreds of millions in special factories, by "systems" that have almost banished the use of manual labor in their production.

The growth of the industry, the multitude of firms, the rapid cheapening of the goods, and the popularity of the business, which requires hermetical sealing and therefore exclusion of the goods from sight, made the fixing of grades and terms of sale and delivery absolutely necessary. Growing in a century from nothing to a vast industry, and peculiar in its nature, it was entirely without commercial rules. The first commercial organization of packers of canned goods met at Philadelphia in October, 1872, but had only a brief existence. In February, 1883, a Canned Goods Exchange was organized in Baltimore, that city then being the great center and producer of these goods. Mr. A. L. Scott was its first president, and Mr. R. Tynes Smith its first secretary. The intention was to have regular sales on the floor daily, but this plan was abandoned. It, however, adopted grades for goods, rules and terms to govern transactions, and laid the foundation of commercial procedure for the business.

In 1885 the packers of the Mississippi Valley organized in Chicago under the title of the Western Canned Goods Packers' Association, with William Ballinger, of Keokuk, Ia., as president, and L. G. Seager, of Gilman, Ia., as secretary, and this has been a successful and powerful influence in the business, under the guidance of wise and tireless officers. It is based on the principle of mutual exchange of private statistics among members. The packers of the State of New York organized about the same year, with T. L. Bunting, of Hamburg, as president, and J. G. Gibson, of Utica, as secretary, with quarterly meetings and the statistical principle. Virginia and New Jersey organized about two years later, each locally.

The basis of a national association was laid at Indianapolis, in February, 1889, at a meeting of a number of representatives of the local associations, thus making it of a federal nature; the plan being submitted by Mr. Bunting, of New York. This was consummated at a meeting in Baltimore in May of the same year, by representatives from all the minor associations. Mr. L. G. Seager, of Gilman, Ia., was chosen its first president, and Mr. E. S. Judge, the publisher of "Trade," as secretary. There is nothing of the nature of a trust in the organizations of the packers; they are based entirely on the advantage of mutual information and general business rules.

In 1894, the Peninsula Packers' Association was organized at Dover, Del., with James Wallace as president and C. M. Dashiell, of Princess Anne, Md., as secretary. The "Atlantic States Canned Goods Packers' Association" was also organized in the fall of the same year, at Baltimore, with E. H. Thurston, of Mechanic Falls, Me., as president, and H. P. Cannon, of Bridgeville, Del., as secretary. These bodies are also members of the National Association.

In 1894, there were in the United States over 1900 known canned-goods packing firms, distributed among forty-two States and operating about 2000 canneries, of which Maryland had twenty-five per cent.; Maine, seven per cent.; New York, six per cent.; Ohio, Illinois, and Virginia, three and one half per cent. each; California, five per cent.; Indiana, three per cent., and the other States ranging from fifty-six factories in Pennsylvania down to one in Arizona. The total output of canned goods is computed to have been about 700,000,000 cans of all sizes and kinds. The principal articles packed are tomatoes, corn, milk, oysters, corned beef, salmon, sardines, peaches, peas, beans, apples, pears, pineapples, small fruits, and pumpkins. They are important in about the order given, although values of the aggregate packs may not run in the proportion of the number of cans.

There is a species of sectionalism about the packing, due mainly to climatic influences. Thus, the principal corn-packing States are Maine, New York, Maryland, Illinois, Iowa, and Kansas. Tomatoes are more southern in their trend — New Jersey, Maryland, Indiana, Virginia, and Kentucky being the heaviest packers, while New York, Ohio, and Illinois have the principal milk-canneries. Cove oysters are confined to Maryland, Virginia, North Carolina, Florida, and Mississippi. Beef has been packed in many sections, but the States north and west of the Ohio now almost monopolize this line of canning. Salmon is now only packed on the Pacific Coast, and Alaska is the main source of supply for the market, the canneries multiplying there as the fish have fled from the over-fishing of civilization.

Maine monopolizes the American sardine-packing, as it does lobster-packing, except what is done in Canadian waters. Peaches are packed principally in Maryland, Delaware, California, and Michigan; Georgia is, however, annually increasing the number of her canneries of this fruit. Peas are packed principally in Maryland, New York, Ohio, Indiana, and of late in Delaware; but many of the States in the upper Mississippi Valley are steadily increasing their output. Beans are of three kinds: string beans, baked beans, and lima beans. The first named are a heavy but profitless pack, being put up in all sections to fill time between other crop seasons; the second have their headquarters in Massachusetts, though New York is a strong second, and the article is being added to the list of packers' products in canning-houses everywhere. Lima beans find most packers in New York, Maryland, California, and Ohio; the Pacific Coast furnishing large quantities that in a mature state come east to be packed in winter as soaked goods. Apples are annually becoming a heavier pack in tin — Maine, New York, Maryland, Ohio, Illinois, Iowa, and Kansas putting up large amounts, and the industry is spreading to the new apple fields of Washington and Oregon. New York and California are the principal packers of pears, Maryland and Delaware also doing much in them. Pineapples, now one of the favorite fruits in tin, are packed mainly at Baltimore, Md., but the packing of them is extending in all directions. Small fruits have declined in the quantity packed till the pack of 1894 was probably not over one fourth the number of cans put up in a year fifteen years ago. California is the great packing region for small fruits, but a varying amount is annually put up by canners in all sections. Pumpkin is almost entirely confined to the Northern States. Soups are packed principally in New York and Illinois, but the output of this class of goods is being increased by large canneries in several of the other States. There is an almost endless line of varieties of canned goods, from green figs in Mississippi and Texas to turtle in Florida, and dandelions and mince-meat pies in New York.

The annual aggregate value of these goods amounts in an average year to over $71,250,000. At 500 cases to the car and two dozen cans to the case, they would need 58,750 box-cars to carry the pack annually. Besides the market it has made for the agriculturist, it has made a demand for labor in the cannery and its work, which requires at least 400,000 people in the height of the season. They would require over 2,000,000 boxes of tin-plate for the cans, about 30,000,000 cases, and 700,000,000 labels. Such is the business to-day that 100 years ago had just been shown to the public in a foreign country. The genius of this American republic seized on this idea of the humble Frenchman, and has made of it a great industry and a new article of quotation in the markets of the world. Its vastness is due entirely to the ability of the American workmen to secure and consume the good things of life which Heaven sends us and genius preserves for us in all climates and all seasons.

E. S. Judge

CHAPTER LVIII

AMERICAN WINES

THE history of the wine business in the United States is very recent. It is recorded that the first attempt to cultivate American vines by European colonists was made in Florida. It is well known that in 1769 the French colonists of Illinois, near the town of Kaskaskia, made wine from the native wild grapes, and even as early as 1630 the London Company sent French vineyardists to Virginia to plant vines. Many efforts were made in the eighteenth century to introduce the tender European vine, and to adapt it to the harsh climate of the Eastern States; but without exception the attempts proved abortive.

In the nineteenth century there must have been several hundred failures in the same attempt, and in 1851, Downing, writing in the "American Horticulturist," said: "The introduction of European vines in America for cultivation on a large scale is impossible. There is first a season or so of promise and then complete failure."

Several of the French settlements in the Ohio Valley succeeded in raising grapes to a limited extent, and early in the century some Swiss from Vevay planted a town in Indiana and attempted the culture of vines on a large scale; but it proved unsuccessful, although a certain quantity of wine was produced. The first successful grower was Longworth, of Cincinnati, who in the forties and fifties raised many grapes and produced some wine. It was of his Catawba wine that Longfellow wrote his inspiring lines. Many other kinds were tried at the time, and while Mr. Longworth lived, a fair return was secured, although possibly at too great a cost, for Cincinnati is not now a grape center. Commercially speaking, wine making was not carried on to any extent in the Eastern United States before the Civil War. Underhill, in his vineyard upon the Hudson, and a few others, made wine; but the sale was small, although grapes were beginning to be produced in abundance. The islands in Lake Erie, which were perhaps the first wine-producing centers of the Atlantic States, practically began to be known about 1857.

The history of vine cultivation in California is like a romance. Where the earliest vines came from no man knows; but, under the familiar cognomen of the "mission" grape, the vine was brought supposedly from Spain by way of Mexico. It was cultivated to a considerable extent around the old missions which were founded in southern California during the second half of the last century. The priests planted small tracts close to the missions, cared for the vines jealously, and surrounded them by high adobe walls. The cultivation was careful, and an abundance of fruit was grown, from which wine was made. What the latter was can be judged from the harsh qualities of the small quantity of mission claret made in California to-day. As far as can be learned, the product of the vineyards of the mission fathers did not enter into the trade of those days, which was largely in hoofs, hides, and tallow; but their wines were used upon the tables of the priests, served to the occasional visitors at the missions, and dealt out to the immediate retainers of each establishment.

Even after the arrival of the American settlers, in 1849, as well as of representatives from every nationality on the globe, next to no advance was made toward increasing the area of land devoted to viticulture until the year 1858, when, through the publication of articles devoted to wine growing, in the report of the State Agricultural Society and in the newspapers, a wide-spread interest was manifested in vine planting, and the area thus required in California was suddenly largely increased.

Many of the vineyards planted in the years immediately after 1858 were devoted to grapes for table use, and the remainder were almost exclusively planted with the old mission grape. The centers of production in those days were in southern California (in the San Gabriel Valley, and about the old town of Anaheim) and in the Sonoma Valley around the town of Sonoma.

Toward 1862 vine planting became almost a matter of general enthusiasm. In 1861 Governor John G. Downey appointed three commissioners to report upon the best ways and means of promoting the improvement and cultivation of the vine. One of these commissioners went to Europe, and, after visiting all the European districts, made an elaborate report upon the methods of cultivating the vine, making wine, and curing raisins, bringing with him on his return 200,000 grape-vine cuttings, with rooted vines of every obtainable variety to be found in Europe, Asia Minor, Persia, and Egypt. This collection embraced about 400 varieties, and in it was brought, presumably from Hungary, the Zinfandel, which has been so prominent in the later production of wine in California.

Between 1870 and 1875 the making of wine had so largely increased that the consumption was more than met. As a natural consequence, in compliance with the laws of trade, there was a great depression in prices, and many vineyards were rooted out. In 1879 the demand again caught up with the supply, and there was a new era of vine planting. It was not until 1880 that the great body of viticulturists of that State had begun to believe that other varieties of grapes, aside from the old mission, were suitable for wine making. Before that time few believed that any grape could be as good as the mission. Experience, however, has proved that California soil is well adapted to the fine varieties of European grapes. In point of fact, most of the vineyards there are planted with varieties more hardy, more resistant to disease, more consistent bearers, and producing finer qualities and greater quantities than the mission ever succeeded in doing, even under the most favorable conditions.

Following the persistent efforts of enterprising viticulturists, the great quantity of the wine made is now produced from imported varieties, whose character is so distinct, and whose quality is so superior to wines made from the mission grape, that new faith in the future of California wines has been born; and the belief has spread that under proper conditions the State makes wine of a high average grade, and eventually may rival some of the classic growths of the Medoc and of Burgundy.

The new era began in 1880. In spite of the efforts made by wine makers and wine merchants, only a limited market had been secured for California wines in Eastern States, plainly shown by the fact that the total shipments out of the State by sea and by rail in that year were but 2,487,353 gallons, valued at $1,343,170, while the exports of this year (1895) are expected to approximate 15,000,000 gallons, valued at about $6,000,000.

In the latter part of 1879, after the short vintage of that year had been gathered in, it was found that most of the old stock had been exhausted. Suddenly the price of all kinds of wine went up, and the supply was barely sufficient to meet the demands of the market. This at once awakened a more general interest in wine growing; but there was a woful lack of knowledge on the part of the growers, and only a few acknowledged authorities to which to apply for information. Numerous newspaper articles appeared calling attention to the value of viticulture in that State, and expressing a desire for the formation of some State institution where such practical knowledge might be obtained as was necessary for the conduct of this important branch of agriculture. Under these circumstances the State legislature took the matter up, and in March, 1880, the State Board of Viticulture was created, and provided with funds to meet its necessary expenditures.

This board has been in existence for fifteen years, and under its direction all the standard literature in the English language on vine planting, vine cultivation, cellar management, distillation, and every branch of viniculture and viticulture, has been collected and published. The wealth of information to be found in French, German, and Italian works has all been drawn upon and compared with the actual experiences in California. Besides this, the board has been instrumental in procuring State laws promoting the making of pure wines, and in attending to matters of national legislation pertaining to the wine and brandy interests, and has exercised a fostering care over those who intended to plant vines, the cellarmen, wine makers, and wine shippers. Its cost to the State has been nominal compared with the returns that have resulted from its efforts.

At the present time wine making in California is one of the best paying agricultural industries, not only in that State, but in the United States. Wheat is depressed beyond example; barley has at present a comparatively low value; wool is scarcely worth the cost of shearing; the hop-fields, not only in California, but in New York, Oregon, and other producing States, are being sadly neglected on account of the great cost of picking; the fruit business at best is, particularly in California, one which depends largely on the failure of the Eastern crop to insure good prices for Western producers; oranges are subject to every conceivable sort of fluctuation; while wine is returning a handsome profit to the producer.

There are two reasons for this. First, not only are the producers combined, but there is an era of good feeling existing among the shippers without parallel, perhaps, in the history of the California trade. The second reason is that there is no overproduction of wine. The shipments to the Eastern States, to Central America, Hawaii, Europe, and elsewhere, added to the California consumption of about 8,000,000 gallons, more than offset the production. No new vineyards are coming into bearing, while many of the old vineyards are being gradually killed by phylloxera. It will take at least six or eight years before the wine production of California can be materially increased, and for that time the wine industry will have to meet steadily increasing demands upon it, both in quality and quantity. There is, therefore, every prospect of an era of prosperity for at least ten years to come.

While I have thus far given a history of viticulture in California, with which I am particularly familiar, it must not be forgotten that there is in the Eastern States, particularly in New York, Ohio, Missouri, Illinois, Virginia, and Georgia, a most prosperous viticultural interest. The viticulturists east of the Rocky Mountains have had to contend with the difficulty of using native American vines and their hybrids for wine-producing grapes. Considering the drawbacks that they have encountered, their efforts have been in every way commendable, and their wines have a steady sale at remunerative prices.

Nicholas Longworth, already spoken of, was undoubtedly the leader in American viticulture. Until he began his efforts wine was practically unknown among Americans in the country districts, although a few bottles, having about as much value as gooseberry wines, were put up in many families, expressed from the grapes which were the progenitors of the Isabella, the Concord, or other common varieties. Longworth showed that really desirable wines could be produced upon American soil, with American growers and makers. Becoming rich early in life by fortunate purchases of land lying in the city of Cincinnati, he retired from the practice of law, his ostensible business, about the year 1825, to embark in horticultural pursuits. He first tried foreign grapes, but unsuccessfully, and then began experiments with native ones, with which he did not have the same difficulty. His first vineyard was a small one, but he gradually enlarged it, until he had 200 acres in grapes. His favorites were the Isabella and the Catawba, and from them he produced wine of a high marketable value. Since 1865 particular attention has been given to grape growing in many of the States in the East, there being a large demand for them for table use, and this incidentally has stimulated wine making. There are years in which the yield is so abundant that it hardly pays the grower to send the grapes to market; then more wine is made. But the bulk of the Eastern crop which is intended for wine is grown for that purpose. It is carefully handled, and by the best houses is kept three years in stock before any is sold.

The chief grape and wine growing district in the East is around Lake Keuka, in the western part of the State of New York. This is in the lake district, and the vineyards are from 500 to 800 feet above sea-level. The natural harshness of the climate is so modified by the existence of these large and deep bodies of water, fed by natural springs, and rarely freezing over, that grape culture can be better carried on there than in much of the region 500 miles south of them. Every one of these lakes, which lie at the end of the Appalachian chain of mountains, has many vineyards adjacent. Next to Lake Keuka come in importance Seneca Lake, Cayuga Lake, and Chautauqua Lake. Along the Hudson many grapes are grown. In an island in this river Underhill propagated the Iona grape, long regarded as the most valuable kind known. Ohio ranks with New York as a wine producer. The soil on Kelley's Island and Put-in-Bay, and around Cleveland and Sandusky, seems particularly adapted to it. Much comes from North Carolina, the Scuppernong being principally grown there; there are admirable wines in Missouri, and Virginia is now producing considerable quantities. No wines come from New England, although possibly they might be grown in the sunny valleys of Connecticut; but New Jersey is now making rapid strides in the way of good sound wines, fit to compare with good Burgundies. The skill of American wine makers has increased. The methods of handling the grapes, of caring for the newly expressed product, of improved cellarage, and of bottling, have all been learned with thoroughness. Although labor is dearer than in Europe, devices which save much cost have been introduced everywhere except to facilitate maturity. This depends entirely upon age, no artificial method being used to hasten that. Neither are there syrups introduced to give mellowness or tone. American champagnes are now largely used, and when properly prepared are much esteemed. Much American wine is sold as foreign.

I am aware that there is a general impression in the East, particularly among some wine dealers who have heretofore handled only the European product, that California should produce but one distinctive variety of wine. On this point I wish to quote from a work recently published by the State Viticultural Commission, and written by Charles A. Wetmore:

"I have found generally that a notion—it is hardly fair to call it an opinion—prevails among the importers that there is, or should be, one distinctive type of California wines in general, and that we make some sort of a mistake in not producing a particularly distinctive type of California wine. To them the well-known characteristics of the vineyard districts of the Old World, such as Xeres in Portugal, Bordeaux, Burgundy, and the Rhine, appear to assume broad territorial significance individually, each being in importance equal to the opportunities of California. Small places in Europe occupy, in their minds, larger places than youthful California. They little appreciate the fact that the viticultural area, both in latitude and longitude, and in the value of climatic and soil conditions, of all the regions where grapes are grown successfully in Spain, Portugal, France, and Germany, is equally matched, both in extent and variety, on the Pacific coast. One might as well speak of the one typical wine of all those countries of Europe as to think of one wine representative of this coast.

"Few realize that the western coast of North America is practically the counterpart of the western coast of Europe, with Great Britain attached to the Continent. Every condition of soil and climate is here reproduced to compare with Xeres, Malaga, the Mediterranean coast of France, the slopes of the Alps, the valleys of the Rhine and Rhone, and the humid climates on each side of the British Channel. In the variations of practical possibilities in viticulture, every distinction known to the west of Europe, from Gibraltar and Nice to Scotland and the Netherlands, is found on this coast from Lower California to British Columbia. Our Algiers is inland in Sonora and Arizona, and our Russian Siberia is between the Rocky Mountains and the Sierra Nevada. To the average New York mind, however, both Los Angeles and Shasta appear to be suburbs of San Francisco, and as nearly related as Xeres and Malaga, or as the Medoc and Sauterne districts, while, in fact, they are as far apart as Xeres and Burgundy.

"To those who do not comprehend this coast let me say that every known viticultural condition of Europe that has been observed from the Rhine to the Mediterranean coast, and even across on the northern borders of Africa and eastward toward Palestine, can be found here in the territory from the Columbia River to the Gulf of California and eastward into Arizona. Every known variety of European wine-grapes finds somewhere here its natural home, and somewhere a place where it cannot be successfully cultivated. In some places none, in others few, and in others many, just as in Europe, are found to prosper. Many mistakes in the attempts to transplant and adapt have been made, and equally many in experimentation with European methods ill suited to locality.

"Our experiences and present conditions are similar to what might have been expected if, during a single generation, an enterprising people had found western Europe unpopulated, and had attempted, with one common purpose, to establish viticulture from the Mediterranean to the Rhine from one common nursery of all vines, and without such knowledge of the local peculiarities as has been, in fact, the growth of generations. Under such a possibility we might have had Spaniards cultivating the Palomino in the Medoc, Frenchmen trying the Medoc in Xeres, Germans essaying the Riesling in Languedoc, and Portuguese worshiping port on the Rhine, with numerous admixtures of all kinds of efforts in all places. The present condition of California viticulture is not much different from such a supposed condition in Europe, with the exception that our producers are far more intelligent and better informed as to their mistakes and the means of remedying them than European vintners generally are as to the causes of any of their present successes.

"I shall show, however, that progress and improvement in given lines of perfection are not entirely subject to the will of producers, even if natural conditions and knowledge are present. The producer who exports is governed by the will of distant markets, and California, so far as even the Atlantic States are concerned, is yet an exporter, aided only by a very limited consumption locally. Even France produces one kind of claret for England and another for the Argentine Republic; one kind of champagne for Russia and another for America; one kind of Burgundy for foreigners and another for Paris; and everywhere in her own territory is satisfied with her local wines of every kind and character, without recourse to foreign delicacies. Whenever foreigners —and I include New York as among the most foreign people we have to deal with—will become

Charles Carpy.

satisfied with the best that each of our districts can produce without any attempt to imitate European styles, it will be time for them to complain that we do not produce typical California wines; but so long as the markets demand styles like favorite European brands, so long must California producers and dealers make attempts to please them, either with ignorantly devised methods and blends, or false labels; and so long as our Eastern Atlantic coast markets refuse to pay as much for equal quality, whether domestic or imported, they cannot expect producers to sacrifice quantity for quality in wine making to any practical extent."

The statistics of the production of wines in California from 1877 to 1895, and the exports out of the State by sea and rail for the corresponding years, are as follows:

PRODUCTION AND EXPORTS OF WINE FROM CALIFORNIA.

Year.	Production in Gallons.	Shipment out of State in Gallons.
1877	4,000,000	1,462,972
1878	5,000,000	1,812,159
1879	7,000,000	2,155,944
1880	10,200,000	2,487,353
1881	8,000,000	2,845,355
1882	9,000,000	2,816,735
1883	8,500,000	3,190,167
1884	10,000,000	3,524,099
1885	11,000,000	4,256,224
1886	18,000,000	5,192,223
1887	15,000,000	6,901,771
1888	17,000,000	7,235,994
1889	18,000,000	8,286,442
1890	18,000,000	9,092,082
1891	20,000,000	11,114,029
1892	20,000,000	11,117,752
1893	25,000,000	12,326,033
1894	15,000,000	14,031,405
1895	17,000,000	[1] 15,000,000

[1] Estimated.

The total consumption of the United States is about 36,000,000 to 38,000,000 gallons annually, which is supplied as follows:

	Gallons.
California (average)	20,000,000
Other States and Territories	14,000,000
Imported	4,000,000
Total	38,000,000

It may be now asked, What of the future? As for quantity, we can expect but little increase in California in the next six years. In quality we can expect much. Many choice producing sections are already well known. The best of foreign varieties have been tested in many locations, and their adaptability to different situations is thoroughly understood. Every year sees some improvement in our methods of viticulture, wine making, and cellar management. An industrious, intelligent, and experimenting class of citizens are bending their energies and thoughts to the production of the highest types. Lacking the experience that has come with centuries of work in Europe, possessing a new and rank soil at best, they are seeking to overcome every defect which may be found by an exacting connoisseur. Financially the prospects are excellent. Most of the old stocks of wine have been bought up and cleared out of the cellars. Markets have been developed in New York, New Orleans, Cincinnati, Chicago, Milwaukee, St. Louis, and all the leading cities of the country. There is scarcely a large city in which our wines have not found a market. The drug trade commends them and the brandies in the highest terms. At home we have the producers combined and standing for prices that will bring them a fair remuneration for their labor; we have the merchants receiving remunerative returns from their connections all over the country.

Of the needs of the viticultural industry there are but few things to say, though much might be said on each topic. We need a national pure wine law. We need some amendments to the internal-revenue laws which will, at least, place our producers upon an equality with the French brandy producers in the matter of blending and bottling brandy.

Concerning the necessity of a general national pure wine law, it can be said that there is a very general movement among all wine-producing countries for stricter regulations. The time has come when it should be generally recognized by the governments of the world that wine means fermented grape-juice, and does not mean a combination recently given by William Bailey Bryant in his "Nineteenth-Century Handbook on the Manufacture of Liquors, Wines, and Cordials without the Aid of Distillation," published by the Industrial Publishing Company, of Owensboro, Ky. His idea of an imitation of "red wine, cheap," is as follows:

"Water, one gallon; sulphuric acid, to the strength of weak vinegar; honey, one pint; powdered alum, one-half ounce; one sliced red beet and a half-pint strong tincture of logwood; one drop oil of wintergreen dissolved in a wineglassful of alcohol; one half of a grain of ambergris rubbed up in sugar; one pint tincture of grains of paradise. Any kind of bright sugar or syrup will answer in the place of the honey, and in less quantities. This wine, when prepared on a large scale, can be made at a very low price, as the honey is the only article that is of value, the tincture of the grains of paradise being substituted for spirit; and any quantity of it can be prepared at the shortest notice. The coloring is kept prepared in barrels for use. When the beets are added, the mixture is allowed to stand for the coloring to become discharged from them for several days."

This book, I believe, is protected by the copyright laws of the United States. It is infamous, not alone that such a receipt should be allowed to be published, but that we have no national pure wine law to prevent the concoction of such a beverage, with sulphuric acid and water as a base. I say that we need a national wine law, because, under the Interstate Commerce Act, no State pure wine law can be made operative outside of the boundaries of that State, and, as far as I am aware, New York, Ohio, and California are the only States which have a wine law designed to prevent adulteration and the manufacture of imitation wines. One effort was made to secure such national legislation, but it was defeated, by what interests it is needless to mention; but the effort is to be resumed. Our second need, to secure the right to bottle and blend brandy in bond, will, I trust, be obtained at the coming session of Congress.

CHAPTER LIX

AMERICAN DISTILLERIES

THE extraordinary consumption of alcoholic liquors, and the extensive application of alcohol for all purposes, show it to be one of the most important substances produced by art. There is but one source of alcohol, its production arising from the fermentation of sugar or other saccharine matter obtained from plants containing either free sugar or starch convertible into sugar. It is a volatile, inflammable, colorless liquid, of penetrating odor and burning taste. In commerce, when made from maize or other grain, it is called grain-alcohol; from reindeer and Iceland moss, moss-alcohol; from potatoes and beets, root-alcohol; and from grapes, wine-alcohol.

The discovery of the art of distillation is attributed to the Arabian alchemists, the first mention of it occurring about the eleventh century; but it was undoubtedly known and practised for centuries before by the Chinese. Brandy was named the water of life, and one of the early alchemists, in his enthusiasm over the discovery, declares that "this admirable essence is an emanation from the Divinity; an element newly revealed to man, but hid from antiquity because the human race was then too young to need this beverage, destined to revive the energies of modern decrepitude." Distillation consists in converting a liquid into vapor in a closed vessel by means of heat, and then conveying the vapor into a cool vessel, where it is reconverted into liquid. The possibility of separating substances by vaporization is dependent upon the fact that very few substances are volatile at the same temperature. Thus while water boils at 212°, alcohol boils at 173°. Strictly speaking, the spirits are not produced by the act of distillation, but are the result of the previous act of fermentation, distillation merely separating the spirits from the mixture in which they already exist.

A little over a century ago, in 1791, the first internal-revenue tax on spirits was imposed, being nine cents a gallon on spirits manufactured from grain, it being estimated that at that time about 3,000,000 gallons were annually produced from domestic materials. This tax, light as it was, was strenuously resisted by the western counties of Pennsylvania, which rose in rebellion, and had to be suppressed by the militia of that State and adjacent ones. From 1802 to 1813 the internal-revenue tax was abolished, after which a tax on distillers was substituted for a tax per gallon. In 1816 the internal-revenue tax was reduced one half, and abolished entirely in 1818, remaining non-existent until 1862, in which year, being pressed for money to carry on the war against the Southern Confederacy, the nation found a prolific source of revenue in the taxation of spirits. The following has been the rate of taxation under the different statutes from 1862 to the present: July 1, 1862, the tax was twenty cents per gallon; March 7, 1864, it was made sixty cents; June 30, 1864, it was increased to \$1.50; December 22, 1864, it was further increased to \$2; July 20, 1868, it was reduced to fifty cents; June 6, 1872, it was changed to seventy cents; and on March 3, 1875, it was fixed at ninety cents, where it remained until August 28, 1894, when it was raised to the present rate of \$1.10. In 1874 the revenue derived from spirits from all kinds of materials, including fruits, was about \$43,000,000, of which \$2,000,000 was from spirits manufactured from fruits. This was \$2,000,000 in excess of the previous year. The total number of gallons produced during 1874 was about 69,500,000. The immense revenue derived by the government from distilled spirits is shown by the fact that during the last ten years it has aggregated about \$1,000,000,000.

The progress made in the distilling business during the past century has probably been greater than in almost any other line of manufacture, all the latest achievements in science having been used to bring about such a result. At the dawn of the present century distilling was chiefly conducted by farmers, who made the crudest product in the crudest way.

A small kettle and a worm placed alongside his log cabin were almost as essential a part of the farmer's household equipment as a flail for his grain or a plow for his lands. In nearly every family liquor was a daily article of consumption, and the brown jug an indispensable adjunct to labor on every occasion. No commerce was conducted in alcoholic liquors in farming regions, each man creating his own supply. When one glances at the present immense business, with its distillery plants, many of which are palatial in their appointments, and some having a daily mashing capacity of 5000 bushels, the progress that has been made appears simply amazing.

The first product that reached the dignity of a place in commerce was so-called rectified whisky. It was the crude high wine after it had passed through a layer of charcoal, which largely extracted the fusel-oil and made a product ready for sale. To this were frequently added flavoring extracts, the compound then being put into heavily charred barrels, and a little sugar coloring added to smooth over its rankness and fieriness. Thus prepared, it was distributed among consumers, and some brands won for themselves a considerable demand. Following this process a redistilling apparatus was invented, by means of which the fusel-oil was more thoroughly extracted from the spirits. To make it more palatable a certain proportion of old-fashioned Bourbon from Kentucky, or rye from Pennsylvania or Maryland, was added to give bouquet, flavor, and the appearance of genuine whisky. This class of goods became known as redistilled whiskies, and the proportion of these which were sold in commerce as against the genuine whiskies of Kentucky and Pennsylvania was fifteen to one. In fact, the genuine goods made in Kentucky were used by dealers mainly for flavoring these so-called redistilled whiskies. It may be well for me at this point to define Bourbon whisky. The name now has a very wide significance. Originally it was whisky distilled from Indian corn or rye in Bourbon County, Kentucky. As its fame spread, countless imitations sprang up, so that today Bourbon whisky may be said to be whisky distilled from corn or rye after the manner in which it is made in Bourbon County. The yield of Bourbon whisky was then about three gallons to the bushel. It was heavy in body and flavor, qualities which made it very valuable in compounding; but it took many years of maturing to neutralize the fusel and other essential oils by the action of the atmosphere. The process of improvement was slow, and the trade recognized the fact that whiskies required at least three years or more to attain full maturity and become ready for consumption. At this stage the science of mashing was greatly improved, increasing the yield and lessening the cost of production. This had the effect of popularizing Kentucky Bourbons among the masses, and instead of being employed so largely for compounding purposes they came into use on a larger scale as a beverage. It also became patent to distillers and dealers that a larger yield did not injure the quality, but, on the contrary, made the whisky finer, as it contained less oils when made in quantity, and did not require so much time to develop its highest maturity. The pressure of competition has since induced some distillers of standing to sacrifice quality for quantity, and they have resorted to artificial means to produce the appearance of development. The whisky which has given Kentucky its reputation is that known as sour mash, and there are a few distilling firms who are so jealous of their reputation that they continue to distil only genuine sour mash, yield being a secondary consideration. To attain a fine bouquet, with its accompanying flavor and body, they eschew all artificial means of forcing development, recognizing as an undisputed fact that the atmosphere is the only chemist that can bring about such results. These firms constitute the bulwark which maintains the reputation of Kentucky whiskies. The larger number of the distillers look merely to the production of a deteriorated cheap grade, and the demoralization has taken such deep root that it is claimed by some producers that a year is all the time that is necessary to fit whiskies for consumption. While the production of cheap grades has lowered the standard of Kentuckies, it has diffused the taste for them among the masses, causing the dealers to substitute them for redistilled whiskies or so-called "domestics," which are but imitations of the genuine article. The present consumption of whiskies of all grades made in Kentucky is estimated at about 25,000,000 gallons per annum. The stocks remaining in bond of the product of the past four years are 83,000,000 gallons. Of rye whiskies, which are mainly produced in Pennsylvania, Maryland, and West Virginia, there were remaining in bond of the past four years' production as follows: Pennsylvania, 23,953,000 gallons; Maryland, 8,838,000 gallons; and West Virginia, 1,073,000 gallons; to which may be added Tennessee, which makes straight wheat whisky, with stocks in bond of the last four years amounting to 1,194,000 gallons. This represents the stocks of so-called straight whiskies, although, as above stated, but a small proportion of Kentuckies can properly be so classified.

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The principal States in which ordinary spirits are produced are Illinois, with a production for the year ending June 30, 1895, of about 21,000,000 gallons, of which there are remaining in bond 6,300,000; Indiana, with a production for the same period of 7,000,000 gallons, having 2,800,000 gallons remaining in bond; and Ohio, with an output also of about 7,000,000 gallons, having 4,000,000 remaining in bond.

I have hitherto confined my remarks almost entirely to spirits distilled from grain, the product from fruits being comparatively unimportant. From its greater availability and its cheapness, grain is in general use; while from fruits, which have a perishable nature and are non-available during the greater part of the year, there is distilled only a limited supply of apple, peach, and grape brandy, the State of California producing more than half of the fruit brandy made in this country. The total revenue for spirits from fruits in 1894 was but $1,287,497. Molasses as a distiller's material yields nothing but rum. Of late, however, attempts have been made to produce pure spirits from that source, but, owing to the difficulty of eliminating the rum odor from the output, the experiment is problematical. There is a very small production of rum, which is principally confined to New England; and the cheapness of grain spirits has tended to reduce the rum product to continually smaller dimensions. It is mainly manufactured for export purposes, very little being used in this country, as straight whiskies have superseded the once popular beverage. It should be stated that common spirits require no aging, being ready for manufacturing purposes or for compounding the day that they come from the still, and they never improve. In most cases, after having been doctored up to produce the appearance of genuineness, they are palmed off as true whisky under some euphonious title, and frequently they are audaciously placed on the market masquerading as sour mash.

In a review of American distilleries it is necessary that I should dwell for a moment upon the distilled spirits consumed in the arts, manufactures, and medicine in this country. Of these alcohol and cologne spirit take the lead, although high wines, whisky, brandy, rum, and gin are also used. Pure alcohol cannot be obtained by ordinary distillation alone. The rectified spirit or alcohol of the pharmacopœias contains nine per cent. by weight of water in the United States, sixteen per cent. in Great Britain; proof-spirit or diluted alcohol, fifty-four and one half per cent. by weight of water in the United States, fifty-one per cent. in Great Britain. That alcohol is used in some localities as a beverage is undoubtedly true, and it is said that fully one half of the alcohol that finds its way to the Northwest is so consumed by Poles, Norwegians, Swedes, Finns, Hungarians, and Russians. It has been estimated that about fifteen barrels of alcohol are consumed as a beverage daily in New York City, but it is impossible to collect data upon which to found a reliable estimate on this point. The foreigners employed in the coal regions of Pennsylvania are drinkers of alcohol, and a considerable quantity is annually disposed of among them. A large percentage of the cost of pharmaceutical preparations arises from the distilled spirits used in their manufacture. Concerning the amount of alcohol alone consumed in the arts, manufactures, and medicine in the United States, the Secretary of the Treasury, in his annual report of December 2, 1889, estimated it at about 6,000,000 proof-gallons. Cologne spirit is used for many purposes for which alcohol would be unsuitable, and whisky, brandy, rum, and gin form the basis of many proprietary medicines and of tinctures and medicinal wines. The amount of distilled spirits consumed in the arts and manufactures has been estimated at fifteen per cent. of all distilled spirits consumed, which is equivalent in round numbers to 12,000,000 gallons. The returns in proof-gallons, for the entire United States, of the wholesale druggists and manufacturers, eleemosynary institutions, and retail apothecaries, are given in the following summary:

DISTILLED SPIRITS CONSUMED IN THE ARTS, ETC., IN 1889.

Returns Received from	Aggregate.	Alcohol.	Cologne Spirit.	High Wines.	Whisky.	Brandy.	Rum.	Gin.
Total	10,976,842	6,745,152	1,453,048	75,992	2,023,900	266,874	189,581	222,295
Manufacturers and wholesale druggists	7,966,640	5,425,791	1,334,033	54,737	879,282	100,482	87,378	84,937
Eleemosynary institutions	102,790	30,092	4,374	883	59,222	6,599	841	779
Retail apothecaries	2,907,412	1,289,269	114,641	20,372	1,085,396	159,793	101,362	136,579

The eleemosynary institutions here referred to are dispensaries, homes, asylums, and others of a similar character. The above table shows that the total quantity of distilled spirits consumed in the arts, manufactures, and medicine in the United States during the twelve months ending December 31, 1889, was 10,976,842 proof-gallons. The following table gives the returns in proof-gallons, by totals for States, of all forms of distilled spirits consumed or sold by manufacturers and wholesale druggists, eleemosynary institutions, and retail apothecaries combined.

The inherent repugnance to paying the heavy tax on alcoholic liquors imposed by the government has given rise to a large number of illicit distilleries throughout the country. Occasionally one of these secret stills is unearthed in the large cities, which indicates that there are always more or less of them in operation at the centers of population. In the mountain regions of the country, more particularly in the South, a large amount of distilled liquor is drunk that never has been recorded in the Internal Revenue Department, or paid a penny of taxation.

DISTILLED SPIRITS CONSUMED IN THE ARTS, ETC., IN 1889.

BY STATES AND TERRITORIES.

States and Territories.	Aggregate.	Alcohol.	Cologne Spirit.	High Wines.	Whisky.	Brandy.	Rum.	Gin.
The United States	10,976,842	6,745,152	1,453,048	75,992	2,023,900	226,874	189,581	222,295
Alabama	41,343	18,781	648	......	19,961	714	237	1,002
Arizona	1,235	244	....	......	778	152	17	44
Arkansas	30,234	13,532	883	......	12,846	1,314	50	1,659
California	294,572	170,948	74,613	7,663	29,236	6,630	1,562	3,920
Colorado	33,409	12,942	117	146	14,961	2,992	520	1,731
Connecticut	234,510	138,011	9,644	7,222	42,437	7,531	12,147	17,518
Delaware	11,063	7,949	581	15	2,012	260	49	197
District of Colnmbia	25,920	8,870	3,410	237	10,033	1,442	793	1,135
Florida	9,737	5,795	849	153	2,238	481	70	151
Georgia	143,153	97,668	32,236	285	11,378	857	188	541
Idaho	3,030	101	15	15	2,028	546	66	259
Illinois	1,306,332	721,552	231,190	18,698	267,022	31,383	4,552	31,935
Indian Territory	41	....	....	......	20	16	......	5
Indiana	294,448	131,123	10,719	1,137	120,561	17,035	1,499	12,368
Iowa	189,962	98,354	6,525	101	74,206	5,431	898	4,447
Kansas	42,518	10,492	790	1,500	26,092	1,905	88	1,651
Kentncky	131,912	59,083	2,824	1,023	58,853	8,153	355	1,621
Lonisiana	152,914	115,276	6,262	627	26,972	2,120	769	888
Maine	115,585	83,369	6,396	53	13,539	1,898	6,949	3,381
Maryland	243,951	187,209	28,154	1,983	20,096	2,039	2,718	1,752
Massachusetts	1,018,080	659,406	74,951	5,051	124,743	19,883	102,354	31,692
Michigan	494,839	356,449	20,133	117	89,688	14,513	8,258	10,651
Minnesota	183,096	125,899	13,583	216	33,794	6,268	692	2,653
Mississippi	16,231	5,493	150	......	9,852	352	48	336
Missouri	1,071,068	655,824	120,688	1,955	253,756	22,641	2,213	13,991
Montana	6,394	4,653	9	......	1,264	327	19	122
Nebraska	180,372	106,258	1,966	136	54,607	11,384	742	5,279
Nevada	2,118	248	....	84	1,222	299	59	206
New Hampshire	59,465	27,133	1,057	75	16,578	2,418	7,447	4,817
New Jersey	176,175	123,909	22,922	1,338	18,372	4,868	1,335	3,431
New Mexico	3,619	500	38	......	2,353	545	43	140
New York	1,760,343	1,107,696	366,164	18,386	197,551	29,581	16,727	24,238
North Carolina	14,661	4,841	81	......	7,987	1,302	264	186
North Dakota	6,272	2,758	188	75	2,485	486	100	180
Ohio	647,339	412,151	37,550	1,321	162,001	16,781	3,243	14,292
Oklahoma	43	43	....	......	....	......	......	......
Oregon	85,917	60,732	8,135	7	12,851	2,851	244	1,097
Pennsylvania	1,142,941	703,625	305,574	1,902	102,711	14,497	5,768	8,864
Rhode Island	133,065	101,848	1,968	225	14,269	2,185	7,734	4,836
South Carolina	22,510	15,591	1,083	853	4,445	334	21	183
South Dakota	5,422	2,179	267	3	2,349	357	68	199
Tennessee	221,981	128,434	32,375	36	54,164	5,343	150	1,479
Texas	101,455	51,994	8,302	2,101	33,660	3,528	75	1,795
Utah	25,058	8,736	7,913	9	5,038	2,593	234	535
Vermont	43,412	30,744	1,820	33	7,213	751	1,653	1,198
Virginia	37,903	26,986	2,448	78	7,414	537	411	29
Washington	10,874	2,406	258	37	5,774	1,622	211	566
West Virginia	32,361	11,929	431	753	16,400	1,708	28	1,112
Wisconsin	164,728	123,675	7,150	343	25,071	5,756	813	1,920
Wyoming	3,231	1,722	38	......	1,073	265	70	63

This criminal branch of the history of American distilling would make interesting reading on account of its picturesque character, but I can only allude to it here. For reasons that are obvious, no estimate worth having can be formed of the amount of distilled liquor in the United States that evades the government tax, but the figures would doubtless reach considerable magnitude.

The daily capacity of grain distilleries in operation February, 1895, was 85,237 bushels, equivalent to an output of 358,620 gallons; and in the previous month there was a daily output of 364,559 gallons. I select January and February as the season when distilling is in full operation. In August, 1895, there was a daily mashing capacity of 68,454 gallons. August is a month in which distillation is almost at a standstill.

It should be stated here that the official compilations as to the number of distilleries are apt to be misleading. A very small number of distilleries are practically turning out the entire output. Officially, it is stated that in February last Illinois had but 15 stills in operation, with a daily capacity of nearly 100,000 gallons; while North Carolina is credited with nearly 300 stills, with a daily capacity of but 3148 gallons. In other words, the number of stills in operation appears nominally very large, approaching 1000, while actually the bulk of the output is produced by less than a tithe of that number.

The number of fruit (apple, peach, and grape) distilleries registered and operated during the year ending June 30, 1894, was 3633, with an average daily capacity of not quite one gallon each. Of these North Carolina had 1115 stills, or nearly one third of the whole; Virginia had 1230, leaving outside of these two States but 1288 stills.

The average quantity of grain used in the production of spirits during the last ten years is about 22,000,000 bushels; in the year ending June 30, 1893, it reached 29,000,000 bushels, which produced 126,545,000 gallons. Fully half the grain used is corn.

An important collateral industry is the feeding of cattle and hogs on the distillery slops. During the year ending June 30, 1894, this industry showed the following results:

CATTLE FEED FROM DISTILLERIES.

	Pounds.	Number.
Number of cattle fed at regular grain distilleries		62,123
Increase in weight of cattle	14,449,516	
Average increase in weight	232	
Number of hogs fed		25,554
Increase in weight of hogs	1,901,748	
Average increase in weight	74	
Total increase in weight of cattle and hogs	16,351,264	

To this increase, Illinois contributed 8,000,000 pounds, or about one half.

The amount of spirits withdrawn from distillery warehouses for scientific purposes and for use in the arts in the United States is very small, but increasing. Thus in the year ending June 30, 1892, there were 39,400 gallons; in the following year, 54,552; and in the next year, ending June 30, 1894, the amount was about 70,000—an increase of 15,000 and 14,500 in each successive year. Of the withdrawals in 1892, 65,000 gallons were alcohol and 4500 neutral or cologne spirits, out of a total of 69,700 gallons.

The entire production of alcoholic spirits from grain in the United States for the last fiscal year, ending June 30, 1895, was 80,116,374 gallons; withdrawn tax-paid, 74,200,720; and remaining in bond, 138,351,894.

The tax paid to the Internal Revenue Department for the maintenance of the government from alcoholic liquors for the last fiscal year, ending June 30, 1895, was $79,862,627, or $5,396,674 less than the previous year.

When one compares these figures, reaching over 80,000,000 gallons, and the enormous revenue accruing to the benefit of the general taxpayers, with the petty production for private use by farmers a century back, the unexampled progress must be apparent without further comment. The spirit interest has interwoven itself with the life of the nation, so that it has become one of the most trustworthy sources of national income.

The necessity of increasing the revenue has fostered legislation favoring a higher tax, which unfortunately tends to bring among the masses inferior goods; for the higher the impost the lower the standard of quality must be in order to make up for the increase in cost. The purpose of every legislator should be to promote the public health and welfare by making it possible for producers to furnish a wholesome beverage, thoroughly matured, at the minimum cost. To tax it to death does not accomplish this object. It naturally forces the production of cheap imitations, which are made out of common spirit, and often sold the same day that they are made. That whisky requires several years' time for properly maturing is universally acknowledged. Those brands alone should be, in my opinion, allowed to be sold that can show natural aging.

In European countries alcoholic liquors, such as brandy, etc., are allowed to remain in bond until required by the trade for consumption. This plan always insures a large stock of matured goods in bond. There is no reason why our government should force the tax-payment at any given period.

In order to extend the trade into foreign countries, the privilege of bottling whiskies in bond, and reducing them to such proof as may be required for commercial purposes, should be extended to the distillers of this country, as it is in Canada, where the government, alive to the interest of its manufacturers, affixes a stamp to each bottle, thus certifying to the genuineness of the contents. This would infuse confidence and promote export trade, as well as afford an opportunity for our citizens to secure a genuine and wholesome beverage. The trade in Canadian whiskies has been steadily on the increase for years, owing to this privilege so wisely conferred by the Canadian government.

The inequality in the conditions affecting our distillers as contrasted with those of Canada may be better understood when it is remembered that at the last session of Congress our government increased the tax on our product from ninety cents to $1.10 per gallon, and lowered that on foreign spirits from $2.50 to $1.80, thus letting down the bars to those who already had superior protection from their own governments. This was not merely the special privilege of bottling in bond, but the ruling, in the case of the Canadian government, that forbade the importation of any whiskies from the United States unless in 100-gallon packages. It should be stated that our packages run about forty-five gallons, larger packages not being found practicable for aging purposes. This action of the Canadian government amounts to practical prohibition, and results exactly as was intended, for none of our whisky now finds its way into that country.

The history of the large combination of American distillers of alcoholic liquors is too recent and somewhat too complicated for me to dwell upon at this time. I have endeavored to show the enormous importance of the distilling industry not only to the government, but to the people of the United States, and my conclusions with reference to legislation on the subject of distilled spirits are arrived at with a sincere desire to foster and assist by intelligent means the progress of one of America's greatest industries. Marvelous as has been that progress during the century now closing, it is but reasonable to suppose that the record of the next hundred years of our history will be such as to reflect the greatest credit upon the intelligence and enterprise of American distillers.

Jas. E. Pepper

CHAPTER LX

THE BREWING INDUSTRY

BEFORE the use of written words the lips of our Aryan ancestors articulated a sound which expressed for them food and drink, and the source from which these things came. This source was the bearded barley of the Himalayas. The porridge and the bread of the Aryans, made from the first grain used for common food, were the crudest forms from which has sprung the brewing industry. It was not until the Sanskrit writers, in their earliest record of the living language, drew the distinction, that separate words were used to express barley, bread, and beer; and even now a euphonious ear will catch the similarity in these three words, which, though much changed from their Aryan prototypes, still have a musical resemblance which tells us of the kinship of the three. The story of beer is therefore as old as the story of humanity.

In the most remote antiquity the Egyptians brewed, as did the Assyrians, and later the Greeks and Romans; and from time immemorial the Teutonic race have been famous for their skill in the production of the beverage for which they praise to-day, in poem, prose, and story, in song and eulogy, the name of the very modern but acknowledged patron saint of brewing, Gambrinus. The word for beer has been preserved, as the art of brewing has been developed, by the Teutons. The Egyptians called beer *zythum*, and the Greeks and Romans, *cerevisia;* but the word "beer" in some form has always been used to express to the Teutonic mind the ancestral beverage.

While the written history of brewing begins with Egypt, and the development of the art of brewing should properly be accredited to the Teutons, to America must be credited the attainment of scientific perfection in the craft, which, like mathematics, has become in the United States practically a finished science. When the Pilgrim Fathers landed on Plymouth Rock they brought with them from England, in addition to the fiery potables they were wont to drink,—"and not a man afraid,"—some of the sturdy brew of "merrie England," and also a knowledge of the brewer's craft, which they soon turned to practical use in the land of their adoption.

The Dutch settlers of New Amsterdam, with their long clay pipes puffing clouds of blue smoke, were wont to sip from generous tankards the beer of the Netherlands, and crack their jokes around the tavern table, the while they grew fat, sleek, and jolly under the gentle influence of their beneficent national beverage. Good William Penn found solace in the brew made under his direction for his young, peaceful, but aspiring colony; and farther south, in old Virginia, many were the happy gatherings where harmony prevailed, and memories of their old home far across the sea rose through their companionable chat, like the foam upon the treasured musty ale.

In New England, where the stronger spirits most prevailed, our good forefathers passed a law granting immunity from taxes and a prize in money to that energetic brewer who should brew in a single year more than 500 barrels of honest beer; for, said they, not only does this peaceful beverage add to the prosperity of the farmer by giving him a market for his grain, but, by supplying to our worthy citizens a beverage of much milder form, adds much to the temperance and good order of Massachusetts Colony. So peacefully, with full approval, and yet with growth most unfortunately slow, an infant industry was formed, which in 1795 produced upward of 2,000,000 gallons.

Legislative enactment, in the varying application of intelligence and ignorance, liberality and fanaticism, has, since the days of the Egyptians, hampered or caused the expansion of the brewing industry. While, prior to 1795, it does not appear that legislation adverse to the brewing industry was enacted, legislation favorable to the cheaper distribution of distilled liquors brought the more potent beverages to the front, and held in check the brewing industry, which would otherwise have proved itself more powerful in promoting temperance than any organized legislative effort. During the administration of Washington, Congress, in considering the very first federal-revenue law, was impelled by consideration of public morality to take cognizance of the importance of fostering the brewing industry. But opposition from various quarters arose. In 1789 Madison expressed the hope that the brewing industry would strike deep root in every State in the Union, and Thomas Jefferson gave expression to the opinion that "no nation is sober where the dearness of fermented drinks substitutes ardent spirits as a common beverage."

In 1810 the domestic production of malt liquors amounted to 5,754,735 gallons. There were only 129 breweries in this country, most of them producing ale and porter exclusively. In 1847 the increasing German immigration brought into America not only a demand for their favorite beverage, lager-beer, which gave a new impetus to the trade, but also a practical knowledge of the craft; and lager-beer breweries began to spring into existence wherever a sufficient number of Germans had settled to make these little local establishments possible. Americans sniffed suspiciously at this form of beer, which was new to them, and allowed difference in race to prejudice them against what was destined to be their national beverage. Owing to the greater popularity of lager-beer, the production of ale and porter at the present time does not exceed 1,000,000 barrels.

The modern reformer, when confronted by the indisputable fact that the Germans are one of the most temperate of nations, if he be somewhat fanatical in his prejudices, blindly closes his eyes, and in his attack upon what he is pleased to call the moral wrong of the production, sale, and use of intoxicating beverages, forgets to discriminate, and thereby misses in many instances the true solution of the whole question, which is such legislation as will make reasonably accessible the mildest of the great family of beverages, and hold under proper restrictions those which are not beneficial in their effects. Long before German immigration had assumed any noteworthy proportions the wisest and most patriotic statesmen of our country were so alarmed at the increased use of fiery intoxicants that they would have resorted to any legitimate means to force breweries into existence. Therefore, between these conflicting elements, it was a constant struggle for existence with the brewing industry up to 1862.

It remained for the exigencies of the great Civil War to bring forth such excise measures as should put the lighter beverages prominently to the front. Heroic measures were taken to raise the revenue and save the government from impending disruption. The internal-revenue laws came into existence. These threw the burden of taxation heavily upon ardent spirits. The passage of these laws in July, 1862, was practically the beginning of the development of the present vast brewing industry. It was like the breath of new life, and the extraordinary advancement of brewing from that day to this has been a surprise and wonder to all who have watched its history.

It was in 1862 that the Brewers' Association was formed. A moving cause in its organization was a desire for self-protection, and yet the fundamental principle which brought the American brewers together was patriotic, for they associated for the purpose of jointly aiding the government in perfecting the revenue laws relating to malt liquors, enforcing by their moral influence the collection of the revenue without discrimination, and of securing themselves by organization against unjust treatment. To its credit be it said that the Brewers' Association has never lost sight of its fundamental purpose. Born in the throes of the great struggle for national unity, it has served the government faithfully and well, and, instead of criticism and opposition, it has evinced sympathy and coöperation in the efforts of the government to establish proper internal-revenue laws, and has willingly acquiesced in the payment of this species of taxation.

The War of the Rebellion also brought about a remarkable revulsion of feeling in regard to our foreign population and their customs, especially as to the Germans and beer drinking. When the war put the patriotism of the people to a crucial test the Germans were found among the first to rush to arms in defense of our country. Old prejudices vanished before the bond of sympathy soon warmly established, like mist before the sun. This brotherhood established by the Rebellion has never died out, but has constantly grown stronger, and has cemented us together as one race. We have contributed to one another many of our habits and peculiarities, many of our customs. The habit of drinking fermented beverages, which was a characteristic of the Germans, is probably the highest contribution to temperance and good order which has come to us from any foreign nation.

The production of beer from the year 1863, expressed in barrels, is as follows:

BEER PRODUCTION FROM 1863.

Year.	Barrels.	Year.	Barrels.
1863	2,006,625	1880	12,800,900
1864	3,141,381	1881	14,125,466
1865	3,657,181	1882	16,616,364
1866	5,115,140	1883	17,349,424
1867	6,207,402	1884	18,856,826
1868	6,146,663	1885	19,216,630
1869	6,342,055	1886	20,289,029
1870	6,574,617	1887	22,460,345
1871	7,740,260	1888	24,569,682
1872	8,659,427	1889	25,098,765
1873	9,633,323	1890	26,820,953
1874	9,600,897	1891	30,021,079
1875	9,452,697	1892	31,474,519
1876	9,902,352	1893	33,876,466
1877	9,810,060	1894	33,789,984
1878	10,181,158	1895	33,237,648
1879	10,589,937		

SALES OF BEER IN THE PRINCIPAL CITIES OF THE UNITED STATES, FOR THE YEAR ENDING MAY 1, 1895.

Cities.	Barrels.
Albany	364,694
Baltimore	591,557
Boston	1,025,948
Brooklyn	1,941,395
Buffalo	618,743
Chicago	2,687,947
Cincinnati	1,145,806
Cleveland	429,665
Detroit	365,215
Louisville	212,695
Milwaukee	2,208,654
Newark	1,209,058
New York	4,732,300
Philadelphia	1,852,106
Pittsburg	435,880
Rochester	554,815
San Francisco	500,183
St. Louis	1,943,084
Syracuse	252,202
Toledo	245,609
Troy	230,539

These statistics, showing a development in the last century from 2,000,000 gallons in 1795 to 1,030,368,088 gallons in the year 1895, speak more eloquently of the marvelous advance than glowing language. There are now 2200 brewing establishments, by far the greater number making the lager-beer of the Germans. They range in magnitude from the little home brewery of some German garden to the gigantic business enterprise with an annual output exceeding 1,000,000 barrels. In the earlier years brewing was carried on exclusively for local markets. Within the last thirty years, however, the shipment of beer in barrels from one point to another began, and now train-loads of the delectable, foam-capped beverage leave the great shipping cities daily. The capital invested in brewing in the United States is about $400,000,000. The value of the annual output of the industry is $200,000,000. It contributes to the support of the United States government, in internal-revenue taxes alone, over $33,000,000. The local taxes paid by it aggregate over $3,000,000 more. The development of the bottling of beer from nothing to a business which, in one brewery alone, amounts to over 42,000,000 bottles annually—mostly quarts—is a remarkable evidence of growth. Over 50,000 men are directly engaged in the brewing of beer in the United States.

These material manifestations of progress by the mere aggregation of figures are based upon a deeper and broader advance in the application of science to the art of brewing. The establishment of brewers' schools, where theory and practice could be brought into constant association, where experiments could be conducted, and where a thorough training could be given to brewers' sons who, with an inherited tendency to skill in the art of their forefathers, desired to equip themselves with a higher knowledge of the craft, has brought into the field of competition a skill in the manipulation of the various processes of the brewing industry which has made possible a greater advance in the art of brewing since the year 1870 than had occurred from the time of Queen Elizabeth and the days of Shakespeare's Falstaff.

Only thirty years ago the principles governing the production of beer were, as we see, essentially unchanged. The interval of seventy years from 1795 had brought no noticeably valuable advances in the art. While it is true that chemistry, physiology, and botany, and, above all, the science of mechanics, passed through great development during the first half-century, it apparently meant nothing for the art of brewing save a thorough and necessary preparation of the various factors which were to be the foundation on which should rest the subsequent extraordinary progress—a progress destined to make brewing one of the most delicately scientific arts of manufacture. During the last quarter of a century, however, the brewing industry, taking advantage of every development of modern analytical investigation and mechanical advance, has been subject to radical improvements in all directions. It is especially indebted to Pasteur, Naegeli, Hansen, Lintner, and Delbrueck, who have contributed immeasurably to the creation of the higher art of brewing.

The dawn of an unsuspected and unparalleled line of improvement in the science of brewing, considered especially with reference to the physiology of fermentation, appeared with the labors of Pasteur, published to the world in his "Études sur la Bière" in 1876, in Paris, and later with those of Hansen at Copenhagen, concerning the physiology of the organisms of fermentation. From time immemorial beer had been known as a perishable product, but the causes leading to its spoiling were shrouded in deep mystery. Pasteur proved that the diseases of beer might be traced to the growth of injurious organisms, especially bacteria, and indicated the ways and means of preventing these diseases through the application of a rational process of wort cooling and fermentation. Hansen advanced an important step further by proving that the brewer's yeast might become, by contact, under given circumstances, with similar organisms closely resembling it, more injurious than bacteria. He crowned his labors by developing and introducing a process of cultivating yeast, in absolute purity and in large quantities, from a single germ, thereby also preventing the introduction of wild yeast into the beer. These improvements were soon applied upon a large scale in the leading breweries of the United States, and brought about material changes in their practical operation. After the principle of preventing infection had once been proclaimed, the old-fashioned open cooler was replaced by a suitable closed apparatus, often ingeniously constructed, which came up to the highest requirements of the new science. Closely connected with this was the use of filtered air, rendered germ-free, and of sterilized water, so that to-day the product of the brewer's art, in its highest and ideal perfection, is absolutely protected against infection. From the moment it leaves the brew-kettle, passes over the coolers, and through the process of fermenting and lagering, and up to the moment when it is served as a refreshing and perfect beverage, perhaps thousands of miles from the place of its production, it is protected by constant, accurate, and effective scientific safeguards.

Physiology and theoretical chemistry, hand in hand, have made brilliant progress in the science of brewing. The most complicated processes in the malting of barley, in mashing, and also in fermentation have been thoroughly explored and have come to be perfectly understood during the last few decades, and have laid solid foundations for the activity of the maltster and the brewer. An important place in this connection must be assigned to an invention which has brought about more radical changes in the brewery than any other, and which alone has made possible the introduction of numerous other improvements and innovations. This invention is the ice-machine and the application of artificial refrigeration upon a larger scale. Hardly twenty-five years ago the imperfect ice-machine of Carré, a Frenchman, was considered a curiosity, while to-day the model machines of Linde and De la Vergne are common property of all the brewers.

Americans may now justly claim to produce in the United States, not only the best beer, but, as is acknowledged by European authorities, the most durable beer, in the world. It is a peculiar, although incontrovertible fact, that the latest scientific theories of brewing, credit for which belongs to European investigators, have always found the most rapid and complete application and introduction in practice in this country. Professor Delbrueck, of Berlin, and Professor Schwackhoefer, of Vienna, who were sent to America in 1893 by their respective governments as authorities upon brewing, for the purpose of studying American breweries, were agreed in acknowledging this fact, and in their official reports did honor to the American brewing industry as they had found it. We have particular reason to be proud of the fact that a special process of fermentation which has been in use in this country for years has recently been proved by Professor Delbrueck to be the most rational process, judged from a scientific standpoint. This shows clearly to what an extent the theories of European investigators have been practically applied in this country before they were ever practically adopted abroad.

It would be going too far to recount all the different improvements to which the science of brewing has led us within the last few years. But there is one innovation that deserves to be mentioned, which has attracted attention of late, and which had its origin in our own country. This is the collection and utilization in its purity of the carbonic-acid gas formed during the process of fermentation. This process makes it possible to abandon the former "kraeusen" process, the old-fashioned method of carbonating. The finished product may now be charged with the finest natural carbonic-acid gas. This collection of the by-product of fermentation produces such a superabundance of carbonic-acid gas that it may readily be liquefied, and is destined to crowd out of the market all other products of its kind. As Americans we have particular reason to be proud of this achievement, because the solution of the problem had been attempted in vain by European authorities for many years.

During a trip covering the year just passed it has been the pleasure of the writer to satisfy his curiosity, as never before, by a careful investigation of the methods of foreign brewers, and, by taking the American method of perfect brewing as a standard, to reach certain conclusions which, as an American, he is proud to hold: first, that while the deep, analyt-

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ical, concentrated, and tireless mind of foreign, and especially German, scientists may, by more painstaking and patient application, have attained for the world a better knowledge of the fundamental theories on which success in the art of brewing should rest, it took the broader grasp, the more nimble and daring intelligence, of the American mind, and the tremendous energy of American enterprise, to put these theories into practical operation; second, there is an overwhelming difference in advanced methods, to the credit of the American; third, the American schools of brewing are now in the very van of scientific progress, and, even if equaled, are certainly not surpassed in the higher technical instruction which they give.

As beer is to become, if it is not already, the national beverage of the United States, and as increasing skill in the art will contribute immeasurably to the good health and temperance of the race, it is indeed a source of congratulation that the brewers of America are fully alive to the responsibility which rests upon them, and that they realize in the deepest, broadest sense that their own prosperity, their own advancement, and their own standing in the community depend upon the development of their craft to the highest ideal of perfection.

Fred Pabst.

CHAPTER LXI

AMERICAN TOBACCO FACTORIES

IT seems almost incredible that tobacco, the dried product of a common herb, possessing the properties of a narcotic stimulant, and in no way necessary for man's sustenance, should have from its first introduction progressively increased in consumption wherever used throughout the habitable globe; that, despite the opposition of the combined powers of the church, the state, and the moralist to its use, its consumers being the subject of ridicule, persecution, and even mutilation, and itself an object of universal taxation, it furnishes at the present time not only one of the largest staples of commerce, but provides as well one of the leading manufacturing industries of mankind.

The use of tobacco being nowhere mentioned prior to the discovery of America, at which time the species *Nicotiana Tabacum*, now almost universally grown, was being extensively cultivated by the natives, it need excite little surprise, when its universal use is considered, that the tobacco industry has been inseparably connected with the history, growth, and prosperity of our country from its earliest settlement to the present time, or that the few thousand pounds grown and exported by John Rolfe, of the colony of Virginia, in 1612, should have increased to the present enormous yield of 500,000,000 pounds per annum, grown upon an area of 693,000 acres, by 205,000 planters. About one half of this product is consumed at home, and the remainder exported, mainly to Great Britain, France, Germany, Spain, and Italy.

The high prices which tobacco commanded upon its introduction into England in 1586 greatly stimulated its production in the colonies. The foundation, however, for the enormous tobacco industry of our country was laid through an event which afterward proved a most potent factor in the destiny of the American Republic. In August, 1619, the captain of a Dutch man-of-war sold to the planters upon the James River, Virginia, twenty negroes (African captives), the first slaves introduced into the territory of the American colonies. Within the next one hundred and fifty years the slaves in the colonies numbered over 290,000, scattered from New England to Georgia; and under the stimulus of this class of labor the annual exports alone of the staple exceeded 70,000,000 pounds.

In Virginia, as early as 1633, tobacco-inspection warehouses were established, to which all tobacco grown for sale was required by law to be brought before the last day of each year, for examination by colonial inspectors appointed for that purpose, "who shall cause all the badd and ill-conditioned tobacco instantlie to be burnt, and the planter thereof to be disabled further from plantinge any more of that commodite of tobacco." These inspectors, being sworn and placed under heavy bonds, were authorized to issue formal receipts for accepted tobacco. Such receipts by law became a legal tender, and under the title of "tobacco notes" were for over a century the medium of domestic and foreign exchange, being receivable for all debts, public and private, at a value per pound annually fixed by the Assembly, the price being based upon quality, supply, and demand. The price was therefore uniform, whether the tobacco was raised for sale or for use as a legalized circulating medium in barter. The penalty for forging these certificates, as well as against inspectors who issued them fraudulently, was death.

During the year 1633 the barter price of tobacco was fixed at ninepence a pound; but in 1639 so great was the over-production and disregard of quality that its cultivation was restricted, and all debts ordered satisfied in tobacco at threepence a pound. Indiscriminate planting was stopped by the governor and council of Virginia, with the consent of the Assembly, and each planter restricted to 100 plants, on each of which should be left but nine leaves. As late as 1732 tobacco was made a legal tender in Maryland, on a basis of value of one penny a pound.

A marked change is shown in the distribution of the tobacco crops of the United States during the past one hundred and fifty years. In 1750 tobacco cultivation was confined almost entirely to Virginia and Maryland. In 1840 the product of the eight leading producing States, expressed in millions of pounds, was: Virginia, 75; Kentucky, 55; Tennessee, 29; Maryland, 24; North Carolina, 16; Missouri, 9; Ohio, 5; and Indiana, 2; while in 1890 the product was: Virginia, 49; Kentucky, 222; Tennessee, 36; Maryland, 12; North Carolina, 36; Missouri, 9; Ohio, 38; and Indiana, 7—the production of Kentucky alone being 33,000,000 pounds in excess of the other seven States combined. Retarded for a time by the War of the Revolution, and again, later, by the Civil War, the cultivation of tobacco has constantly increased, until at the present time its production is the largest in its history. Its cultivation has always been confined to the belt where it originated—a tract of about 600 miles in length by 300 in breadth, comprising portions of the States of Maryland, Virginia, and Kentucky, the northerly counties of North Carolina, the Cumberland Valley in Tennessee, the Miami Valley and Ohio River counties in Ohio, and small areas in Missouri, Indiana, Illinois, and Mississippi. These districts produce nearly all of the manufacturing and export tobaccos of the United States, exclusive of the tobacco grown for cigars, which is a more northerly product.

The manufacture of tobacco and snuff is, so far as known, coeval with its cultivation. The practice of snuff taking was observed by sailors sent by Columbus to the isle of Cuba on his second voyage in 1494. In 1502 Spanish explorers on the South American coast noted the habit of tobacco chewing among the natives, and a few years later European explorers crossing the North American continent observed the universal custom of pipe smoking among the Indians, both as a symbolical and a social custom. Small factories were early started throughout the colonies to supply, in some form convenient for handling, those localities where either tobacco was not grown or the larger proportion of settlers were engaged in other pursuits.

The earliest form of general use, by which each individual became, as it were, his own manufacturer, was the rubbing and breaking up of tobacco in the hand for pipe smoking. As the outside demand became greater the dried tobacco was rubbed by the manufacturer through sieves of various meshes to the inch, to suit the convenience and taste of consumers. This procedure, with improved methods of handling, is still the process by which granulated smoking-tobacco is made. A machine for making cut smoking-tobacco was described in 1732 as located in a Virginia manufactory, the output of which was 54,000 pounds per annum. In 1765 the manufacture of snuff was in comparatively few hands, the product being ground entirely by hand through the use of iron mortars and pestles. Before the adoption of the Constitution the leading snuff industries of the country, which were located at New York, Boston, and Philadelphia, had attained considerable proportions.

About the year 1760 the entire tobacco industry was revolutionized by the introduction of water-power. This in turn being later replaced by steam resulted in the industry becoming centralized in the hands of a few manufacturers. As late as 1794, under a law for the encouragement of manufacturers, State aid was conjoined with private capital in New York for the construction of a combination mill near Albany, to manufacture and grind, roll and cut tobacco, Scotch and rappee snuff, mustard, chocolate, starch, hair-powder, split pease, and hulled barley. In this mill all the operations, even to the spinning of tobacco, were performed by water-power, the tobacco-mill having a capacity of 100,000 pounds per annum. This plant, at that time the most extensive and perfect of its kind in the country, well illustrates the advance of the tobacco industry during the past one hundred years.

The subdivisions of the industry at the present time maintain about 800 factories, of various capacities, located in all sections of the Union, at least 4 of which are snuff-mills, each producing annually upward of 2,000,000 pounds of snuff; 10 plug-tobacco factories, each with an annual output ranging from 5,000,000 to 20,000,000 pounds; 15 smoking-tobacco factories, whose annual production varies from 1,000,000 to 5,000,000 pounds each; and 5 factories in each of which are annually manufactured from 1,000,000 to 4,000,000 pounds of fine-cut chewing-tobacco. In all there are 50 factories manufacturing over 1,000,000 pounds each, and nearly 200 factories producing over 100,000 and less than 1,000,000 pounds each.

Manufactured tobacco and snuff were early the objects of internal taxation by the general government. Alexander Hamilton, Secretary of the Treasury, in 1790, recommended a tax of ten cents per pound on snuff, and six cents on other kinds of manufactured tobacco, as likely to produce annually from $90,000 to $100,000, computing the quantity of these articles manufactured as exceeding 1,500,000 pounds, and reasoning that "this, being an absolute superfluity, is the fairest object of revenue that can be imagined." Acting upon this recommendation, an act was passed by Congress in 1794, under which snuff and sugar were combined in one bill as objects of internal-revenue taxation, the tax on the former being eight cents and the latter two cents per pound, the import duty being respectively fixed at twelve cents and four cents, and the drawback or allowance for export the same as amount of internal tax paid.

In 1795 the internal duty was taken from snuff and laid on snuff-mills, for the reason that "the tax was difficult of collection and liable to great evasion"; and "it appearing that a snuff-mill works about half the year,—that is, 156 working-days,—yielding per mortar an average of forty-five pounds of snuff per day, it follows that $561.66 per mortar per annum, as the equivalent of eight cents per pound, would yield a similar revenue." The tax was therefore fixed as follows: every mortar worked by water-power, $560; every pair of millstones, $560; every pestle other than that worked by hand, $140; every hand-pestle, $112; and every mill in which snuff is manufactured by stampers or grinders, $2240—providing at the same time for a drawback of six cents on each pound exported. The internal-revenue tax on snuff collected for the six months ending March 31, 1795, at the rate of eight cents per pound, amounted to $3887.84½, while for the six months ending September 30, 1795, including the mill tax, the collections increased to $11,662, and for the year ending September 30, 1796, the collections, under the law taxing the snuff-mill, etc., aggregated $17,124.80. This last system of taxation caused great dissatisfaction among manufacturers, since the duty was paid on the plant regardless of the quantity manufactured; and as the government paid out for drawbacks to some manufacturers an amount exceeding that received for revenue, the inequality of the operations of this law was so apparent that the act was suspended in 1796, and again by subsequent sessions of Congress until 1800, when it was repealed.

During the past thirty-two years the tax on tobacco has proved a source of enormous revenue to the government. During this period the contribution through taxation of the tobacco industry to the support of the general government approximates close to $1,000,000,000, being nearly one quarter of the receipts from all sources of internal revenue between July, 1863, and July, 1895, and nearly ten per cent. of the entire income of the government from customs, internal-revenue and direct taxes, sales of lands, premiums on bonds, and other miscellaneous sources during the same period of time.

By the United States internal-revenue laws the tobacco industries were divided for purposes of taxation into two distinct classes: one the manufacture of chewing and smoking tobaccos and snuffs; the other the production of cigars, cheroots, cigarettes, etc. The factory production of tax-paid tobacco and snuff in the United States for the calendar year ending December 31, 1893, exceeded 250,000,000 pounds, subdivided into plug chewing, 148,000,000; fine-cut chewing, 14,000,000; smoking-tobacco, 76,000,000; and snuff, 12,000,000 pounds. Other materials aggregating 70,000,000 pounds annually—mainly sugar, licorice, malt, etc.—are added in various proportions during the manufacture of these products, to suit the taste of consumers.

The amount of tobacco and snuff exported during the same period was 15,500,000 pounds. In addition it is estimated that fully 28,000,000 pounds, representing the local consumption by growers, escape taxation. Statistics covering a series of years show that the percentage of consumption in our country of the various kinds of manufactured tobacco and snuff is: plug, 62 per cent.; smoking-tobaccos, 27 per cent.; fine-cut, 7 per cent.; and snuff, 4 per cent. During the past twenty-five years the improved methods of manufacture introduced in all the subdivisions of the tobacco industry have materially reduced the cost of production, with a corresponding decrease in price to the consumer. In manufactured tobacco and snuff the processes of cleaning, ordering, casing, drying, cooling, cutting, dressing, flavoring, weighing, packing, stamping, labeling, with the additional procedures in the cigarette manufacture of carding, rolling, wrapping, and cutting off, are now generally carried on by machine instead of hand labor.

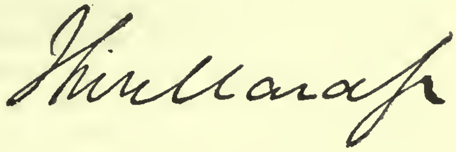
The general consumption of the product of the tobacco industries of the United States has increased enormously during the past thirty years. Such increase has not been relative in its subdivisions. Based upon the collections of the internal-revenue department, the production of manufactured tobacco and snuff during 1863 was 24,000,000; 1865, 37,000,000; 1875, 119,000,000; 1885, 180,000,000; and 1895, 259,000,000 pounds. A comparison of the reports of the internal-revenue department with the last published report for the calendar year ending December 31, 1892, shows that the consumption

Pierre Lorillard, Jr.

of plug tobaccos has increased during this period 66 per cent.; fine-cut chewing, decreased 18 per cent.; smoking, increased 117 per cent.; and snuff, increased 201 per cent. The large number of cigar makers who have qualified as tobacco manufacturers for the purpose of sorting, sieving, and packing for sale their refuse scraps, clippings, and cuttings, accounts in a measure for the increased consumption of smoking-tobacco. The increase in consumption of snuff from 4,000,000 pounds in 1880 to nearly 12,000,000 in 1893, due in a large measure to its use for dipping purposes, is entirely at variance with the generally accepted view of the public that the use of snuff is fast becoming a relic of the past.

During the fifteen years ending June 30, 1895, the annual consumption of tax-paid cigars, cheroots, etc., increased from 2,682,000,000 to 4,164,000,000, an increase of 56 per cent.; and during the same period the annual consumption of tax-paid cigarettes has increased from 567,000,000 to 3,328,000,000, an increase of 486 per cent. While this increase has in both instances been annually progressive, it is apparent that the greater increased consumption in cigarettes has been at the expense of the cigar industry; for while the production of the former during the years 1894–95 was 270,000,000 in excess of the average for the past five years, the production of cigars, cheroots, etc., declined 250,000,000 during the same period of time. In addition there are annually manufactured for export about 2,000,000 cigars and 400,000,000 cigarettes. Aside from the cultivation, preparation, and handling of the raw material, according to the latest available statistics the various tobacco industries of the United States are carried on by 11,351 establishments, with an invested capital of nearly $100,000,000, employing 129,423 persons, whose annual wages aggregate $53,336,060, using material costing $79,491,209, and having miscellaneous expenses incident thereto aggregating $23,000,000.

I have thus endeavored, so far as the space allotted me would allow, to trace the progress and present status of the tobacco factories in the United States from the early cultivation of the raw material in the colonies to its present extensive production, both as the basis for one of our largest domestic industries, as well as furnishing one of the largest of our staples for export.



CHAPTER LXII

AMERICAN SOAP FACTORIES

SOAP making in the American colonies was largely a household art in the beginning. The thrifty housewife, utilizing the kitchen fats saved in the dripping-pan, made her own soft soap for domestic purposes, and even a species of hard soap, usually molded in the form of a ball, and of a quality that, though considered excellent in those days, would scarcely be used by housekeepers of to-day.

If the soap boiler proper, as distinguished from the household maker, attained little prominence in the early days, soap was still a product the preparation of the material for which afforded a flourishing colonial industry. So early as 1608, when the second ship sent out from England to the Jamestown colony arrived, there were landed a number of Germans and Poles, skilled craftsmen, among whom were several proficient in handling fat and soap-ashes. The superabundant timber of the virgin woodlands afforded every advantage to this industry. In 1621 soap-ashes for export to England were worth from six shillings to eight shillings per hundredweight, and fifty years later the settlements in that part of the country now included in Maine and New Hampshire derived their chief wealth from the fat and soap-ashes there produced.

The candle and the tallow dip, then the ordinary means of illumination, have always constituted in their manufacture a branch of the soap maker's business, but in those days it was a far more important one than it is to-day. Newport, R. I., had a number of these establishments by the middle of the last century. Boston and all New England were likewise active in this trade, owing to the large whaling interests there, which furnished the sperm-oil.

Such was the status of the soap industry at the beginning of the century which comes within the limits of this article. While there were small soap-boiling establishments in nearly all the large towns by 1795, it is safe to say that they did not produce a great deal over $300,000 annually. The bulk of the product consumed was, as has already been stated, home-made.

The earliest moving cause in the evolution of a small and comparatively unimportant trade into a great industry was the discovery by Leblanc, a Frenchman, in 1791, of his celebrated process for the manufacture of soda on a large scale. This discovery, although made so early, was not appreciated in its full significance until more than thirty years later, when chemical manufacturers and soap makers began to avail themselves extensively of the supply of soda thus cheaply afforded.

Prior to this latter event, however, the trade foundations of the great soap industry of to-day were laid by a few persons who were long-sighted enough to perceive the future requirements, and courageous enough to believe they could fulfil them. Among these, one of the oldest, as it is one of the largest, in both present and past importance, was the establishment of William Colgate, founded in 1806 in a modest way in the old building in Dutch Street, where the warehouses and offices have remained to this day. Fancy soaps were at this time unknown, and the makers of the American product contented themselves with a very common grade of soap. The same conditions prevailed in both Philadelphia and Boston; but so rapid was the advance that by 1835 we were supplying all the home demand, with the exception only of certain of the finest qualities of soap, the secret for making which was possessed by some English or French manufacturer. We were in addition heavy exporters, sending abroad, principally to England, nearly as much every year as we are bringing in from there to-day. The total imports of soap for 1835 were but $36,218, while of our home-made product of soap and candles there was shipped abroad $534,467 worth. In Great Britain the soap industry was hampered at this time by a duty originally imposed in 1711, and not repealed until 1853. Despite this drawback, it is interesting to note, as showing the growing commercial and industrial importance of soap, that during the fifty years which followed 1801 the annual production increased from the amount as previously stated to over 197,600,000 pounds.

The increased importance of the soap industry thus developed in England, together with the many new uses to which the product was soon being put, especially as an auxiliary in other manufacturing processes, was speedily felt on this side of the water. Nevertheless the stimulation manifested itself rather in increased production than in improved quality.

Fifty years ago we were employing substantially the same methods and processes that were used in England. New England was then the principal center 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, although dating back to the beginning of the century, had made very slow advances.

While processes and methods were thus, comparatively speaking, at a standstill during the first four decades of the present century, the soap industry, nevertheless, steadily advanced in importance, and prepared itself for the wonderful development that immediately followed the discoveries of Chevreul in 1841. He demonstrated the true principles of saponification, and no later improvement, whether it be 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. The impetus thus given is shown in the fact that only one year later, in 1842, there were produced in the United States alone 50,000,000 pounds of soap, 18,000,000 pounds of tallow candles, and 3,000,000 pounds of wax and spermaceti candles, while exports to the value of more than $1,000,000 attested the preëminence we were gaining in the markets of the world. Of the total soap product at this time Massachusetts was credited with over one quarter, and of the spermaceti she produced nearly all.

Five years later, at the time when our house removed its factory to Jersey City, the soap industry had grown to great proportions. There were many manufacturers of soaps and candles in New York at this time, and among the more prominent of these I recall Enoch Morgan, James Buchan, Johnson, Vroom & Fowler, D. S. & J. Ward, J. D. & W. Lee, Holt & Horn, Patrick Clendenen, John Alsop, C. W. Smith & Company, John Taylor & Sons, W. G. Browning & Company, Lee A. Comstock, John Buchanan, George F. Penrose, John Ramsey, John Kirkman, and John Sexton. The manufacture of fancy soaps had already been begun, and in 1850 was established on an extensive scale by our house. Shaving-soap, always in great demand in those days, when beardless faces were the vogue, 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.

In common, too, with almost every manufacturing industry of importance, the making of soap was soon facilitated by the introduction of machinery. American ingenuity, always on the alert for labor-saving devices, has since been active in this field as in others, and the improved and extensive equipment of the modern factory testifies to its success. Manual labor, which was the rule in the earlier days, has been replaced in many of the various processes by machinery that performs the work more expeditiously and at a reduced cost. 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. A technical specification of the nature and functions of these machines would not only require too much space, but it would be tedious as well to the general reader, and is therefore omitted.

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 *Phalanjium Pomaridianum* are found in great abundance, and have 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 stearine, palmitine, and oleine. Different kinds of alkalis 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 stearine and soda, and the softest soap by the union of oleine and potash. Glycerine is often combined with fatty acids, since it is broken up by the action of the alkali, the glycerine 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.

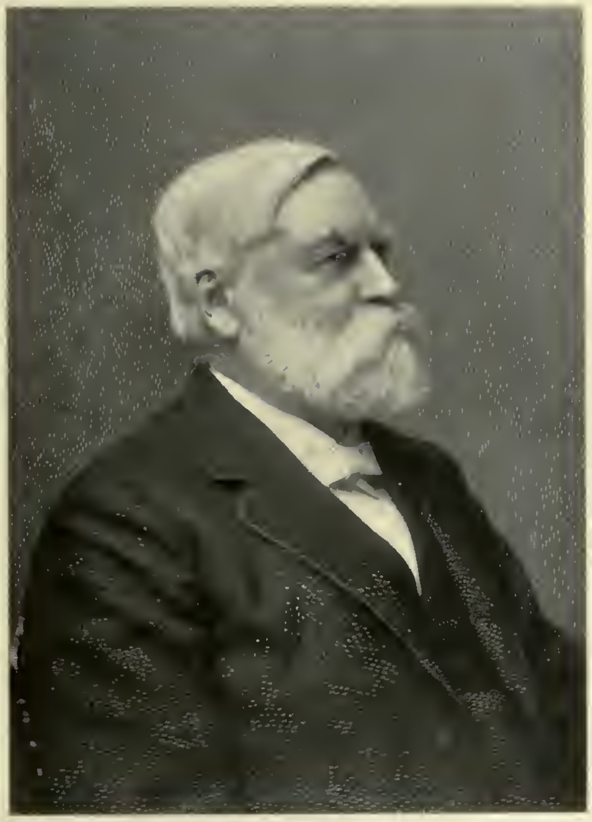
Olive-oil is used in the manufacture of Castile, Marseilles, and other marbled and plain soaps of southern Europe. Similar results by similar methods are attained in this country. The best oils for marbled soaps are obtained from Naples. The Spanish oils are also valuable for the same purpose. The oils from the East are not so rich in stearine, 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—which by its very Latin derivation shows that the manufacture existed among the Romans—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.

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. 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 alkalis, a process which is not much in use. Second, there is the treatment of fats with definite quantities of alkalis, in which the glycerine 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.

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 "crutch-



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ing." 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 good curd or yellow soap is used as the basis, special precautions being 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," which consists in the use of great pressure to form the soap into bars. These bars are then cut and stamped. The lower qualities of toilet-soaps are generally made by the "cold process." Transparent soaps are produced by dissolving good dry soap in alcohol, pouring off the clear solution, and then removing the bulk of the spirit by distillation. The soap remaining is then put into molds, cooled, and preserved for several months in warm chambers, until it becomes quite transparent. Many kinds of transparent soaps are made by the "cold process," the transparency being accomplished by the addition of sugar. Glycerine is often incorporated with opaque and transparent soaps for emollient effects, while for disinfecting purposes carbolic acid, cold tar, eucalyptus-oil, and other substances are added. The commercial value of all soaps depends upon the percentage of fatty anhydride present in them.

Having thus briefly reviewed the technology of the soap-manufacturer's art, we return to the consideration of the historical features of the subject. In the decade ending in 1850 the annual production of soap and candles had reached nearly $10,000,000, and by 1860 it had increased to still greater proportions. Its extent in that year, as well as in each succeeding decade, as gathered from the census reports of the United States, was as follows:

THE SOAP INDUSTRY, 1860 TO 1890.

Year.	Establishments.	Employees.	Wages.	Capital.	Material Consumed.	Value of Product.
1860	614	3,247	....	....	....	$18,464,574
1870	614	4,422	$1,925,951	$10,454,860	$15,232,587	22,535,337
1880	629	5,289	2,219,531	14,541,294	19,907,444	26,552,627
1890	578	9,305	4,951,648	....	28,687,412	43,600,385

The above figures demonstrate most clearly the growth that has been made by the soap-manufacturing interests, but they do not express another and most important phase of this industrial success. This is contained in the fact that American soaps are strong competitors in the markets of the world. Not only do we produce enough and to spare for our own wants, but we also send annually great quantities to foreign countries. Showing as this does the superiority of the American article, it is most gratifying; and the fact that England and France are still the most noted producers of toilet-soaps does not prevent me from declaring that we are producing here at home at the present time articles every bit as good, if not better than those made abroad, and that it is a question of only a short time before our superiority in this direction will be as freely conceded as it now is in the commoner grades of soap. The development and present importance of our foreign trade can be gathered from the subjoined table, giving the exports and imports of soaps by half-decades during the past twenty-five years:

EXPORTS AND IMPORTS OF SOAP, 1870 TO 1894.

Year.	Imports.	Exports.
1870	....	$627,352
1875	....	693,491
1880	$306,386	728,689
1885	401,150	697,294
1890	553,440	1,109,017
1894	578,810	1,139,722

Modern conditions have greatly changed the methods of soap manufacturers. Commencing with the introduction of the first pressed cakes of laundry-soap in this country by B. T. Babbitt, innovations and improvements have followed thick and fast. Upon the breaking out of the Civil War resin became very scarce, and other substances were added to the soap as substitutes. After the war, when resin became plentiful, there was a tendency to revert to the old methods of making soap; but late in the sixties the process of hardening resin soaps by the use of sal-soda was first introduced by A. Van Haagen, at that time of Philadelphia. Gradually the process of recovering glycerine from waste-soap lye was perfected in England, but it has been improved upon here, so that now refined and chemically pure glycerine is made by a goodly number of soap factories. The manufacture of soap-powder pertains to this same period. White floating soap was first put upon the market by Procter & Gamble, of Cincinnati.

The introduction of sapolio also 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. Intense competition has burdened the business with enormous advertising expenses, with all the various ramifications thereon attendant, such as the "gift trade" of premiums in crockery, glass, lithographic art work, and household novelties. While the maker of the housewife's soaps has had increased by these things his cost of production, the manufacturers of the finer grades have been equally alert to keep abreast of the demand for artistic wrapping and boxing, with the result that thousands of dollars are annually expended for the purely esthetic requirements of the business. Despite all this, the best grades of soap are now made in the United States. In quality, form, and preparation they are equal to those made anywhere in the world, while along the line of mechanical facilities for operating upon large quantities of material with the greatest economy of time and labor this country is acknowledged to take the lead among the nations of the earth.

Among the great firms engaged in the business to-day, and identified with its progress, I might mention B. T. Babbitt, N. K. Fairbank & Company, James S. Kirk & Company, D. S. Brown & Company, Procter & Gamble, and Colgate & Cox.

Thus far I have avoided all mention of perfumery, notwithstanding the fact that its manufacture is sometimes a subsidiary branch in the great soap establishments. The subject, nevertheless, is one that must properly come up for discussion by itself. Under the general head of perfumery are grouped a great variety of articles for toilet use, such as cosmetics, pomades, toilet powders, oils, depilations, dentifrices, sachet powders, etc. In their manufacture has been developed a business which more than almost any other demands the extremest care, taste, and experience on the part of the maker.

The hardy settlers and stern old Puritans who first came to America had little use and less desire for the sweet-smelling unguents of the Old World dandies. Accordingly it was long before perfumery was established as a manufacture here. In the proud old Tory days before the Revolution, and in the time of the Confederation which followed, perfumery, cosmetics, and the like were necessities in the toilet of any person of fashion. The carefully powdered hair and cue, the delicately scented shirt-frills and handkerchief, were all indispensable to the gentleman who wished to appear in good society. The supply of these articles, however, was drawn almost altogether from abroad, from the great centers of England and France. The housewife's rose-water, steeped lavender, and kindred preparations were generally known, and made by each family in quantity requisite for its own needs. As in the case of soap, so with perfumery, it took many years and changed conditions to bring the industry from the kitchen to the factory.

There are several methods for the extraction of the odoriferous qualities of plants, and for imparting them to spirits and oily bodies. For pomades the best fat to be procured is the marrow of the ox. An inferior source lies in the mixture of beef and veal fat and lard. These are beaten in a mortar, melted in a water-bath, and then strained. Before cooling the essential oil for the perfume is stirred in, or else flowers are thrown in and left to digest for several hours. These flowers are then removed, the fat is again heated and strained under heavy pressure, and fresh flowers are supplied. This process, known as maceration, is continued for several days; the product is then strained.

For delicate plants such as jasmine, tuberose, and cassia, the process employed is known as "absorption" or enfleurage. In this process square wooden boxes, the bottoms of glass plate, are used. In these is first placed a layer of purified lard and suet mixture; freshly gathered flowers are placed upon this layer every morning. The boxes are then shut, and the grease finally acquires a very strong odor from the flowers. For the saturation of oils the boxes are supplied with a wire bottom, on which cloths are placed after being soaked in the oil. After being charged the cloths are placed, several of them together, under heavy pressure, and the perfumed oils are thus regained. For the scenting of spirits the process of maceration or of digestion with essential oils is conducted in a water-bath and by agitation for several days. Perfumed soaps are prepared by substituting pomades for the grease in the mixture of soda lees.

The meagerness of the records, and the difficulty of distinguishing between the perfumer who dealt in imported articles, or at best made but one or two special and usually simple scents in limited quantity, and the actual American manufacturers, prevent as full a history of the early trade as might otherwise be given. It is certain that perfumery was being made in the United States, and in steadily increasing quantities, during each of the first four decades of the present century. The impetus given to the soap industry early in the forties by Chevreul's discovery reacted directly upon the production of perfumery. Many Frenchmen, skilled perfumers, had come to this country, and were vying with the American manufacturers for a trade that was already most profitable. Distinctive American scents had been introduced and become popular. "Ask for Cream of Lily," or "Take nothing but Violet Blossom," were advertisements illustrating the extent to which the business had grown. Among the manufacturers in New York at this time—between 1845 and 1847—were Thomas Jones, John Lindmark, Levi Beals, John Wyeth, Johnson, Vroom & Fowler, James Mackey, John Ramsey, William White & Company, Robert Reed, and John B. Breed. The French element in the trade was represented by such houses as J. M. de Ciphlet, F. F. Gouraud, August Grandjean, and Eugene Roussel.

Since then the growth of the trade has been great, and its importance is steadily increasing as American processes, intelligence, and push bring their forces to bear in competition with the great established centers abroad. The foreign strongholds of the perfumery industry are London, Paris, and the Mediterranean cities of southern France, together with the rose-growing regions of Turkey and Persia, where the manufacture of the ethereal attar of roses is carried to great extent. Cannes is famous for its roses; Nimes for its thyme, rosemary, astic, and lavender; Nice for its violets and mignonettes; Sicily for its lemons, bergamot, and orange perfumes. In England some essential oils are obtained from the native herbs, as at Mitcham in Surrey, where tons of peppermint and lavender are often distilled at a single operation. In the northern part of the United States there are many essences and essential oils manufactured from scented woods and herbs, such as wintergreen, sassafras, and others. Peppermint and roses and other flowers from gardens, fruits, seeds, and other vegetable products are unlimited sources for the production of this fascinating article.

The delicate scent of flowers has been traced to certain oils and ethers which may be elaborated from substances possessing even disgusting odors. The fetid fusel-oil affords odors which, obtained by processes of differentiation, are the same as those of fruits. Oils from gas-tar yield bitter-almond odors or the essence of mirbane. These are extensively used for perfuming soaps, and in many instances are regarded as preferable for culinary uses and the perfuming of confectionery. Then we have perfumes supplied from animal sources as well as vegetable. Among these are musk, civet, ambergris, and hartshorn. Ambergris supplies the most ethereal odors for use in combination with other perfumes. The greatest number of materials for perfumes (this being twenty-eight) comes from the south of France. Among these are the orange and the jasmine flowers, which form the bulk of the product, and also violets, roses, cassia, and tuberoses.

The progress made by the perfumery industry in this country during the last four decades is best shown in the following tabulated statement, taken from the United States census reports for the years noted:

PERFUMERY AND COSMETICS, 1860 TO 1890.

Year.	Establishments.	Employees.	Wages.	Capital.	Material Consumed.	Value of Product.
1860 [1]	33	535	....	$597,000	....	$1,222,400
1870	64	727	$260,415	1,172,900	$892,219	2,029,582
1880	67	741	238,259	813,827	1,201,409	2,203,004
1890	157	1,755	877,679	....	2,128,420	4,630,141

[1] The statistics for this year include the manufacture of fancy soap.

Of our foreign trade in perfumery there is little to be said, except that its condition has been and is encouraging. France and England, controlling as they do to a great extent the supply of raw material, have long been regarded as rulers of the perfumery market. Nevertheless this country has for many years sold abroad nearly as much as it has imported. In 1894 the figures show the imports to have been of the value of $427,850, while the exports were but $327,835, or, speaking roundly, $100,000 less. This disparity, however, is not so great as it at first appears, owing to the fact that the classification of imports includes toilet preparations of every description, embracing many articles excluded under the export grouping. At home, with an annual production at the present time certainly amounting to, if not in excess of, $5,000,000, the progress of the last quarter of a century is plainly evident. Among the great firms active to-day in that advance throughout the country are Colgate & Company, Lundborg, Lazell, Dalley & Company, Theodore Ricksecker, Solon Palmer, Alfred Wright, E. W. Hoyt & Company, Lanman & Kemp, and Frederick Stearns & Company. Great, however, as has been the advance made here in both this and the soap industry, it is safe to predict that its full extent is not yet reached. An increased capital, a wider knowledge of applied chemistry, and a development of internal resources are all tending to place us at no distant day in the very van of the world's progress in these industrial arts.

Samuel Colgate

CHAPTER LXIII

THE CHEMICAL INDUSTRY

LABOR is a combined effort of the animal kingdom, led by mankind, to overcome and subdue, to subject and utilize, the forces of nature. Labor, in its various relations, assumes forms that are both psychical and physical in character. Groups, combinations, and subdivisions of these forms exist in the great war of the animal kingdom on the solid, fluid, and gaseous conditions of matter. Hence it is that the chemist and chemical manufacturer are called on to organize and array the final attack on all known productions of the earth, of the water, and of the atmosphere.

The chemical industry of the United States may be considered to have been in existence, at this time, about one hundred years. In common with other leading manufactures, it has reached large proportions. Almost every State of the Union has within its borders chemical establishments of some kind. The industry is affected for good or bad in quick response to the rise and fall of other manufactures.

Before the Revolution no chemicals were made here. From such reports as are obtainable it appears that 8000 pounds of copperas were made in Vermont in 1810, and a smaller quantity in Maryland in the same year. In 1813 alum was made in the latter State. Oil of vitriol was manufactured in Philadelphia in 1793. At Baltimore, the manufacture of chemicals, paints, and medicine began in 1816. When the census of 1820 was taken, two chemical establishments were reported from New York City.

By 1830 the industry was firmly established in the United States, Philadelphia being the center. There were then thirty firms in the business in the entire country, having a capital of $1,158,000, and producing articles valued at $1,000,000 per annum. Alum, copperas, and some other articles were manufactured to the almost entire exclusion of the foreign product. The list of productions included calomel and various other mercurial preparations, Glauber's and Rochelle salts, tartar emetic, ammonia, sulphate of quinine, oil of vitriol, tartaric, nitric, muriatic, oxalic, and acetic acids, aqua fortis, Prussian blue, chrome-yellow, chrome-green, refined saltpeter, refined borax, refined camphor, acetate and nitrate of lead, prussiate of potash, and bichromate of potash.

The totals for the chemical industry, as reported at the Eleventh Census (1890), are shown in the following summary:

CHEMICAL INDUSTRY IN 1890.

Number of establishments reporting	1,626
Capital:	
Direct investment	$168,462,044
Value of hired property	$12,098,037
Miscellaneous expenses	$13,640,343
Average number of employees	43,701
Total wages	$25,321,077
Officers, firm members, and clerks:	
Average number	5,953
Total wages	$7,464,260
All other employees:	
Average number	37,748
Total wages	$17,856,817
Cost of materials used	$106,521,980
Value of products	$177,811,833

The principal products reported, and their quantity and value, were as follows:

CHEMICAL PRODUCT: QUANTITY AND VALUE.

Products.	Quantity.	Value.
Alum	(lbs.) 93,998,008	$1,616,710
Coal-tar products		687,591
Dyeing and tanning extracts and sumac	(lbs.) 187,906,911	8,857,084
Gunpowder and other explosives	" 125,645,912	10,993,131
Fertilizers	(tons) 1,898,806	35,519,841
Paints, colors, and varnishes		52,908,252
Pharmaceutical preparations		16,744,643
Potash and pearlash	(lbs.) 5,106,939	197,507
Sodas	" 333,124,375	5,432,400
Sulphuric acid [1]	" 1,384,776,972	5,198,978
Wood-alcohol and acetate of lime		1,885,469
Chemicals (including all acids, bases, and salts not heretofore enumerated)		24,751,974
All other products		13,018,253
Total value		$177,811,833

[1] Includes 581,536,200 pounds manufactured, and consumed in the manufacture of fertilizers, for which no value is given as sulphuric acid.

The most important of all chemical products is sulphuric acid, which maintains its supremacy over any other known article in promoting the manufacturing interests of the world. By the census of 1890, 105 establishments were reported as engaged in the manufacture of this acid, the production being 1,384,776,972 pounds. Of this quantity, 581,536,200 pounds, estimated as being worth $2,480,495, were produced and consumed as an intermediate product by establishments manufacturing fertilizers. Taking this into account, the total value of all sulphuric acid manufactured in the United States during 1890 was $7,679,473, an increase in value of 109.71 per cent. over 1880, and in quantity of 348.49 per cent. The large increase in the number of establishments and in the quantity produced, together with the reduction in price, indicates the advance that has been made in general manufactures in the United States during the decade intervening. Of the 1,384,776,972 pounds reported, 1,009,863,407 pounds were 50° Beaumé acid, 20,379,908 pounds were 60° acid, and 354,533,657 pounds were 66° acid. Reduced to a uniform strength of 50°, the total production for the year was 1,567,138,777 pounds. Supposing all of the chambers to be running 365 days in the year, we find the amount of 50° acid and equivalents manufactured in each twenty-four hours to be 4,293,531 pounds, or 2147 tons.

From technical considerations, manufactured manures are the next in importance to sulphuric acid in the category of chemical productions. The total of 1,898,806 tons of these materials produced, indicates, by no inaccurate measure, the extent of the farming interests of the country. When we consider that about 300 pounds of artificial fertilizer are commonly used to one acre of land, it is seen that 12,658,700 acres were enriched by its use. Dr. David T. Day, chief of the Division of Mines and Mining, states that 375,000 tons of fertilizers were consumed during the last census year in the Southern States, leaving 1,523,806 tons as the consumption of the Eastern, Middle, and Western States. The increase in manufacture over 1880 is 1,171,353 tons, or about 161 per cent. These figures show that large areas of our country are becoming unprofitable to farm without the use of these aids to fertilization; and the existence of factories in the States of California, Illinois, Indiana, Michigan, Minnesota, and Wisconsin is indicative of the gradual exhaustion of soil that was virgin in character less than twenty-five years ago. These facts tend to show that the time is approaching when none of our unmanured soils will yield in remunerative quantity. They prove that economies are coming into practice in the utilization of material that formerly ran to waste.

The farmer occupies a reversed position to that of the manufacturer of artificial manures. By prodigal wastefulness and culpable ignorance he permits immense quantities of manurial matter to find their way to the sea, while bemoaning his lot and sighing over the yield of virgin lands in comparison with that of his own; whereas the manufacturer, by the aid of chemical skill and mechanical devices, converts refuse matter into valuable merchandise.

The figures presented here yield consolation to the farmers of the Atlantic slope. When the not distant time arrives for the extinguishment of an agriculture that is based on primordial soil, the lands of these regions will recover their lost value; for the facts herein submitted tend to show how closely fertility is allied to the production of manufactured manures, and this manufacture can be carried on most profitably at those points where supplies of foreign crude material can be obtained, and where seaboard transportation can be made available.

The decade between 1880 and 1890 is rendered memorable to the chemical industry by the permanent establishment of the manufacture of soda salts in the United States. Previous to that time all attempts to produce these articles successfully from common salt had failed. The causes that led to repeated failure and the consequent loss of large sums of money are to be found in the high cost of labor, the absence of customs-duties on bleaching-powders or chloride of lime, and the exceedingly low rates of ocean freight that rule on this class of merchandise.

The Solvay Process Company, of Syracuse, N. Y., has been founded on the experience and skill of the now noted Solvay, of Belgium. But, however satisfactory the process may be, it has a drawback that affects the production of many articles in the United States,—notably bleaching-powders, paper stock, and certain chemicals,—inasmuch as all the chlorine of the common salt employed is lost, passing away as valueless chloride of calcium. Consequently the United States remains dependent upon Great Britain and Germany for its supply of so important an article as bleaching-powder.

A question of the greatest interest centers in this problem—how to overcome this defect in our manufacturing system. The efforts of inventors have for many years been directed toward the solution.

Henry Bower.

Theory has marked out a number of paths, but practice has not yet succeeded in following any of these to a satisfactory result. It may be remarked that, in addition to bleaching-powders, the important chemicals, alizarin, chlorate of potash, and chlorate of soda, are not found among the salts produced in this country, and that these articles, so essential to the textile interests, are free from customs-duty.

The States of the Union often provide chemical manufactures relatively to their natural products; but the markets for chemicals are situated chiefly at such attractive points as the great centers of textile manufacturing, of dyeing and bleaching works, and of the oil-refineries and artificial-manure works; hence, chemical works are to be found principally at or near these points. It appears from the report for the Eleventh Census on the dyeing and finishing of textiles, considered as a distinct industry, prepared by Mr. P. T. Wood, that chemicals and dyestuffs to the value of $8,407,693 were consumed by the 248 establishments engaged in this industry, to which must be added $11,278,970, the value of chemicals and dyestuffs consumed during the census year by textile manufacturers who do their own dyeing and finishing, making a total of $19,686,663 as the value of this class of chemicals consumed in the textile industry.

The leading articles of raw material and their derivatives used in chemical manufactures, briefly stated, are as follows:

RAW AND MANUFACTURED CHEMICALS.

Raw Material.	Manufactured Articles or Derivatives.
Brimstone or sulphnr; pyrites containing sulphur.	Oil of vitriol, or sulphuric acid, the most important of all chemicals.
Nitrate of soda.	Nitric acid and all nitrates.
Salt (common).	Soda; muriatic acid.
Potash salts.	Bichromate of potash, prussiate of potash, and many other combinations.
Nickel ores.	Salts of nickel, for plating.
Chromic-iron ores.	Chromates of potash and soda.
Autimony ores.	Alloys; medicinal salts.
Bismuth ores.	Alloys; medicinal salts.
Copper ores.	Snlphate of copper, or blue vitriol.
Cobalt ores.	Oxide of cobalt.
Iron ores.	Sulphate of iron, or copperas.
Lead ores.	White and red lead; litharge.
Manganese ores.	Disinfectants; chlorine.
Mercury ores.	Calomel; white and red precipitate; vermilion.
Zinc ores.	Oxide of zinc.
Gold.	Chloride of gold.
Silver.	Nitrate of silver.
Innumerable vegetable productions.	Dyeing extracts; alkaloids; acids; and pharmaceutical preparations.
Linseed.	Paints.
Cotton-seed.	Soap; oils nsed in cooking.
Cotton.	Guncotton.
Corn and all cereals.	Glucose; alcohol; starch.
Wood.	Explosives; oxalic acid; potash; acetic acid; paper.
Argol or tartar.	Tartaric acid; cream of tartar.
Borate of lime.	Borax.
Barytes.	Paints.
Chalk.	Whiting.
Iodine.	Sublimed iodine; all iodides.
Limestone.	Lime; carbonic acid.
Magnesia.	Carbonate and sulphate of magnesia.
Ochres.	Paints.
Crude phosphates.	Phosphorus.
Fats.	Soap; glycerine.
Animal matter, such as horns, hoofs, and leather.	Prussiate of potash; artificial manures.
Oils.	Soap; perfumes.
Coal (bituminous).	Ammonia; coal-tar colors; cyanide of potash.
Clays.	Alum.
Cornndum.	Aluminium.
Cryolite.	Alum; soda.
Silica or sand.	Silicate of soda; glass.
Tin.	Tin-salts, for dyeing purposes.
Atmospheric air.	Oxygen.
Water.	Gas; hydrogen; oxygen.

The innumerable variety of combinations made of the raw materials named renders it impossible to state them in any limited space. The variety of raw materials, and of the numberless combinations thereof, gives to the chemical industry a unique position. No other branch of manufacture can approach it in scope, in the necessity for its existence, or in the knowledge required for its prosecution.

The merchandising in chemicals is of a complex character, and is based chiefly on chemical tests, both of the raw materials and of the manufactured articles. The markets of all quarters of the globe are scanned, and supplies, in many instances, are carried in large quantities, owing to the remote points of their production. The chemical industry affords one of the largest sources for transportation to railroad and water carriers, in raw materials as well as in partly finished and wholly manufactured stuffs. In many articles the competition of countries enjoying low prices for labor is difficult to meet. On the other hand, through advantages not enjoyed by foreign manufacturers, considerable exportation of certain chemicals is going on at this time.

The industries or trades dependent upon the manufacture of chemicals may be enumerated as follows:

INDUSTRIES USING CHEMICAL PRODUCTS.

Woolen manufactnre.	Tanning.
Cotton "	Glass manufacture.
Silk "	Soap "
Oil-cloth "	Artificial ice mannfacture.
Explosives "	Pharmaceutical "
Pyroxylin "	Pyrotechnic "
Paint "	Electrical or galvanic manufacture.
Glucose "	Printing-inks manufacture.
Artificial mannres.	Paper manufacture.
Oil refining.	
Bleaching-works.	

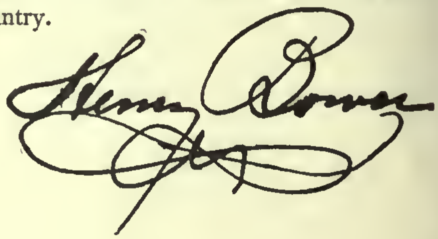
The plant of a chemical works involves the use of a larger area of land than is necessary in other manufactures, as the buildings adaptable to the operations are usually only one story in height, nearly all the work being done on the ground floor, where large furnaces, grinding-mills, and engines can be placed. This is one reason that the capital required for the conduct of these manufactures seems disproportionate to the value of the products, in comparison with other branches of industry. In the eyes of one unversed in the art, a chemical works may appear to be only a mass of rude furnaces, old pots, and rough machinery; yet the establishment may contain appliances of the most costly description, such as underground flues; furnaces of the most modern construction; iron castings fashioned in innumerable forms and weights; copper vessels, coils, and stills; thousands of fire-bricks and other forms of refractory material; steam boilers of the most economical pattern; lofty chimneys; powerful engines; expensive pumps; mills of different kinds for the grinding and powdering of a great variety of materials; leaden chambers for acid making, with tanks, towers, and accessories of the same metal; platinum apparatus and stills for concentrating sulphuric acid; and chemical earthenware, vitrified to resist the action of acids. Indeed, it may be stated that a chemical works of any magnitude contains and requires every manufacturing appliance used or known, excepting those adapted especially to weaving and printing.

Skill and scientific knowledge are needed in the successful conduct of manufacturing chemistry at this time to an extent unthought of by the men who were good workers twenty years ago. The competition of scientific Germany in many departments of chemical manufacture has forced the progress of an industry that was yet in its infancy two decades ago. The laboratory, well equipped with careful workers and good apparatus, has become the pulse of the whole establishment. Each step in the processes is indicated in the unerring results obtained by the analyst and tester, while the huge and costly machinery of the factory is the counterpart, to a great extent, of the miniature equipment of the laboratory. Chemical engineering is an important factor in the adjustment of plant to the exigencies of the difficult and tortuous operations. Some institutions of learning have recognized this fact by adding to their curriculum a course of chemical engineering. The advance in the manufacture of chemicals in the United States during the past twenty years has been marked, not by many changes of processes, but essentially by the new appliances furnished by engineering skill.

The processes used in making chemicals are almost as varied as are the articles produced, but certain leading steps are essential to all, as grinding, furnacing, dissolving, separating, evaporation, filtration, and crystallization. The laws governing chemical constitution are closely followed at each step, and the processes improved and revised, from time to time, by the aid of mechanical contrivances. These changes are rendered more and more necessary as the strong competition of the age sweeps away old and unsuitable appliances.

Many chemical operations demand a long time for the production of finished material. Crystallization is of slow growth in many instances, and decomposition takes place very gradually in others; therefore another reason presents itself for the abnormal amount of capital required to carry on this branch of industry. Both crystallization and decomposition are hastened or retarded by many physical conditions; heat and cold, intense motion, and absolute quietude are in their turn called to the aid of the chemist. When we speak of crystallization we should bear in mind the fact that by this process the great purity of commercial chemical salts is obtained—sometimes, it may be, by frequent dissolvings and as many distinct crystallizations.

The chemical industry takes rank as the fourth among the great manufacturing divisions of the country, the three preceding it being (1) iron and steel, (2) woolen goods, and (3) cotton. (It may be well to explain that cattle killing, the making of clothing, and of boots and shoes, and any other assembling industries are not considered manufacture proper.) The chemical industry represents a diversity of interests such as center in no other department, and it affords to the United States a source of activity for labor, skill, and capital that is highly encouraging to those who have pride in the progress of their country.



CHAPTER LXIV

THE LEAD INDUSTRY

LEAD was known, probably, to the earliest peoples of the earth. Its use antedates written history, and its abundant occurrence in nature, taken in connection with the ease with which it is reduced from its ores, leads archæologists to infer, even when little mention and few traces are found, that the ancient nations were familiar with its properties. Egypt, when the pyramids were building and the golden serpent of the Pharaohs still represented living royalty, knew the plumber's metal and used it, either as an alloy for her wondrous bronze, or in native form for small images and amulets. The armies of Thotmes III. brought it back with their spoils from Mesopotamia, and made it into sling bullets, the Egyptian slingers using it, as did the Persians, and later the invincible legions of Greece and Rome. Babylon used lead to render moisture-proof the famous hanging gardens; Troy, ere Hector fell, and Priam, saved by the most dutiful of sons, became a wanderer, made images of lead; and the Phenician mariner, steering his bark across the sea by the glittering constellation of the Little Bear, not only carried it in his hold, consigned to the great storehouses of Sidon and Tyre, but the hollow tubes of his anchors were weighted with it as well.

Greece and Rome knew lead as well as we of to-day. Conquered Britain yielded to the Roman not only the "imperial tenth," but her immense stores, which produced thousands of tons, and which Rome claimed, in fee forceful, and took. Spain also yielded the Romans thousands of tons, and the mines of the Urals were works of antiquity when Cæsar was a child. Nearly every land on earth found more or less lead within its borders, and the mining of this metal in a small way was almost universal at the time America loomed up before the European imagination as the world's El Dorado. Naturally so base a metal as lead was not the objective treasure of the adventurous miners and metallurgists who first struck their picks into American soil. Gold and silver they sought, and if for many years they found little, their search at least developed many mines and regions, as perhaps the too easy discovery of the yellow metal they coveted might not have done.

The first American lead discovered, by white men at least, was in 1621, in the vicinity of Falling Creek, near Jamestown, the original English settlement in Virginia. Iron-smelting works had been erected by the London Company, and an expert metallurgist named John Berkeley was put in charge. Berkeley, in addition to his services rendered to the company, did a little prospecting on his own account, which developed the existence of a vein of galena —the sulphide and commonest ore of lead. He worked this secretly, and supplied his neighbors with lead for bullets and other purposes; but cupidity caused him to keep the location of the vein a secret, so that when, a year or two later, he was killed by Indians, his secret died with him. A few years later a friendly Indian disclosed the location of the old mine, and the lead deposits of Virginia have been worked more or less ever since, although the output has never been very great. Lead was also early discovered in Connecticut and Massachusetts, and by the middle of the last century valuable workings were open in New York State. The lead-mines of the East, however, have never been of such importance as those of the great central and Western regions of the Upper Mississippi and in Missouri, which were early developed by the French. The lead-fields of the Galena district, comprising portions of Iowa, Illinois, and Wisconsin, which have been among the most productive in the world, are believed to have been first discovered and worked by an Indian trader named Nicholas Perrot, who explored from the Canadian settlements of the French as far as the river Des Moines during the last of the seventeenth century. By 1690 the Indians living in the regions about Galena were smelting and selling lead to the French traders. The region contiguous to the present city of Dubuque, which was one of the richest lead districts in America, was also first worked by a Frenchman, Julien Dubuque, who settled among and made friends with the Sacs and Foxes in 1774, just prior to the Revolution.

The Indians in 1788 granted to Dubuque the mine he had discovered, known as Prairie du Chien, and in 1796 the grant was confirmed by Baron de Carondelet, the French governor-general of the tract called Louisiana, which included the present States of Missouri, Arkansas, Mississippi, Louisiana, parts of the States of Kentucky, Tennessee, and Illinois, and all the broad lands to the westward. Dubuque worked his mines until his death, in 1809, when the Indians, after burying him with tribal ceremonies in a massive leaden coffin on the great bluff which bears his name, reclaimed them from Dubuque's creditors, and held possession until their removal from the district, in 1832, by the United States government. Dubuque's heirs at once claimed the property, but the government ejected them; and legal squabbles kept the status of the district in a most uncertain condition until 1847.

The mine La Motte, upon the head waters of the St. Francis River, a great lead property, was also discovered by a Frenchman, the famous adventurer and explorer, M. de la Motte-Cadillac, who founded Detroit. La Motte discovered the celebrated Golden Vein sometime between 1715 and 1719; but authorities differ as to the precise year, William H. Pulsifer, in his "Standard Notes for a History of Lead," seeming to incline to the former date. The lead-fields in the vicinity of Potosi, Mo., were discovered about 1720 by Philippe François Renault, and in 1763 the extensive fields known as Mine à Burton were discovered by Francis Burton, who in 1798 granted about one third of his claim to Moses Austin. The latter erected improved furnaces for smelting, sunk the first shaft ever seen in a lead-mine in that district, and began the manufacture of shot and sheet-lead. Around this industry grew up the town of Herculaneum.

The condition of the lead-mining interests of the country in 1795, when the century of which this paper properly treats began, was as outlined above. Minor workings in the Eastern States, while they produced but a comparatively small output, were the only really American interests.

France and Spain, with their respective territories of Louisiana and Florida, had jurisdiction over nearly all the valuable mining lands of the lead region; and even in those districts where the United States had acquired rights, the mining privileges were usually in the hands of the French and Indians, who recognized their value and were slow to part with them. The Indians, in particular, made the rich surface sheets of galena a source of continual profit. Their methods of smelting were crude in the extreme, consisting usually of a small hole dug in the ground and lined with rocks. This was usually located on a side-hill, both for the purpose of getting a strong air-draft, and also in order that a small tunnel connecting with the bottom of the furnace-hole might be dug, through which the molten lead could run off when the galena and fuel were thrown in and fired. Rough pigs, run in a scooped-out hollow of the earth itself, and weighing about seventy-five pounds, were usually made by the Indian squaws and taken to the trading-posts for barter. This method of smelting was wasteful, but with the practically unlimited supply it made little difference, and almost any man who found either a pocket of the "float" mineral or a small vein could mine and smelt it roughly himself. As the surface deposits became exhausted, and the miners had to go deeper, while at the same time improved and economical methods of reducing the ore became necessary, more capital was required and the works became more extensive.

There is probably no ore that reduces more readily than galena, yet at the same time the volatility of the molten lead permits great loss from careless methods. The composition of the ore, which, as before stated, is a sulphide, is about eighty per cent. of lead, frequently carrying more or less silver, and sometimes nickel, cobalt, or antimony, with about seventeen per cent. of sulphur. Simple roasting suffices for its reduction, the sulphur combining at a low temperature with the oxygen of the air, and passing off. This is, in its simplest statement, the process by which lead is extracted from this ore; and either open furnaces with strong draft, or reverberatory furnaces, are used. Unfortunately a considerable quantity of the lead passes off in fumes from the furnace. In remedying this, some of the modern smelting-works have found it profitable to build a very long funnel-pipe, through which the fumes from the furnace are passed before they reach the air. During this passage they are cooled, and a very appreciable quantity of lead in the form of powder is deposited along the pipe.

Another and great discovery was not made in this country until 1838, when cerusite, or the lead carbonate, was found by the American miners to be reducible and a valuable ore. This ore, previously thrown away by the miners, who called it "dry bone," was found in large quantities, and its utilization very greatly increased the annual output during the decade following. Under this stimulus, and the litigation over the more important lead regions having been settled, the output of the mines in the Galena district jumped from 664,530 pounds in 1825 to 54,494,856 pounds in 1845. The decade between 1840 and 1850 witnessed the high-water mark of the lead interests in America up to the time that the Western lead-fields were opened. The rich properties of the Mississippi and in Missouri yielded plenteously, and in their eagerness the mine owners allowed themselves to glut the market, with the inevitable result that prices fell and the entire lead industry received a set-back from which it was some years in recovering. The Jasper County lead-fields, which have built up the town of Joplin, Mo., were also discovered during this decade, in 1848. Operations were carried on in a small way, but no general attention was attracted to this district until a dozen years later, when, in three years, 17,500 tons were produced from these mines. Since then the annual output has been as great as 17,765 tons, and in one year (1884), the disastrous one for all lead interests, as little as 2665 tons.

American lead-mines held but a poor third place among the productive fields of the world, however, until well into the seventies. England and Spain each produced greater quantities of lead than the United States in 1872; but the development, about this time, of the great Western deposits of argentiferous galena, which had been discovered in 1864, changed all this. This rich region, neglected on account of its inaccessibility to a market, suddenly took on life and activity with the extension of the railroads through the territory. In 1877 the Eureka district was turning out nearly 20,000 tons of lead annually; the Utah lead-fields, worked by the Mormons, were producing 15,000 tons annually so early as 1873, and by 1877 the output had increased to 27,000 tons for the year. Colorado was a year later in showing respectable results for her workings, but by 1883 the output of the mines of that State amounted to the tremendous total of 70,557 tons. This marvelous increase was largely due to the cerusite deposits at Leadville, which were first worked in 1878, and from which fully one half of the total lead production of the State was derived.

These Western lead ores were, almost without exception, very rich in silver. While silver in small quantities is found in all galena, and has been extracted even from the ores of the Mississippi and Missouri lead regions in quantity ranging from six to twenty ounces per ton, it was only in the Western mines that the precious metal was found in quantity sufficient to make the lead a by-product so far as relative values were considered. So little was thought of lead, in fact, that in the earlier days, when transportation was more difficult and expensive, the ore was cupeled at the mines, and only the silver brought to market. For this reason the lead output has been more or less dependent upon the silver market, but this is beginning to change. Lead itself has gained a place in the useful arts and manufactures that cannot be ignored, and its supply must be maintained. Owing to this the production of the American mines has been developed to a point far in excess of the figures of twenty years ago. The year following the development of the Western argentiferous deposits the United States was producing as great a quantity as was England in 1872, when she was the great lead miner of the world. Less than ten years later the annual output of the American mines had reached a figure greater than the combined production of England, Spain, and the United States in 1872, and the increase was steadily maintained.

In the foreign commerce of the nation lead has, within the past five years, come to play a far more important part than it ever did before. In 1885 the imports of lead and its manufactures were only $486,436, and the exports $123,466. In 1890 the figures had only increased to $657,658 for the imports and $182,412 for the exports; but the very next year saw a marvelous advance, which has continued ever since. The importation of silver-bearing ores, containing much lead, has also become an important matter, and until the silver repeal bill was passed, and the "bull" days for that metal ceased, Mexico had a great interest in that direction. The figures for the past five years, excluding 1895, for which full reports are not yet published, are as follows:

VALUE OF LEAD IMPORTS, 1890 TO 1894.

Year.	Lead, and Manufacture of.	Silver-Bearing Ore.
1890	$657,658	$7,748,572
1891	2,560,886	8,953,608
1892	3,653,378	9,656,761
1893	5,792,624	11,100,747
1894	6,606,865	6,679,171

The exports during the same period show only a comparatively slight gain, having ranged from $182,412 in 1891 to $638,636 in 1894.

During the sixty-five years between 1825 and 1890 the production of the lead-mines of this country amounted to the almost incredible total of 5,324,794,000 pounds, or, expressed in the briefer figures of commerce, to 2,662,397 tons. The product, as summarized for the same period by the demi-decades, will give, if the previous explanation of causes is borne in mind, the best illustration of conditions, rise, and progress in the lead industry that can be drawn. Up to 1873 lead was almost entirely obtained from the non-argentiferous ores of the Missouri and Mississippi regions; but after 1875 the table specifies the relative quantities from the two grades of ore. The figures given are in the standard short ton:

PRODUCTION OF LEAD, 1825 TO 1894.

Year.	Total.	Non-Argentiferous Ore.	Argentiferous Ore.
1825	....	1,500	....
1830	....	8,000	....
1835	....	13,000	....
1840	....	17,000	....
1845	....	30,000	....
1850	....	22,000	....
1855	....	15,800	....
1860	....	15,600	....
1865	....	14,700	....
1870	....	17,830	....
1875	59,640	24,731	34,909
1880	97,825	27,690	70,135
1885	129,412	21,975	107,437
1890	161,754	31,351	130,403
1892	213,262	31,678	181,584
1894	159,331	37,686	121,645

In the production of the 161,754 tons of metallic lead in 1890 the smelting and refining works employed 6131 men, to whom was paid in wages for the year $4,228,634.15. This sum, together with $5,154,682.04 paid out for supplies and materials, and other charges incidental to the carrying on of the business, brought the total expenditures for the year to $11,457,367.25.

Between lead crude, and cast or hammered into some required form, and lead manufactured, chemically changed, and metamorphosed, there is a great break in time. The chief of all the products of lead manufacture is, of course, the carbonate, which was the psmithium of the Greeks, the cerusa of the Romans, and is the white lead of to-day. As a pigment and base for colors it finds its chiefest use, its well-known body and opacity and ready assimilation with linseed-oil, which is the best of all vehicles for coloring-matters, making it the best substance man has yet discovered for this purpose. Other important lead products are litharge, the yellow protoxide; minium or red lead, which is a combination of the protoxide with a peroxide; orange mine or orange mineral, made by heating white lead; and lead acetate or sugar of lead. There are several other forms in which lead combines, but the substances already given are those of most importance in the arts.

In point of antiquity the oxides seem to have been longer used than the white lead, no traces of which are found in the wall-paints of the Egyptians, Hindus, or other ancient peoples; whereas the oxides are found to have been used both for the glazing of pottery and in colors. White lead was first brought into extended use by the Romans; and Rhodes, the manufacturing center of antiquity, was the place from which the finest was obtained. Roman women used the ceruse as a cosmetic—a use it also found among the Athenian belles; and minium was used as rouge. In these peculiar uses, despite the well-known injurious qualities of lead, the same substances have remained up to a comparatively recent date. White lead was also used by the Romans as a body for their paints, and both it and its manufacture are described by such ancient writers as Theophrastus, about 300 B.C.; Vitruvius, who wrote about two hundred years later; and Pliny and Dioscorides, who filled respectively the records of the two succeeding centuries. These writers all agree in stating that white lead was produced by placing sheets of lead in pots with vinegar or wine lees, and allowing them to stand. This fails to account for the presence of the carbon dioxide necessary to the reaction which converts the lead acetate to the carbonate; but it is certain that this substance was present, for the product was unquestionably white lead. During the dark ages, and up so far as the sixteenth century, there was but little use for white lead. About the latter date its manufacture was begun in Holland by what is now known as the "Dutch process." This process, however, can scarcely have been original with the Dutch, since Theophilus, a monk who wrote about the tenth century, describes it very exactly, and the Saracens, Italians, and Spaniards are all said to have used it. With the addition of stable litter banked around the jars, in which small bits of marble are also placed, the Dutch process differs in no way from that described by Pliny, who says: "The lead is thrown into jars filled with vinegar, which are kept closed for ten days; the sort of mold which forms upon the surface is then scraped off, and the lead is again put into the vinegar until the whole of the metal is consumed."

William P. Thompson.

The Dutch process, whether it dates from Amsterdam or Rhodes, has ever since, however, been the one which, in its elemental principles, but with improvements and technical modifications from time to time, has proved the best and most profitable. Holland became skilled in this manufacture, and England had already established it firmly upon her own tight little island at the time when the century under discussion opened. America, on the other hand, had not one establishment for the manufacture of white lead. What white lead was used during the eighteenth century came from England; but the primitive habits of the community in those early days caused paint to be regarded not only as a luxury, but, furthermore, as a useless one, since timber was far too plentiful and cheap to require preservation at the expense of paint. Neither inside nor out were the buildings of the early colonial townspeople painted, and the log cabins of the settlers needed little such adornment. After the Revolution, however, more luxurious customs and greater pretensions were indulged in by the citizens of the new Republic, and the use of paint became general in the cities. For the body of this paint all the white lead had to be imported from England. The English product at this time was most unblushingly and heavily adulterated, and prices were more than high. So great did the demand become, and so profitable the business to the English manufacturers, that when the manufacture of white lead was proposed and commenced in the United States, the most desperate attempt, resorting to means beyond even the lawful limits, was made to ruin the new American industry. Had it not been for the War of 1812 and the consequent shutting out of British goods, it is highly probable that the white-lead industry would have been delayed for many years in this hemisphere.

The original manufacturer of white lead in the United States was Samuel Wetherill, of Philadelphia, who was also one of the earliest woolen, cotton, and general chemical manufacturers. This enterprising gentleman, who was one of the most prominent members of the Pennsylvania Society for the Encouragement of Manufactures and the Useful Arts, which was established in 1787, began the manufacture of white lead early in the present century. Concerning the exact year authorities differ, —some so widely as to place it in 1789,—but Mr. Pulsifer, to whose "Notes for a History of Lead" I have before referred, takes the authority of a descendant of Mr. Wetherill, and dates the first lead manufactory in the United States from 1804. Shortly after the factory was opened a young Englishman applied for work. A night or two later the factory was destroyed by fire, and the young Englishman left that very morning for England. Gossip always connected the two events. About 1809 the factory was rebuilt, and then began the bitterest struggle any two great commercial interests here and in England ever waged. British lead was put on the market at a price that was absolutely impossible for the American maker to quote. The War of 1812 saved Wetherill from ruin, and under the impetus thus given the industry grew rapidly for a few years, its growth being still further aided by the development of the recently acquired lead regions that Louisiana, as purchased from the French, included. By the census of 1810, Wetherill's factory, which was the only one in the country, was credited with an annual product of 369 tons. Red lead was also produced in small quantities, but the imports of these two products exceeded the domestic production as two and one half to one. In Philadelphia, where the industry began, the second factory in the country was started by John Harrison, at the Kensington Works, about 1810. In the latter year the manufacture of white lead was begun at Pittsburg by Adam Bielin and J. J. Stevenson. A second factory in the same town was started, but proved unsuccessful after a year or two. Meantime an Englishman named Smith appeared in Philadelphia as a manufacturer of white lead, and all five of these firms were struggling against the English manufacturer when the War of 1812 came to their relief.

All of these early manufacturers employed, so far as can be learned, the Dutch process, as previously described. Certain patents for improvements upon it were taken; but the burning of the Patent Office has destroyed all record of them, except that Samuel Wetherill devised and secured a new and better method "for setting the beds or stacks." Stable litter as the source of the required heat was in universal use. Various new and speedier methods for the manufacture of white lead than those provided by the Dutch process were invented, and in 1814, Welch & Evans, of Philadelphia, patented one by which granulated lead, placed in revolving lead-lined barrels partly filled with water, was ground by attrition, oxidized by the air, and carbonized by the addition of burning charcoal. A factory for the manufacture of lead by this process was built soon after by a Mr. Richards, who had succeeded the Englishman Smith. The venture, like all similar ones, proved unprofitable.

The price of white lead before the War of 1812 was from ten to twenty cents per pound. American manufacturers mainly used the imported pig-lead, and the domestic supply was small. When the importation of the foreign pig-lead was suspended by the war, the price of the native metal took a great jump. The Western lead-fields, however, were either undeveloped or, as in the case of the rich Galena district, still in the hands of the Indians; and a great scarcity of the metal resulted, which caused the price of white lead to advance to thirty cents a pound. The profit inevitably suggested by these figures, together with the general resumption of business that came after peace was declared, gave a fresh impetus to the white-lead industry. During the next twenty years many new works were established, and older ones extended. By 1830 there were twelve establishments in the country, of which eight were east of the Alleghanies. These factories were not turning out over 3000 tons annually, and as the price of white lead, following a temporary glut of the pig-lead market, had declined to nine cents per pound, the total value of the year's output was but a little over $500,000.

One of the great advances made in the manufacture of white lead in this country came about two years after this, when Augustus Graham, a prominent New York manufacturer of white lead, discovered, by obtaining employment as a common workman in one of the great English factories, the secret of the use of spent tan-bark instead of stable litter as a means of obtaining heat and carbonization. This knowledge worked a considerable change in white-lead manufacture, and by 1840 the annual product had increased about sixty-six and two thirds per cent. in the whole country. Prices, however, had advanced but little, white lead being quoted at only a cent a pound more than in 1830. The sudden bursting forth into prosperity and productivity of the mines in the Galena and Missouri lead regions, which occurred during the fifth decade, had an immediate effect upon the white-lead industry. The supply was unlimited, but the question of transportation was a serious one. Waterways were, of necessity, considered the only freight routes available, and Europe was far nearer to the Eastern cities than those towns situated to the westward of the great bar of the Alleghanies. From the Missouri lead-fields, and the Galena region as well, the pig-metal was boated down to New Orleans, and there transhipped by vessel to New York. Not only was it a long journey, but it was a costly one as well; and in some sections, not readily within the distributive field of New York or the large coast cities, other means were adopted. At Buffalo, especially, I recall the method of transportation by which the Galena district pigs were landed at the factories of the corroders. The manufacturer had to keep an agent at the mines, and buy daily, as auctioned off, the product of the day's smelting. When an agent had thus purchased a sufficient quantity he secured a caravan of prairie-schooners drawn by oxen, and started it across the open prairie to the nearest settlement and lake port, Milwaukee, where the lead was shipped in sailing vessels and taken to Buffalo.

The ten years preceding and those during which the Civil War was raging marked no important advance in the lead industry. The introduction of the manufactured zinc oxide as a substitute for white lead, together with the advance in the price of metallic lead under the strong influence of the war-time demand, checked the use of the manufactured product until the return of better times at the conclusion of the war. Furthermore, adulteration, which had long been regarded as permissible by white-lead makers, came to the condemnation it deserved, and the purer product developed by this sentiment had its immediate effect in raising the manufactured lead in the public estimation. It was about this time, also, that "sublimed lead" came to be introduced for use as a substitute for white lead. The discovery resulted from certain unsuccessful experiments made by two gentlemen named Lewis and Bartlett, in the direction of an improved and speedier process for manufacturing white lead. It is a singular fact that the manufacture of white lead is one of the few of the useful arts in which modern science has so far been able to make little appreciable advance. The monkish presbyter Theophilus, in the ninth century, knew, as did the Rhodians before him, and the Dutch nearly seven hundred years after him, the basic principles of the manufacture of white lead; and if the empirical knowledge of that early day has been replaced by formulated knowledge, it still has accomplished but little to recompense its added learning. Englishmen, Frenchmen, Germans, and all other nationalities have experimented with the subject abroad, and Americans have invented and patented at home, but all to no purpose. The original Dutch method, with certain improvements in detail and manipulation, seems destined to survive this century, as it has the many before it.

The white-lead production of the United States, as followed by decades from 1810, while it can only be given for much of the time in approximate amounts, is still sufficiently exact to show the steady growth which has brought it to prosperity and prominence in the industrial affairs of the nation. As accurately as can be obtained, the figures are:

WHITE-LEAD PRODUCTION, 1810 TO 1890.

Year.	Tons.	Year.	Tons.
1810..........	369	1860........	15,000
1820..........	...	1870.........	35,000
1830..........	3,000	1880	50,000
1840..........	5,000	1887.........	65,000
1850..........	9,000	1890.........	75,000

The lead oxides, of which a considerable quantity is annually produced in the United States, were, like white lead, first manufactured in the western hemisphere at Philadelphia, where, before the War of 1812, there were at least three establishments. Their manufacture has changed little during the last one hundred and fifty or two hundred years, during which time they have been recognized products of the English factories, and have also been made in Holland, and to some extent in France. In making red lead, which is, perhaps, the most important of the oxides, the method is simply to heat litharge in a reverberatory furnace, which immediately changes it from yellow to red. In this country this method is the one commonly employed, although some works substitute a bottle-shaped iron cylinder for the reverberatory furnace. Red lead and litharge are usually manufactured at the white-lead works, and there are but few separate establishments for the exclusive manufacture of the lead oxides. Orange mine or orange mineral, a form of lead oxide produced by heating white lead, is another of the useful products of the metal; and the valuable astringent known in medicine as sugar of lead, and chemically as acetate of lead, being obtained by the simple treatment of lead with acetic acid, and without the presence of carbon dioxide, is still another product well known to the commerce of to-day.

The personnel of the white-lead industry since its establishment in 1804 has been an interesting one, and has included many men of the rarest business abilities and most unswerving integrity. For a comprehensive summary of it up to within ten years I acknowledge my indebtedness to the author of "Notes for a History of Lead." According to this authority there were, outside of those firms already mentioned, only two established during the second decade—the Cincinnati Manufacturing Company in 1815, and Barney McLennon's works, in the same city, in 1820. Dr. Vanderberg, of Albany, was experimenting with its manufacture by improved processes in New York in 1820; and ten years later, having come back from experiment to the old-time Dutch process, he, together with David Leavitt and John and Augustus Graham, under the title of the Brooklyn White-Lead Works, were operating successfully. This company was incorporated in June, 1825. Another Brooklyn firm of early establishment was the Union White-Lead Company, started by the Messrs. Cornell about 1827. The Salem Lead Company in 1824, and Francis Peabody in 1826, established the white-lead industry in Salem, and Robert McCandless and Richard Conkling established works in Cincinnati during this same decade. In 1830 there were about a dozen white-lead factories in the United States, and eight of these were east of the Alleghanies, including, besides those just mentioned, Lewis & Company, Wetherill & Sons, Harrison & Brothers, of Philadelphia, and Hinton & Moore, of New York, who also handled large quantities of the imported article. During the next decade there were started the Boston Lead Company, in 1831; Great Falls Manufacturing Company, in 1832; Jewett, Sons & Company, at Saugerties, in 1838; Gregg & Hagner, at Pittsburg, in 1837; and Reed & Hoffman, at St. Louis, in 1837. This latter establishment, taken shortly afterward by Henry T. Blow, became in later years the Collier White-Lead and Oil Company.

From 1840 to 1850 was a period of the most rapid growth for the white-lead industry. Among the larger works established during this decade were: the Atlantic White-Lead Company, of New York, founded by Mr. Robert Colgate; John Jewett & Sons' Staten Island works; the Great Falls Manufacturing Company, changed by Batelle & Renwick to the Ulster White-Lead Company; Suffolk Lead-Works and Norfolk Lead Company, of Boston; the Forest River Lead Company, of Salem, successors to Francis Peabody; Thompson & Company, of Buffalo; B. A. Fahnestock & Company, of Pittsburg; Eagle White-Lead Works, at Cincinnati; and William Glasgow, Jr.'s, works, at St. Louis.

The succeeding decade saw less increase than the one preceding. William Wood and T. J. McCoy took the Eagle Works, of Cincinnati; the Niagara White-Lead Company started at Buffalo, and Wilson Waters & Company at Louisville. This was but a lull, however, that was to give place to renewed activity. From 1860 to 1870 there were founded, among others, such great establishments as the St. Louis Lead and Oil Company, which succeeded the

O'Fallon White-Lead and Oil Company in 1865; the Southern White-Lead Company, established by Platt & Thornburg in the same year; Goshorn Brothers, who secured the McCandless establishment in Cincinnati, and afterward organized it as the Anchor White-Lead Company; the Eagle White-Lead Company, also of Cincinnati; the Shipman White-Lead Company, organized at Chicago by D. B. Shipman; J. H. Morley's works, at Cleveland; Haslett, Leonard & Company, who succeeded Waters in Louisville; Lewis & Schoonmaker, of Louisville, who later sold out to T. J. McCoy and the American White-Lead Company; the Western White-Lead Company, in Philadelphia; the Cornell Lead Company, which succeeded the Niagara Company, at Buffalo; four branch establishments of Fahnestock & Company, at Pittsburg; Hall, Bradley & Company, of New York and Brooklyn; the Salem Lead Company, a new company organized by Mr. Francis Brown at Salem; and the Maryland White-Lead Company, which was established in Baltimore in 1867. In Cincinnati Frederick Eckstein became interested in the business of Townsend Hills.

Since this period there have been comparatively few large establishments founded. Even so early as 1870 the tendency toward consolidation rather than individual extension was already noticeable, and the two largest of the plants founded during the succeeding decade were both absorbed by the older companies.

The manufacture of white lead in former years had been very profitable, which had induced the building of an unnecessarily large number of factories in different sections of the country, which in turn brought on severe competition, and many of the factories became unprofitable. In order to lessen this competition various devices of association were successively tried, and failed, until at last, in 1887, a number of factories came together in an association practically similar to the then existing Standard Oil Trust. The association, however, was unsuccessful, and in 1889 my friends H. H. Rogers and the late Charles M. Pratt, both of whom had had large experience in the lead and paint business, knowing that I was about to retire from my association with the Standard Oil Company, called my attention to the fact that the National Lead Trust were desirous of my becoming interested with them. At that time the suggestions were declined, because of the totally inadequate capital of the existing concerns, the extreme and foolish capitalization, and the disorganized condition of the management. Subsequently arrangements were made by which other great factories of the country, consisting of the John T. Lewis & Brothers Company, Philadelphia; the Salem Company, of Boston; the Atlantic Company, of Brooklyn; the Collier and Southern Companies, of St. Louis, including the Southern Company, of Chicago, and the Maryland Company, of Baltimore, were acquired. These properties came in, necessarily, on the same basis of capitalization as in the preceding organization. The writer then became president, and shortly thereafter acquired the important works of Armstrong, McKelvy & Company and the Davis-Chambers Company, at Pittsburg; and by the end of that year the then National Lead Trust manufactured about eighty per cent. of the country's production of white lead, seventy per cent. of red lead, fifteen per cent. of linseed-oil, ten per cent. of sheet-lead, nine per cent. of lead pipe, and sixty per cent. of lead acetate, together with sundry other of the important manufactures of lead. These, together with the large smelting and refining plant at St. Louis, smelters at Socorro, N. Mex., and Leadville, Colo., and sampling-works in different parts of Mexico, were included in the great organization with which the lead industry of this country entered upon the last decade of the century.

The real work of consolidation, sifting out, and practical organization may be said to have then fairly commenced. Many small factories operating in a desultory way, with frequent stoppages, were closed for good; works in favorable localities, and capable of producing the best results in any one direction, were devoted to this branch, enlarged and improved, and the best class of employees selected and taken to the more important works. New machinery and more healthful appliances were at once put into use. Schools for mutual education among the more important manufacturers were organized, and the expert knowledge of each placed at the service of all.

Efforts to reduce the unwieldy capitalization culminated successfully in 1891, when the Lead Trust was dissolved, and a new company, organized under the laws of the State of New Jersey, with a capital of $15,000,000 preferred and $15,000,000 common stock, took its place. Before the organization of the National Lead Company all the floating debt of the various corporations included in it had been paid off, and soon after its organization the large mortgages which had existed upon some of the works were liquidated, and the National Lead Company enjoys the unique position of never having borrowed a dollar. Economics have been introduced in every department, and the character of all manufactured products marvelously improved, and at the same time placed upon the market at prices lower than ever before known, and the fact demonstrated that honest management in a combination of interests is of greater advantage to the shareholder for profit, and to the public for cheapness, than an unintelligent system of piratical competition. With practically the same methods as those employed by the ancients, the industry has risen, through the sheer executive intelligence of the present age, until it has assumed the proportions seen to-day. Less than a century old, the lead industry in America ranks with that of any nation in the world; and from our boundless mineral resources will probably some day be drawn the greater part of the world's supply.

W. P. Thompson

CHAPTER LXV

THE SALT INDUSTRY

THE early history of salt making in this country is veiled in much obscurity. The principal centers of population on the Eastern coast were in great measure supplied with the article imported from England, the price of which was exorbitantly high, and during times of disturbance with the mother country was almost unattainable. In the early part of the eighteenth century small saline plants were established along the Atlantic coast from Massachusetts to Virginia, and salt was made directly from the water of the sea, either by direct open-air evaporation in broad vats, or in smaller kettles with the aid of artificial heat. Fortunately fuel was plentiful and cheap, and, as the process was simple in the extreme, special experience and skill were not requisite. Almost every family, therefore, on the seaboard was its own salt maker, just as, within the writer's recollection, people residing at a little distance inland were their own soap makers and candle makers.

While those living on the coast could always obtain sufficient salt without difficulty, the settler advancing westward could not carry with him a very abundant supply, owing to his lack of capital and of means of transportation. As he penetrated the wilderness, however, he came in contact with the Indian and the beast of the forest, to whom salt was just as necessary as to civilized man. From them he soon learned the sources of their supply, and, locating at one of the "licks" or brine springs, set up his kettle, poured in his brine, and lighted his fire. In a short time he could thus prepare a supply of salt sufficient for his needs during several months. These brine springs were found at various localities in nearly all of the Middle and Western States invaded by the early settler, but none of them was as rich in saline constituents or as ample in supply as those which were found in the country of the Onondagas.

Upon the coast, salt making, by both solar and artificial heat, was extensively practised until after the War of 1812. The restrictions on our commerce being then greatly relieved, salt from foreign countries was more freely imported; and this, together with increasing supplies from the Onondaga district, led to the reduction in price to fifty cents per bushel, and even less. It was then found cheaper to buy the salt from merchants than to continue its manufacture in the primitive manner at the coastwise stations. These, then, were gradually abandoned, and the Eastern and Middle States obtained their supply almost exclusively from the two sources above mentioned. This could hardly be otherwise when we consider that the water of the ocean contains only about two and one half per cent. of salt, as against the brines of the Onondaga salines, which held in solution from fifteen to seventeen per cent. of the precious substance. With salt selling, at the present time, for six or seven cents a bushel, the use of the word "precious" in such connection may seem extravagant; and yet salt, absolutely essential as it is to human life, has been in former times and among certain peoples the general unit of value, and has even, further, served the purposes of a circulating medium.

The American salt industry proper dates back to just beyond the last decade of the last century, when the State of New York, with enlightened foresight, purchased in 1788 from the Indians the Onondaga salines, embracing an area of about 15,000 acres. In the winter of 1789 and 1790 Nathaniel Loomis made 600 bushels of salt on the State reservation. Others followed, and in 1797 the State deemed this infant industry of sufficient importance to put in force laws and regulations regarding the control and management of salt making in this field, a Superintendent being appointed to see that they were properly carried out. During the first year the product of this field amounted to about 25,000 bushels, equal to 700 tons, of 2000 pounds each, of what is now graded as common fine salt.

The general arrangement made by the State with salt makers was to lease them the ground, on which the lessees erected the necessary structures. The State then pumped the brine and delivered it to the boilers, who paid a royalty of one cent for every bushel of salt obtained from the brine. Even with the early methods of salt making then in vogue (chiefly boiling in kettles) the manufacture was very profitable, and many were induced, on this account, to undertake it. This led to the rapid development of the field, and a corresponding increase in the output, which as early as 1820 amounted to about 13,000 tons. At about this time it is stated that the manufacture of solar salt was commenced on the State lands; but I fail to find any estimate of the quantity produced until 1841, in which year 6000 tons of solar and about 87,000 tons of the other grades were accounted for to the State. The production of salt steadily increased until 1862, when it amounted to about 56,000 tons of solar and 200,000 tons of other grades. From this time there was a gradual diminution in the product of fine salt, which altered the proportions theretofore existing, until in 1880 84,000 tons of solar and about 155,000 tons of other grades were being made. Since 1880 there has been a further falling off in the output, and the official figures for 1894 indicate a production of about 66,000 tons of solar and less than 25,000 tons of other grades. The seemingly immense output of the Onondaga or Syracuse district would doubtless have become still greater had it not been for the development of a field in Michigan, which soon surpassed its older rival in the amount of its output, and materially restricted the territory in which the latter could compete to advantage. The second important blow given to the Onondaga industry was the development of the western New York salt-field, in Wyoming, Genesee, and Livingston counties, embracing what is known as the Warsaw and Genesee districts, the latter being in Livingston County and bordering on the Genesee River. In these districts salt of various grades is made by evaporating the brine with artificial heat, the amount of solar salt being insignificant. As an offset to this, four large shafts have been sunk, three in Livingston and one in Genesee County, from which immense quantities of salt have been brought to the surface in lumps or blocks, some of which are reduced by grinding to smaller sizes. The output of this field increased from 16,000 tons in 1885 to 324,800 tons in 1893. The evaporating-works in western New York possessed a great advantage over those near Syracuse, as they were able to obtain brine holding from twenty-three to twenty-five per cent. of salt, which in practice meant that two tons of fuel would produce as much salt there as three tons would at Syracuse. As a partial offset to this, Syracuse, by its location on the Erie Canal, was enabled to transport its product to the seaboard more cheaply than its rivals. Despite this slight advantage in freight rates the fine salt industry at Syracuse has been obliged to yield the field to competitors in other places, and with no present prospect of revival in this branch of its trade.

The Michigan salt-fields, which were the second of any importance to be developed, possessed the very great advantage of cheap fuel, using, in most cases, sawdust, chips, slabs, and other refuse from the lumber-mills. The first salt made in Michigan on a commercial basis was in 1860, and during the last half of that year 560 tons were made. This was increased in 1861 to nearly 18,000 tons, and the output gradually augmented, until the maximum point (about 550,000 tons) was reached in 1887. Since then there has been a somewhat lessened product. Besides the Michigan fields there were other important regions discovered in the West. The Kansas field was opened with a product of about 22,000 tons in 1888, increasing to 178,000 tons in 1893. In California the product, which was almost wholly solar salt, increased from 30,000 tons in 1886 to 41,000 tons in 1893. During the last two years, however, finer grades of salt have been manufactured in that State. In Ohio there are several salt plants, the principal one of which, at Cleveland, enjoys exceptional facilities in the way of cheap water transportation for its product. The output of the State for 1893 amounted to about 70,000 tons. In Utah the production of salt increased from about 15,000 tons in 1883 to nearly 200,000 tons in 1892, dropping back in the following year to about the output of 1883. This was due to the shutting down of the silver-mines, which had drawn their supply of salt from this district.

The development of the salt industry in Louisiana reads almost like a romance. About eighty years ago, a Mr. Marsh, desiring to obtain a well of fresh water on an island of his, known as the Petite Anse, after digging a few feet, found instead a well of brine. By evaporating this he obtained considerable salt, and upon exploring his possessions farther he discovered a bed of rock-salt about fifteen feet beneath the surface. This salt was mined in the usual way, and as the surface of the rock was further exposed, various aboriginal relics, such as stone axes and other implements, were brought to light, showing that the same mines had been worked hundreds, perhaps thousands, of years before. The Louisiana salt deposit has never been an important factor in the American trade, except during the War of the Rebellion, when the Confederate States, shut off from purchases in the Northern market, drew largely on these mines, running the price up to $30 and even $90 a ton. At the present day it probably does not command over $2. During the past ten years the annual output of the Petite Anse mine has varied from 25,000 to 50,000 tons. In addition to those above mentioned there are a few other localities in which salt has been manufactured on a commercial scale, but the output is too limited to demand separate mention. The United States reports give the total production of salt for the year 1893 as 11,816,772 barrels, equivalent to 1,654,040 tons; but in my judgment New York is credited with 1,000,000 barrels more than the facts will warrant.

Salt is obtained in this country in several different forms and ways. From the mines it comes in blocks, and from strong brines it is obtained by evaporation or boiling by solar or artificial heat. Boiling is conducted under four distinct systems: (1) in long wooden troughs containing steam-pipes (these are called grainers, and the system is distinctively American); (2) in large open pans of iron or steel, with direct heat beneath them; (3) in large vacuum pans in which the brine is boiled at a comparatively low pressure; (4) heating in closed tubes, at a temperature much higher than that at which brine boils under ordinary atmospheric pressure. As the writer is a manufacturer using two of the above-named systems, he deems it improper in this place to comment on or discuss the merits of the methods adopted by others. Boiling in kettles was at one time an important feature of the Syracuse field, but has never been generally adopted elsewhere.

The grades of salt prepared for market in the United States comprise rock, solar, common fine, and common coarse, which are not artificially dried after manufacture; and so-called "dairy" salt, which is dried and either sifted or ground. The term "dairy" salt is generally used in too comprehensive and loose a sense, and is made to include salt prepared for table use rather than for the dairy. A strict dairy salt specially prepared for the use of butter and cheese makers is the most expensive grade manufactured, selling for a little over half a cent a pound at the works, and costing the consumer about one cent a pound, including package, at most points east of the Mississippi River. For table use this price seems too high, for neither merchant nor consumer will pay it. The greater part of the table salt used in this country is sold by the manufacturers on a basis of about $3 a ton. At $5 a ton there are comparatively few buyers, and at $10 a ton (half a cent a pound) there are none. (These are car-load lots, free on board, and exclusive of the cost of barrels, sacks, or other packages.) This is especially true of large cities like New York and Chicago, while in smaller cities and country towns the merchants are more generally willing to pay higher prices, thereby securing better qualities of the article. For a strict dairy salt there is but little market in New York City, this point not being a distributing center for this grade. Chicago, however, takes large quantities of the best qualities. From that city it is distributed to the large creameries and cheese factories of the West.

The uses of salt are manifold. Many, perhaps, look on it simply as a condiment, or as a preservative of food, butter, cheese, beef, pork, and so on. Its other uses, however, are extensive and important. Hide salting, bottoming of ships (to prevent decay of the wood), acid making (muriatic), and salt-cake (used in the manufacture of glass), soda-ash, bleaching mixtures, soap making, and silver smelting, all make their demands on the salt deposits of the country. The farmer also feeds it to his stock and spreads it on his land.

The salt industry of the United States has had its ups and downs, and history repeats itself wherever a new location is selected for its development. In the Onondaga region salt making was for many years highly remunerative, attracting capital so freely that in course of time upward of 100 firms or corporations made this the seat of their operations. The inevitable result of this was a general fall in prices, the profit on each bushel of salt becoming smaller and smaller. To meet this each operator increased his output to the limit of his resources, thus aggravating the difficulty, until finally it became a question of the survival of the strongest; the only alternative being a combination of all interests under one efficient management. The manufacturers of fine salt solved the problem of existence many years ago by pooling their interests, forming in 1860 the American Dairy-Salt Company. This concern for twenty years or more received reasonable returns on its investments, but when called on to compete with the stronger brines of Michigan and western New York was obliged to yield to the inevitable, and some three years ago these interests were put

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into the hands of a receiver. The manufacturers of coarse salt at Onondaga in like manner formed a combination, under which their plants are still operated.

In Michigan the vast and rapid development of the territory led to a combination of a majority of the manufacturers, under the name of the Michigan Salt Association, which controlled all sales and fixed all prices. This was well enough until western New York entered the field. The manufacturers of this district wanted the trade that formerly had been supplied by Syracuse and Michigan, and made prices sufficiently low to attract a great deal of it. Not content with this, they entered into the most intense competition among themselves, until the price was brought down so low that some were forced to the wall. Here also attempts were made to harmonize the diverse interests and place prices on a just and equitable basis. Selfishness, dishonesty, and inefficient control rendered these attempts nugatory. Of the Kansas field the same story might be told, and no one field has yet found an effective means of controlling the industry in its own district.

When we consider that any one of the States of New York, Ohio, Michigan, and Kansas is capable of supplying, and desires to supply, the entire country, we need not be surprised that a good article of common salt may be bought at almost any of the manufactories in our country for about $2 a ton. The superintendent of the Onondaga Salt Springs, in his last report to the legislature of the State of New York, correctly expresses the situation in the following words: "The past season has not been remunerative to those engaged in the manufacture of salt." A similar expression could, we believe, be justly employed in connection with the salt industry of the entire country. The Ohio field, with enormous resources in both salt and money, also wants its share of the business. The general outlook for the salt industry, therefore, is not very encouraging. Two attempts have in recent years been made, by drawing in the aid of foreign capital, to consolidate the native salt interests. The first effort failed; and the second, when on the verge of fruition, came to grief in consequence of the failure of certain land speculations in South America.

Foreign competition was for many years held in comparative check by a moderate duty on the imported article. For a little over a year, however, salt has been admitted free. The effect has been a very decided increase of importation and a corresponding decrease of home manufacture. As the domestic prices were already very low, there was very little appreciable gain to the consumer, and some of the works have shut down, and their employees have been deprived of this means of gaining a livelihood. Without having accurate figures on which to base an opinion, I hazard the estimate that about twenty per cent. of our salt operatives have been thrown out of employment, while the wages of the remainder have been reduced by about the same percentage. The sums thus lost to the American artisan have gone in part to the middlemen; and in part to the salt workers of England, the coastwise inhabitants of southern Europe, and the negroes of the West Indies. It may be stated that at the present time the salt factories of England are getting from $2.50 (ten shillings) to over $3 (thirteen shillings) per ton of 2240 pounds for common salt. As the freight from Liverpool to American ports is less than half the freight from the New York State fields to the seaboard, the removal of the duty places our workers at a great disadvantage, and has absolutely compelled the reduction of wages. Comment is needless.

CHAPTER LXVI

THE BISCUIT INDUSTRY

THE history of the biscuit industry in America for the past one hundred years is the story of a phenomenal development from an almost complete obscurity to the wide-spread and well-known conditions of to-day. Perhaps no other single industry is so far-reaching in its sources of supply, or enters into so many homes with its perfected product, as that under consideration. Great difficulty is experienced in procuring early statistics in relation to the biscuit business, as those who were engaged in it during the first part of the century have all passed away and have left no written records. Tradition, therefore, is responsible for almost all our early information.

The name "biscuit," derived through the French from the Latin, means "twice baked," and had, according to Gibbon, its origin in the fact that the military bread of the Romans was twice prepared in the oven. As applied to the product of bakeries, this term was brought from England to America, and came into general use here probably not much earlier than the middle of the century. In Europe all articles of food in the shape of small cakes made from flour, with sweetening or flavoring added, have always been and still are called "biscuits." Goods of this variety, however, were at first unknown in the United States, and the term generally applied to the first crude productions made of plain and unsweetened dough was "cracker." This latter name has ever since retained its significance in this country in connection with the plain, usually crisp, unflavored grades of goods, which last, however, when introduced much later into Europe, were there all absorbed into the generic title "biscuit," the name "cracker" falling into disuse. We have gradually adopted to some extent in America this more sweeping classification, but the distinction between the specific name "cracker" and the general term "biscuit" it is well to bear in mind.

The first cracker produced in the United States, so far as known, was pilot or ship bread, a large, round, clumsy, crisp affair, which supplied the demand of the merchant marine for an article of food that would, unlike ordinary bread, keep for a prolonged period. Subsequently another variety was originated, the cold-water cracker, which differed from the first chiefly in its smaller size, more compact texture, and greater hardness. For a long time these two crackers were the only goods known to the trade. They were both made of unleavened dough (flour and water and a little salt), mixed and kneaded by hand; and each cracker was rolled out and shaped separately before being placed, one at a time, on a long-handled sheet-iron shovel or peel, and transferred in order to the floor of the oval-shaped tile oven then in use. It was not until some time later that raised or fermented dough was used in the manufacture of crackers, and it is only within the past fifty years that any great variety has been produced.

The first cracker bakery in the United States of which we have any trustworthy record was that of Theodore Pearson at Newburyport, Mass., in 1792. His specialty was the pilot or ship bread already spoken of, and in that quaint old town the manufacture is still carried on, the name Pearson having long been a household word in all that part of the country. At Milton, Mass., in 1801, Joshua Bent erected his first oven, which doubtless was a small affair, as it was carried on no more than three days in the week by himself and family, the product then being loaded into his wagon and sold in the surrounding towns. This was the beginning of the baking of the celebrated "Bent's water-cracker," which has achieved a more than national reputation. A little later, in 1805, Artemas Kennedy, a great-uncle of Frank A. Kennedy, established himself at Menotomy, now known as Arlington, Mass., afterward moving to Westford, and finally to Milton. The elder Kennedy died in 1832, and in 1834 one of his sons, Jason, started a similar enterprise in Charlestown. Jason's cousin, also named Artemas Kennedy, who was his foreman, came in 1840 to Cambridgeport, Mass., and commenced baking for himself. Continued success marked the business until 1861, when Mr. Kennedy died, its conduct devolving upon his son, Frank A. Kennedy.

In Boston the oldest recorded bakery was that of Richard Austin, who started in Ann Street about 1830. He was succeeded by his brother Thomas in 1843, and the business continued under various titles, in which the names of both J. B. Fowle and A. L. Graves appeared at different times, until it came, in 1885, into the hands of J. W. Austin, a descendant of the first Austin, who still carries it on. At a later date came several other firms of prominence in New England, among them Thurston, Hall & Company, of Cambridgeport; John S. Carr, of Springfield; Parks & Savage, of Hartford, Conn.; C. D. Boss, of New London, Conn.; and the New Haven Baking Company, of New Haven, Conn.

In New York City the oldest existing firm is the house of Treadwell & Harris. Ephraim Treadwell, the founder, began business in 1825. About this date, and during the quarter-century following, the firms of Robert Spier, Erastus Titus, John T. Wilson, C. T. Goodwin, J. Bruen, and J. Parr were also in business in the same city; but none of them is now in existence. Later, in 1850, Garrett B. and Edwin O. Brinckerhoff started business on Madison Street, removing, in 1857, to Elizabeth Street, where the Brinckerhoff branch of the New York Biscuit Company is still carried on. At Albany, N. Y., Belcher & Larrabee established themselves about 1860. In 1871 the firm name was changed to E. J. Larrabee & Company, which gained and still maintains a most enviable reputation. Mr. John Holmes, an Englishman, entered their service in 1870, and in 1877 formed in New York City a partnership with G. H. Coutts, under the firm name of Holmes & Coutts. The famous brands of this house at once forced their way to the front, and gave their owners both fame and fortune. A little later J. R. Vanderveer and D. M. Holmes erected, also in New York City, a model establishment, and in a few years made their names recognized as manufacturers of the highest grade of goods.

Meanwhile, following the lead of New England and New York, other bakeries were springing up all over the country. It would be impossible to present any adequate list of these, and the mention of the following more important firms must suffice: Hetfield & Ducker, of Brooklyn; Walter G. Wilson and A. J. Medlar & Company, of Philadelphia; James Beatty (since gone out of existence), J. D. Mason, and J. R. Skillman, of Baltimore; Haste & Harris, of Detroit; the Margaret Bakery, of New Orleans; C. L. Woodman (no longer existing), D. F. Bremner, and the Dake Bakery, of Chicago; Garneau, Dozier & Company (later known as Dozier & Weyl), of St. Louis, and S. S. Marvin & Co., of Pittsburg, Pa. These and many other smaller houses joined in the race for recognition and competed with one another over the country, sending their representatives from Maine to Oregon and from the lakes to the Gulf, besides exporting no small quantity of goods to parts of South America, Africa, and Australia.

Turning our attention at this point to the mechanical processes employed in the manufacture of the goods which the foregoing names represent, we discover in the twenty-five years during the middle of the century a development no less remarkable than rapid. Until about 1840 machinery in the biscuit business was almost unknown, all the goods being worked up and put into the oven one piece at a time by hand. As the demand increased a machine was finally invented which rolled out the dough, already prepared by hand, into a thin sheet. This sheet, passing along on an endless belt or apron, was cut into the required shape by a stamp rising and falling automatically. In this way about a dozen crackers were cut out at a time, and it became possible to bake five or six barrels of flour a day—an important increase over the preceding average rate of one barrel. Except in size and capacity the ordinary cracker-machines of to-day differ but little from the first crude invention. The machines for making fancy goods, however, were of a later date and of correspondingly greater variety, and must not be confounded with those used for making the plain, unsweetened crackers.

In 1849 the discovery of gold in California, and the consequent demand for crackers as a suitable article of pioneer food, proved a marked stimulus to the biscuit trade. Up to about this time the first machines had been turned by man-power. Gradually horse-power and then steam-power were introduced, and the capacity of the various existing plants enlarged. The War of the Rebellion gave a second great impetus to the industry, and the old-time flat-tile ovens being taxed beyond their capacity to meet the increased demand for hard bread for the use of the army and navy, a mechanical reel oven, consisting of a series of long iron pans revolving in a framework, similar in action to the Ferris wheel, the whole located in a large brick oven-chamber, was invented, and practically revolutionized the cracker business. This change at once caused the capacity of a single oven to jump from the earlier rate of six barrels to twenty-five or thirty barrels of flour a day. The size of these reel ovens has been gradually increased, until at the present time almost all the large plants have a daily capacity of from forty to fifty barrels per oven.

Commensurate with the growth of the business was the increase in the variety of goods produced. In 1840 but five kinds of crackers were known, these being the original pilot-bread, the hard cold-water cracker, the soft or butter cracker, the square soda, and the round sugar-biscuit; the last three differing from the others in containing shortening, butter or lard, and in being the product of a fermented dough. This fermentation or raising greatly increased the lightness and softness of texture of the cracker, and in consequence rapidly met the approval of the public. It will be noticed from the above statement that, with the exception of the sugar-biscuit, no sweet or fancy biscuits were manufactured here at that time. In England, however, fancy cakes of several kinds were on the market; and some years before the War of the Rebellion the two large English firms, Huntley & Palmer, and Peak, Frean & Company, began sending different lines of their fancy biscuit to America. They established agencies in nearly every large city of the Union, even as far west as California, and their goods were sold in all the principal retail grocery houses in the United States. Recognizing the growing importance of this new line of trade, but unable to procure any machinery in this country to supply it, Belcher & Larrabee, of Albany, already mentioned, sent to England in 1865 for the necessary cutters and machines to compete with the foreign imports. Their attempt was successful from the start, and thus began in America the production of sweet or fancy biscuit, which, gradually extending, has become at the present day the most profitable element of the biscuit industry. Shortly after the above date American mechanical skill started into action, and soon H. J. McCollum, of New York, and Denio & Roberts, of Boston, the only prominent makers of bakers' supplies at that time, were equipping the various plants with machinery which, at less cost, rivaled in capacity and operation that of England. In consequence the importation of English goods decreased, and the American varieties, being equally good, almost entirely took their place.

Encouraged by this success at home, several American firms, among them being Holmes & Coutts, Wilson of Philadelphia, and F. A. Kennedy, made an attempt about 1880 to introduce into England and France some of our brands of unsweetened goods; for it will be remembered that in Europe unflavored biscuit—or plain crackers, as we call them—was at that time utterly unknown. For a time this attempt proved successful; but the two large English firms above referred to, finding a growing demand for these new importations, sent men to the United States to study the processes and the grades of flour used here. The result, as may be expected, was but the complement of their earlier experience with their own specialties in America. The English ovens soon produced all the grades of common crackers exported from here, and the American trade, in consequence, declined. Nor has it been possible since that time to revive it to any great extent, owing to the almost prohibitory competition of foreign cheaper tin packages in which the goods must be placed to be shipped, and cheaper labor. American goods are, however, still exported in medium quantities to Africa and South America, while in many of the large cities of Europe some of the specialties of a few firms can be found.

Glancing over the development of recent years, we see a progress and a growth that it is almost impossible to analyze. Originative skill and strict business application have produced machine after machine and established system after system, by which the industry, though perhaps still somewhat short of perfection, has reached a high rank in the scale of magnitude and efficiency. A great many of the processes involved have been practically revolutionized, in almost all instances machinery taking the place of the former hand labor. As an instance, the dough, which until twenty years ago was mixed and kneaded by hand in long boxes, is now entirely prepared in large iron mixers by means of a revolving paddle, some of these machines being capable of handling as much as twelve barrels of flour at a time. Machines, also, to produce an almost endless variety of fancy cakes and biscuits have been invented and introduced, resulting in an ever-increasing list of new goods. When Joshua Bent first established his bakery at the beginning of the century only two kinds of crackers were known. To-day the number reaches in the aggregate at least 500 different grades and varieties. Some of the greatest successes in this increase have been the result of accident, while others are the perfection of long and costly experiment. In this connection must be mentioned the names of J. H. Mitchell, of

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Philadelphia; Ruger, of Buffalo; H. J. McCollum and Fowler & Rockwell, of New York; and Roth & McMahon, of Chicago, all manufacturers of bakers' supplies and machinery, and each taking a part in the invention and development of the mechanical processes introduced. And the end is not yet. New specialties are constantly being produced by the various competing firms, and the skill and ingenuity of all those directly interested are constantly taxed to bring to life some new combination of delicacies, while a host of artists is kept active in originating attractive and suitable labels and coverings for the various packages in which the goods meet the public. To give some slight idea of the magnitude of the biscuit business as it stands to-day, a few statistics may be of interest. Before giving these, however, it will be necessary to add a short account of the recent organization of the biscuit industry.

In 1890 three large companies were formed, comprising together nearly all the largest and most prominent plants in the country. The first of these, the New York Biscuit Company, includes the leading houses of New England and New York, with an immense factory in New York City, the largest and most complete in the United States. The building is 600 feet long, 200 feet wide, and rises six stories in height. Forty ovens are its complement, with an aggregate daily baking capacity of 1000 barrels of flour. The second is the American Biscuit and Manufacturing Company, with one factory in New York City, but doing its principal business in the West and South. The third is the United States Baking Company, its largest factories situated in Indiana, Ohio, and Pennsylvania. These three companies represent an aggregate capital of $25,000,000, and in 1894 their consumption of flour approximated 1,400,000 barrels. A fourth, somewhat smaller, company, the National, has since been formed, which has plants situated respectively in Denver, Colo., Cedar Rapids, Ia., Des Moines, Ia., Rock Island, Ill., and New Orleans, La.

Although these four companies represent almost all the important plants, it is safe to assume that their consumption of raw material and consequent product is not above one half the total in the United States, for in nearly every large city and town from Eastport to California can be found independent bakeries, each with one or more ovens. In the manufacture of biscuit, flour is, of course, the most prominent item; and the importance of this fact to the farmer can be gauged when we calculate that in order to supply the needs of all the cracker bakeries of this country during the past year at least 2,800,000 barrels of flour were required. Reckoning five bushels of wheat to a barrel of flour, and twenty bushels to the acre, we find that the above figure means the product of no less than 14,000,000 bushels or 700,000 acres. But flour, though the most important, is by no means the only raw material of consequence used in the biscuit business. The following figures are taken from the report for the year 1894, and, though rough, are as close an approximation to the actual amounts of materials other than flour as it is possible to estimate:

MATERIALS CONSUMED IN BISCUIT MANUFACTURE.

51,000,000	pounds	sugar.
1,800,000	gallons	molasses and syrup from the West Indies and our Southern States.
34,000,000	pounds	lard.
6,000,000	"	butter.
400,000	gallons	milk.
1,900,000	dozen	eggs.
1,017,770	pounds	honey from Cuba, Florida, California, and the far West.
2,132,330	"	raisins from the Mediterranean and California.
722,439	"	figs from Smyrna.
22,486,636	"	soda.
1,830,982	"	cocoanuts.
18,748	"	almond nuts.
4,145,004	"	salt.
814,598	"	currants.
408,510	"	ginger.
7,128	gallons	extract vanilla.
564,034	pounds	jellies.
70,764	"	almond paste.
15,936	"	oil of lemon and orange.
230,545	"	chocolate.
73,988	"	cream of tartar.
97,770	"	apricots.
21,306	"	citron.

To these figures must be added the following, which enable the finished goods to properly reach the consumer: 10,000,000 wood boxes; 7,000,000 barrels; tin to the value of $250,000, made into cans and packages; together with 5000 tons of paper and pasteboard. To handle all these materials and prepare the product for market an army of workers is required. For all the heavier labor, mixing and baking, men are employed; but the packing, labeling, and some portions of the fancy or iced work are done by skilful-fingered girls. Traveling salesmen visit every portion of the country for orders, and in the large cities drivers by the hundreds, with handsome wagons, make daily and weekly rounds, supplying the trade with the factory product. The New York Biscuit Company alone has 2500 operatives, besides 350 salesmen and drivers; and the total number of hands engaged in the various processes of the biscuit industry in the United States will probably reach not less than 25,000.

Not a freight-train or steamer of any principal line but carries these goods over the country. Not a yacht skims along our shores, not a vessel crosses the ocean, without carrying biscuit in greater or less variety in its store-room. Not a hotel would think its menu complete without the after-dinner coffee with crackers and cheese. Not a picnic party would arrange for an outing without calling upon the grocer for its supply of biscuit. Not an afternoon tea, luncheon, or other social function would be complete without the dainty novelties so lavishly supplied by our leading bakeries. When we add to this the daily home consumption, and the constantly increasing exports to the West Indies, Central and South America, which are following closely on the growth of political alliances between the American republics, the value and importance of the biscuit industry to the country is appreciated. No field affords better opportunity to intelligence, genius, and business enthusiasm. The century which is closing has recorded great achievements, but that which lies ahead is equally full of promise.

Frank A Kennedy

CHAPTER LXVII

THE COTTON-SEED-OIL INDUSTRY

THE utilization of one waste product does more to enrich the world than an increase of many millions of dollars of product in some old and well established industry. Perhaps there is no single thing that more forcibly illustrates this truism than the utilization of the once despised cotton-seed. In the process of ginning seed-cotton the result is a little more than two pounds of seed for every pound of cotton produced; and forty years ago, aside from the small amount of seed that might be reserved for the next season's planting, and such small quantities as were consumed by the cattle on the plantation, there was absolutely no use to which it could be applied. At the gins the great seed heaps grew, as the sawdust heaps rise to-day around the portable sawmill, until, as a last resort, the gin would be moved from the base of the seed mountain it had reared up to itself. Thus was cotton-seed, in 1840 and 1850, a source of actual expense and an encumbrance. That there was an oil that might be made useful contained in the cotton-seed was known, of course, ever since 1783, when that august and venerable body, the London Society for the Encouragement of Arts, Manufactures, and Commerce, first called public attention to it. The real value of this oil, or a method for its extraction, was, however, not known to the society; and while it declared that the seed-cake resulting from the manufacture of the oil was good cattle-food, and though the society offered gold and silver medals of reward for the first successful process of making the oil and cake, it never had occasion to bestow its honors. Later on, when the seed of the Egyptian cotton was introduced into Europe, the manufacture and refining of the oil was begun and carried on quite extensively. The use of the product for food purposes was also learned abroad before any advance whatever had been made by this country in that direction.

The dilatoriness of Americans in availing themselves of this great wasted asset was undoubtedly due to the fact that the South, where cotton was king, was not a manufacturing community, and had neither taste nor inclination to develop along any but agricultural lines. Her population, further, embraced but few of the operative class needed for the labor of the manufactory. The first recorded attempts in this country to extract the crude cotton-seed oil were made at Natchez, Miss., in 1834, and at New Orleans in 1847. Both were complete failures from the standpoint of practicability, and it was long a lugubrious jest with the late Mr. Frederick Good, of New Orleans, who was active in the second attempt, to show a small bottle of the crude cotton-seed oil, which he stated had cost him just $12,000. Abroad the seed of the Egyptian cotton continued to be used more or less successfully, and experiments—rather desultory in their nature, perhaps—were continued on this side of the water. The greatest difficulty encountered by the pioneers in this field was the total lack of appropriate machinery. Foremost as Americans have been in the invention of mechanical appliances, they were singularly backward in developing machinery for the expression of the cotton-seed oil. At the time now under discussion each mill that was attempted had its own mechanical ideas, and these were uniformly crude and unsuccessful. In fact, the introduction of improved or even fairly practicable methods of extracting and refining cotton-seed oil did not come until some of the American manufacturers—notably Mr. Paul Aldigé, of New Orleans—had visited the great European works, including those at Marseilles, and patterned from them, in the early years after the Civil War.

Prior to this, however, the industry had gained a foothold on a small scale, and crude cotton-seed oil was put on the market in limited quantities. Its appearance as a domestic product dates from about 1855, and to Mr. Paul Aldigé, of New Orleans, later one of the most prominent cotton-seed-oil manufacturers in the country, is due the credit for the first successful attempt at crushing the seed in a mill. He had to contend with many difficulties, not the least of which was procuring the cotton-seed. The wealthy planters of those ante-bellum days, when their cotton crop was picked, ginned, and baled, were quite disposed to regard the business as completed. To be troubled about selling the waste seed product of the gins was not worth their while; and as the small planter did not exist to any extent, it was more than difficult to secure the needed seed. It was harder to get one ton then than it is to get one hundred to-day. Furthermore, the transportation facilities for bringing in the seed from the outlying districts were of the poorest. These obstacles, together with crude machinery and little knowledge concerning the valuable by-products to be obtained from the manufacture of the oil, all operated to keep the industry at the lowest point.

Singularly enough, it was in the tight little Yankee State of Rhode Island that the first firm foothold for this peculiarly Southern industry was obtained. A mill was started at Providence, R. I., in 1855–56, and the seed was shipped from the South, principally from New Orleans. While but a small affair compared with the huge works of to-day, this mill continued to be operated until the outbreak of the Civil War put an end to Southern seed shipments. During the years of war that followed, the cotton-seed-oil industry made little headway here, although abroad it was rapidly coming into prominence. There were a few small mills and refineries in the cities along the Mississippi, notably at Vicksburg and New Orleans; and after the blockade of that river began to shut off supplies, their product came into demand as an illuminating oil, despite the fact that it could not be burned in chimney-lamps. In the accumulation of the seed-cake resulting from this blockade, which prevented all exportation, the South first came to use it, in default of anything better, as a food for cattle. It had never been used for such a purpose here before, although it had been exported, and its valuable properties were well known on the continent of Europe. The hulls, also, were discovered at this time, in the same forced way, to be good food-stuff for cattle, and their use for this purpose, in a limited way in the South, dates from this time. These hulls, mixed with a certain percentage of the meal of the seed-cake, make a compact form of fodder, and were used in the timber regions and other localities where hay was hard to obtain and difficult to transport.

It is not many years ago that every cotton-seed mill in the country utilized, as far as possible, its hulls for fuel to operate the mills; but this demand fell short of the production, and the larger mills were put to an expense for hauling the hulls away or for erecting furnaces to convert them into ashes. Gradually the value of the hull became known to the dairyman, and then to the feeder of stock for the butcher, till at the present time practically all the hulls produced are utilized as cattle-food, and that which was only lately an expense to the crusher has become a source of revenue.

This and many other most valuable by-products were, however, almost unknown here until after the war had ended. In New Orleans and at Vicksburg the crushing of the seed was continued in a small way during the years between 1860 and 1865, when peace, with the consequent return of the people to their agricultural pursuits, again brought larger crops and increased activity. In 1866 there were in the whole United States just seven mills for the crushing of the cotton-seed. Though the diverse usefulness of the cotton-seed oil was manifesting itself almost daily in some new form, the growth of the industry was comparatively slow. Twenty-six mills in 1870 increased in the next ten years to only forty-five. These represented a capital invested of $3,862,300, through which was turned out an annual product valued at $7,690,921. In wages the cotton-seed mills in 1880 paid out $880,836 to 3319 employees, and the value of the material consumed by them in the processes of manufacture was $5,091,251. These figures, while of respectable amount, considered with due allowance for the short time the industry had been known, still sink into insignificance by contrast with those representing its condition to-day. The fifteen years that followed 1880 have seen the most wonderful change in the status of the cotton-seed-oil business among the commercial and industrial interests of the country. While the total product of the country in 1880 was less than $8,000,000, that of a single concern, the American Cotton Oil Company, ten years later, was over $20,000,000, and 5000 employees were carried on the rolls of this one company.

One of the great factors in this wonderful growth has been the continued bringing to light of new uses and value for the product. What the discovery of the by-products of petroleum did for that mineral oil was done for cotton-seed oil, when the manifold uses of the refined product began to be understood. As an oil, that of the cotton-seed possesses in high degree all the properties common to the best vegetable oils, with the exceptions that for household illumination, or as a lubricant, it cannot be used to advantage. As ordinarily known in the phraseology of the market, refined cotton-seed oil is of four varieties, viz., summer and winter yellow, and summer and winter white. From the summer yellow are derived many valuable products. The well-known lard compound, "cottolene," and similar products, which have so largely superseded hog-lard for cooking purposes, take a great deal of this grade of oil, the bulk of which, in fact, may be said to be consumed in culinary channels. When cheaper than tallow, "summer yellow" is also used in great quantity in the manufacture of laundry and toilet soaps, and a large amount of it, made from selected crude oil, is exported for use abroad in the making of butterine, a substitute for butter much used in Holland, Belgium, France, and other European countries. This grade of oil is of the finest quality, and in many places has supplanted olive-oil as a dressing for salads or the general uses of the table. Druggists find in it a reliable and excellent substitute for olive-oil in many preparations for external application, such as salves and liniments. Not being inflammable, cotton-seed oil is used by the salt manufacturers to float on top of their tanks, and the paper makers find a similar use for it. By a process of bleaching, "summer yellow" is converted into "summer white." "Winter yellow" and "winter white" will stand a cold test at 32° Fahrenheit, without chilling. These oils are produced from the summer oils by extracting a large percentage of the stearin contained therein. Winter oils are largely used as a substitute for whale and lard oils in miners' lamps, and considerable quantities are used in foreign countries. Cotton-seed soap-stock, as known to commerce, is the residuum of the refining-kettle, and is utilized in low-grade laundry soaps and in wool-scouring soaps.

Besides these uses of the refined oils, the crusher of cotton-seed sees his product and by-products bring him returns from various other sources. The cotton-seed cake, or solid residuum of seed remaining after the expression of the oil, finds sale as cake, principally in Great Britain; but by far the larger portion of the cake is converted, by grinding, into cotton-seed meal, which is of such high repute at home and abroad, both as a food for cattle and sheep and as an ingredient of ammonial fertilizers, that the entire production finds a ready sale. The "linters" or short staple cotton, ranking relatively as of about half-value with "middling cotton," is another by-product which the cotton-seed crusher gains through a careful reginning of the seed.

The process of extracting the oil from the cotton-seed is a rather complicated one in its preparatory stages, but is simplified to the last degree by the employment of machinery at each and every step. The seed, on reaching the mill, is first screened, to remove sand, dirt, bolls, and foreign substances, and finally a draft of air is used to complete the cleaning process. The seed is now ready for the linters, which machines are an elaboration of the ordinary cotton-gin; and whatever staple remains upon the seed is stripped off in passing through them. From the linters the seed passes to the huller, a high-speed cutting-machine, which cuts it up most thoroughly. The hulls, by screens and beaters, are now separated from the meats, which latter are, by screw-conveyers, conducted to bins contiguous to roller-crushers, and as fast as required are passed through the crushers, where the mass is reduced to a uniform consistency, and is known to millmen as "uncooked meal." The first step is cooking this meal, which is done in steam-jacketed kettles. When heated to a proper degree the meal is drawn from the kettles, formed into cakes, enveloped in camel's-hair cloth, and placed in boxes of an hydraulic press, when by the application of proper pressure the crude oil is speedily extracted. The solid residue remaining in the press-box is the decorticated cotton-seed-oil cake of commerce.

In the practical methods by which these mills are supplied and operated all the improvements of modern industrial enterprise have been laid under tribute. In the distribution of the oil product, tank-cars on the railroads and tank-steamers on the high seas are used for transportation in bulk; and the American Cotton Oil Company, in its immense export business to Rotterdam, has a tank-steamship capable of carrying 4200 tons of oil in bulk, thus saving the heavy item of cooperage. This steamer can thus carry, without injuring, even the finest quality of the food-oil, which is in great demand in Holland and Belgium. As an evidence of the amount consumed there it is shown that Rotterdam alone imported in one year, recently, no less than 8,356,676 gallons of cotton-seed oil, of which 5,973,760 were from this country. The diversity of the industry requires factories other than the crude-oil mills, as refineries, lard and cottolene plants, soap factories, cotton-ginneries, cotton-compressors, and fertilizer-mixing establishments. The supply for all these is derived directly from the crude-oil mills, which in their turn are operated immediately from the raw material, in providing which there has grown up a most important branch of the agricultural system of the South.

With the development of the industry in later years have come, of necessity, radical changes in the methods of collecting the seed and covering the country. The commission-merchant, who, in the early days after the war, did almost all the business for the large cities, has disappeared. With New Orleans as a center for the large milling interests, these seed buyers formerly laid only the Mississippi River bottoms under contribution for their annual supply. They acted as middlemen, and to them the mills sent as many bags as they desired to have filled for their season's supply. These bags were in turn sent out by the agents to the planters to be filled, and on their return were forwarded to the mills, where they were reweighed, inspected, and, if found defective in any way, a charge was entered against the commission-merchant, who was furthermore responsible for the bags, and was duly charged with any shortage of return. As the mills increased, however, and competition became keener, buyers from the various great concerns supplanted the commission-merchant. They represented their particular mills, and scoured great districts of the cotton-growing sections, hundreds of miles distant, buying up all the seed they could find. This arrangement entailed upon the mills the necessity of direct dealing with the planters, which sometimes has resulted in more or less pecuniary loss. Where twenty-five years ago the commission-merchant stood between the mill and short weight, poor-quality seed, or shortage in the bags, there is no one to do so to-day, and the petty losses in the individual dealings make up an aggregate sum that adds materially to the annual expense account.

As collections are now made, everything has been systematized to a point that insures the greatest possible expedition of business. In the small inland towns the seed is brought in entirely by wagons, drawn by the inevitable Southern mule; and every Saturday morning during cotton-picking time a long string of these wagons can be seen waiting in the sun outside the seed depot to be weighed and unloaded. All is grist that comes to a cotton-seed buyer nowadays; that is, until he begins to grind. Foreign substances and poor-quality seed mix with the wagon-load, and are shoveled in to him at the same market price as the good product. He has no time to object, as the early cotton-seed grinder would most certainly have done. He now knows the machinery in the mill will sort all that mass of seed as intelligently as he himself could do it, and with infinitely more rapidity. He knows that he and his colleagues are now buying from 1,250,000 to 1,500,000 tons per year, where a few thousands only were bought twenty-five years ago, and if the expediting of this vast business involves some increased expense, it must be borne. This buying in bulk is also practised where the seed is transported by rail to the mills. Immense tracts are laid under contribution in this way, and remote districts reached by the mills in their ever-extending hunt for the seed. Much of the product brought in by the railroads is transported for several hundred miles, and statistics place the average expense to the mills of this single transportation item at $2 per ton, which, supposing that only one half the total seed-supply was carried over the railroads, would run into large figures.

The third and most favored method of collecting the cotton-seed is by boat along the rivers. In this form of collection it is found necessary to sack the seed, and for this purpose the mills supply the bags. A steamboat carrying several thousands of empty bags will leave New Orleans or Vicksburg, as the case may be, and steaming slowly up the river, stop at each small town and at the various plantations along the levees. At each stopping-place as many bags are left as each planter thinks he can fill; and when the last bag has been given out, the steamboat is turned and headed down the river to pick up the freight by the dozen or by the hundred bags as it returns. The great drawback to this system is that the bag used for cotton-seed is altogether too popular an article among the planters. These "planters" are not the class of men they were in the old antebellum days. The glory of the manorial residence, with its broad acres, has departed, and the name has ceased to signify anything more than an ordinary farmer. The planters to-day are small holders, and for the most part negroes, to whom a cotton bag has a varied utility that would scarcely be believed at first sight. It makes an excellent pair of trousers or a coat for plantation work, a good saddle-cloth for the road, and can even be found as bedding in not a few of the houses along the levees. That the loss entailed in this seemingly petty way is really a heavy one may be gathered from the fact that the mills have had a shortage of as many as 1,500,000 bags in a single season.

The effect upon the cotton-growing interests of the South of the great industry that has sprung up from this seed has been undoubtedly great. In the face of a declining market the total production of the plantations has more than doubled during the past twenty-five years. A crop of 3,154,946 bales in 1870 had increased to a total production of 7,527,211 bales in 1894. Cotton-seed oil solely, has not been, of course, responsible for this advance, nor is such a claim advanced. It can be stated, however, that since the small planter, with his five to ten bale crop, became common throughout the cotton belt, the additional revenue which he has been able to derive from the sale of the cotton-seed has done much to aid his progress.

The quality of the cotton affects little or not at all the quality of the seed, and soil so poor as to yield a hardly marketable cotton will still grow a plant whose seeds are as good as the best. In the making of the cotton-seed oil there has already been utilized a large amount of the seed of the almost worthless "bumblebee" cotton. This cotton is stunted, either from poor soil or lack of cultivation, and grows so near the ground that only the very smallest negro children, known as "bumblebees," are able to pick it without becoming exhausted by stooping. Finally, when it is considered that the seed of the cotton-plant more than pays the entire expense of ginning, baling, and tying the crop, the economy it effects is plainly seen. Even the slave labor of the ante-bellum days cost its own maintenance, and, little as that cost was, the financial interests of the plantation to-day are better served because of the added value of the seed. In fact, the whole agricultural life of the South has been benefited by this formerly despised gift of old King Cotton, and it is only just to say that the people are becoming appreciative of this fact.

To return to the history of the industry from the point at which we left it in 1880. The fifteen years which have intervened between then and now have formed the period in which cotton-seed crushing may fairly be said to have taken its place among the great American interests. Forty-five mills in 1880 had increased to sixty within two years, or at the rate of thirty-three and one third per cent. Since then the increase has been steady, both in the number of mills and in the capacity of those already in operation. In 1890 there were 119 establishments, and it is a small mill nowadays that does not crush 10,000 tons of seed during the season, although twenty years ago such a capacity would have been looked upon as enormous.

Looking back upon the cotton-seed-oil industry for fifteen years, the personnel of the trade gains an added interest and a deeper significance viewed in the light of later events. Few of the men who were looked up to as leaders in the business at that time are leaders to-day. Many are dead and all are changed, but they are still remembered as pioneers in the days of the early successes of cotton-seed crushing. The babe is now become a giant, both at home and abroad. The prejudice against cotton-seed oil—so rampant fifteen years ago as to induce Spain at that time to begin a war against its importation, in which Italy, moved to the defense of her olives, speedily joined—has largely disappeared. Since 1889 the exportation of cotton-seed cake and meal has become an important item of our foreign trade, and one which bids fair largely to increase. The amount exported in 1893 was 195,319 tons, and in 1894, 208,042 tons. In addition to this the exports of cotton-seed oil in 1894 amounted to 14,958,309 gallons, valued at $6,008,405.

In the year 1894, with a cotton crop of nearly 8,000,000 bales, there were over 1,500,000 tons of seed crushed. This means that at least $10,000,000 were distributed among the planters of the South in cash payments for cotton-seed; the railroad and transportation companies received as much more in freights. From this resulted a product approximating 60,000,000 gallons of crude cotton-seed oil, besides about 500,000 tons of oil-cake and meal. Wages and the legitimate expenses of the industry further circulate millions annually. Its prosperity reacts beneficially upon the country, and its product adds to the comfort and conveniences of the time. With it the South takes her place among the other sections in the manufacturing interests which will bring wealth to her and commercial honor and credit to the American nation.

CHAPTER LXVIII

THE STARCH INDUSTRY

STARCH is a white pulverulent substance composed of microscopic spheroids, which are, in fact, sacs containing amylaceous matter. These microscopic particles vary in size and form, and exist in many plants. Chemists name three kinds of starch—one found in cereals, another called inulin, and a third called lichen-starch. They are all insoluble in cold water, alcohol, ether, and oils, and, with the exception of inulin, are converted into sugar by dilute sulphuric acid and by diastase. The first-named forms with hot water a mucilaginous solution, which, when cold, is the starch used by the laundress of to-day; it is tinged blue by iodine. The second forms a granular precipitate when its solution in boiling water is allowed to cool, and is tinged a fugitive brown by iodine. The third, by cooling the concentrated solution, gives a gelatinous mass, with clear liquid containing very little starch floating over it; its jelly becomes yellow with iodine. Starch is found in wheat, rye, barley, oats, buckwheat, rice, corn, millet, pease, beans, potatoes, arrowroot, and other plants, and varies greatly in quantity under different circumstances.

The making of starch had a very ancient origin, for it is spoken of by Pliny, in the first century A.D., as being made from wheat on the island of Chios. Very little is said of it by modern writers, however, until the time of the reign of Queen Elizabeth, when its use became almost a necessity for stiffening the enormous ruffs worn by the queen and her court. So scarce and exclusive was the article at that time that its use was forbidden by English law except for the purpose just mentioned, and by perfumers in making the hair-powders then in vogue. The Greeks made starch from wheat for food about the beginning of our era, and potatoes formed a considerable source of starch-supply early in the sixteenth century.

As the manufacture of cotton goods increased, and especially after the development of calico printing, there was a greatly enlarged demand for starch, and as the early restrictions upon its manufacture were removed, inventors and experimenters turned their attention to its cheaper and better production. Crude methods for making it became generally known, and it was produced in small quantities in many families for home use. New sources of supply were also discovered, and gradually took their proper place in the general economy of the industry. The importance attaching to these is indicated by the fact that in 1796 the British Society of Arts gave a medal to Mrs. Gibbs, of Portland, for her discovery of *Arum maculatum* as a source of starch. But for many years the principal source of the article was wheat or potatoes.

One hundred years ago there was not a starch factory in all our broad land except the domestic ones, where our great-grandmothers grated the potato and washed the starch out of the pulp. This was then strained and left over night to settle; in the morning the water was poured off, and the starch removed from the vessel and dried in the sun, being then laid aside to be used as occasion required. The oldest process of manufacturing wheat-starch in the United States consisted in steeping the grain in water until it was soft, when it was passed through a malt-mill, or between rollers, and again mixed with water. Fermentation then set in, forming lactic and acetic acids, which disintegrated the cellular structure of the kernel and liberated the starch granules. These were collected by repeated washings and precipitations, the process being continued several days, the gluten putrefying and giving off a very foul odor. The sugar and a portion of the starch were converted into alcohol, and a part of this into lactic and acetic acids, which dissolved the gluten that had escaped putrefaction. Thorough washing removed the soluble matter, and the starch left behind was dried and prepared for market. The other method, known as non-fermenting, is of French origin, and consisted in kneading wheat-flour into dough with water, and then

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washing in a fine sieve in a stream of water as long as the passing water continued milky. The starch in suspension and the sugary portion in solution were caught below the sieve, and the gluten nearly all remained behind in a sticky mass. What passed through was left to ferment twenty-four hours in an oven at 68° Fahrenheit, and a little leaven was added, or the skimmings of a former operation, to hasten the process. The portion of gluten carried through with the starch was thus separated and recovered by skimming. The starch was then treated like that otherwise produced. This last-described method gave a product of about fifty per cent. of the weight of flour, while by the first process it was only thirty-five or forty per cent. Most of the gluten was saved in a condition to be used for food by mixing it with potato or other substance. The starch thus produced, while good for some purposes, lacked the required strength for fine laundry-work, was not clear and pure white like the modern product, and, being made from wheat, was comparatively costly. The removal of the gluten was never perfect, causing endless annoyance and perplexity to the laundress when it came in contact with her hot irons; and it was by these, or still more crude and costly methods, that nearly all the starch was produced down to about the year 1841.

The uses to which starch is put are numerous. Not only in the laundry and kitchen do we find it, but also in many of the leading manufactories of the day. It is used largely in the manufacture of textile fabrics, in calico printing, paper, confectionery, breadstuffs, paint, wood filling, etc.

The manufacture of starch from potatoes in this country is now confined principally to the New England States, Maine having forty-four factories. There are sixty-four factories engaged in this branch of the starch industry of which I have knowledge, these factories consuming 2,824,512 bushels of potatoes, producing 24,008,352 pounds of starch per annum, requiring 1536 horse-power, and employing 659 hands for about three months in each year. The capital invested is $355,765, and the value of the annual product, $854,697.33. Cull potatoes are largely used. Potato-starch is used almost entirely by manufacturers of textile fabrics.

The wheat-starch industry early in the century gave promise of great importance, the annual output of this commodity continuing to increase until 1842, when the discovery and perfection of the process for the extraction of starch from Indian corn, by Thomas Kingsford, turned the attention of manufacturers to this cereal as a source of starch supply, and many wheat-starch factories were remodeled thereafter to use Indian corn. The first wheat-starch factory of which I have knowledge was that started by Edward and John Gilbert at Utica, N. Y., in 1807, which factory continued until about 1849, when it was remodeled to use Indian corn. The business was given up and the plant abandoned in 1859. In 1817 a wheat-starch factory was started by Thomas Barnett at Philadelphia, Pa., which was removed to Knowlton, Pa., in 1879, and there continues in operation. The next wheat-starch factory was operated by George Fox in Cincinnati, O., in 1824, at which time but five bushels of wheat were consumed in the weekly output. The business gradually increased, until 500 bushels per week were required to meet the demand. This factory began the manufacture of starch from Indian corn in 1854. In 1827 William Colgate & Company started a wheat-starch factory in Jersey City, N. J., where they had a very successful career in this branch of the starch industry. Their plant was altered into a corn-starch factory in 1842, and continued in the manufacture of starch from the latter-named grain until 1865. In 1843 Colgate & Wood (Charles Colgate and Julius J. Wood) began the manufacture of wheat-starch at Columbus, O. There are but five wheat-starch factories in this country at the present time of which I have knowledge. These factories have an aggregate capital of $195,000, the annual production being 8,312,000 pounds, valued at $346,000, requiring 250 horse-power, and employing 88 hands. The capacity of these factories is 1077 bushels of wheat per day.

As early as the year 1841, while Thomas Kingsford was superintending the wheat-starch factories of William Colgate & Company in Jersey City, N. J., where he had been employed since the spring of 1832, he clearly saw the objectionable features of both the methods of manufacture and of the product, and in his study to remove them became convinced that in our ripe Indian corn lay the future source of abundant starch that would in every way excel all others if it could be separated from every substance foreign to its nature. He imparted his conviction to his employers, the result of which may be inferred—manufacturers and capitalists are seldom ready to aid in the experiments of investigators. They thought that, at the best, the prospects of success were doubtful. They were making money, and why should they not continue manufacturing starch from wheat instead of taking up a wild project? He talked with other starch makers of that day, who ridiculed the idea, and declared it to be impracticable and visionary.

Satisfaction with present conditions is always a foe to advancement. The more he thought of the subject the more his mind was imbued with the belief that ultimate success awaited him. The history of his experiments is deeply interesting.

In the year 1841, at the Colgate factory in Jersey City, N. J., he began a series of experiments to test his theory, following substantially the processes in use in the factory. He first soaked a quantity of Indian corn-meal, and then washed it through a fine sieve, hoping thus to secure the starch; but it remained only corn-meal. He then obtained some shelled corn, soaked it several days in lye to soften the grain, and endeavored to reduce the kernels to pulp with a mortar and pestle. This done, he washed out the starch, or endeavored to, from the other constituents; but this attempt also failed. He then tried a wooden screw-crusher, with which, and the use of several solutions, he endeavored to extract the pure starch; but again failure attended him. His next mechanical contrivance for reducing the corn to pulp was a paint-mill, but the final result was the same—he failed to effect a separation of the starch. He then soaked another quantity of corn, and passed it between the rollers of an old sugar-mill, borrowed from a grocer; but the rust on the mill discolored and spoiled his product. Still persistent, he procured a pair of granite rollers, mounted them on shafts in a frame, and by passing the corn repeatedly between them, obtained a clear pulp. When this was strained, washed, and settled by the process with which he was familiar in the manufacture of wheat-starch, he found it so mixed with gluten, albumen, woody fiber, and other impurities, that he could not effect the separation desired. Mr. Kingsford now continued his experiments with various kinds of acid, hoping to produce the long-sought separation of the pure starch from all the other constituents of the grain, but without success. He then made a solution of wood-ash lye, the use of which also failed, as did other similar experiments. Almost discouraged, but still stimulated with a desperate hope of ultimate success, he ground up another quantity of corn and treated it with a solution of lime. Again success evaded him. But he was now nearing his triumph. He had thrown the first lot, treated with a lye solution, into a receptacle, and to this, in his discouragement, he added the last quantity, upon which he had experimented with lime, and left them to be thrown away with the results of many former failures. On entering the room a few days later to put it in order, he proceeded to empty the tub, and to his great joy and surprise found at the bottom a quantity of beautiful white starch, thoroughly separated. Continuing his work, he rapidly perfected his process, and in 1842 produced his first quantity of marketable starch. Mr. Kingsford fully realized the importance of his discovery, although his most sanguine anticipations could scarcely have led him to hope for the great success that followed. Corn was then vastly cheaper in comparison with wheat than it is at the present day, thus promising lower prices and greater profits, as well as increased demand for the new starch. He freely exhibited his product to buyers and consumers, as well as to his employers, and there was only one verdict: it was incomparably superior to any other starch. Now he did not have to ask for financial aid. William Colgate & Company were ready and anxious to make any investment necessary to establish the manufacture if they could share in the profits, and a business engagement was accordingly effected, under which Mr. Kingsford was to superintend all the operations and devise the necessary machinery for the manufacture, at the same time retaining the knowledge of his process for himself. None of the starch-making devices formerly used in the factory could be utilized, and he set himself to the work of inventing and building special machinery for the new process. The task was successfully accomplished, the manufacture began, and the new starch soon reached consumers in comparatively large quantities. It met with prompt and universal favor, and soon crowded the former starches from the market.

In 1846 the firm of T. Kingsford & Son was formed by the association of Thomas Kingsford and his son Thomson. They erected a small factory at Bergen, N. J., and there the manufacture of the Kingsford starch was successfully inaugurated. As the knowledge of the superiority of this starch spread, and the rapidly increasing demand became known, capitalists came forward with propositions for investment in the business. This resulted, in 1848, in the incorporation of an organization styled the Oswego Starch Factory, and the removal of the business to Oswego, N. Y., where suitable factory buildings were erected. Unfailing water-power, a pure water-supply for manufacturing purposes, and good shipping facilities were the chief advantages secured by this change of location. In 1850 Thomas Kingsford became impressed with the conviction that, by following processes somewhat different from those employed in making laundry starch, a food-substance might be produced from corn, which would be free from the objections inherent in corn-meal, extremely nutritious, and at the same time suited to the most delicate or infantile stomach, supplanting arrowroot, sago, tapioca, and similar farinaceous foods. He immediately began a series of experiments, which resulted in the discovery and production of the now universally known corn-starch for food purposes. From 1842 the demand for corn-starch continued to increase, leading to the establishment of many plants; but the concentration of the starch interests into fewer hands has within the past few years resulted in the cessation of work in seventeen factories. There are at present sixteen factories engaged in the manufacture of starch from Indian corn in this country, with an aggregate capacity of 29,000 bushels of corn per day, producing 206,673,000 pounds of starch annually, valued at $8,738,895. In this branch of the industry there is, at present, an invested capital of $8,450,000; 11,740 horse-power are required, and 2219 hands are employed. In 1891 a combination or trust was formed, composed of many of the starch companies in the United States, and called the National Starch Manufacturing Company. The manufacture of starch may be counted among the leading industries of this progressive nation, and a large proportion of the product is annually shipped to, and finds a ready market in, foreign countries.

Like other industries, the growth of starch manufacture has kept pace with our ever-increasing population. In 1880 there were 139 factories engaged in the manufacture of starch from potatoes, wheat, and corn. Ten years later there were but 80 factories, which would seem a falling off of the industry. But a carefully prepared table of facts concerning the subject shows a marked increase in the number of hands employed, quantity produced, and value of annual product. A brief summary shows a total of 2966 hands employed in potato, wheat, and corn starch factories, utilizing 13,526 horse-power, producing 238,993,352 pounds of starch annually, valued at $9,939,592.33, and employing $9,000,765 capital.

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CHAPTER LXIX

THE MATCH INDUSTRY

BY the coaction of thought and energy are all things developed from nature. The quick-whirling, sharp-pointed stick of hard wood, brought in contact with resisting hard wood, generated by friction the heat which gave primitive man his first spark of fire. That primitive man who, with energized thought, produced the first spark of fire was a greater inventor than any who followed him up to the day when man harnessed electricity to produce the same spark of fire. How similar their methods,—action and reaction; the positive and negative poles of the battery; the whirling armature of metal coming in contact with metal, generating the heat-fluid that is distributable by proper conductors; yet how great the step in mechanics between the two—one base and rudimentary, the other the perfection of mechanics!

It has been written that "human culture may be said to have begun with fire, of which the use increased in the same ratio as culture itself." The ancients regarded fire as a sacred element, and, when once produced, it was watched, replenished, and cared for with a religious zeal by virgins, who were scourged if they permitted it to expire.

To the development of mechanics and chemistry we owe our progress physically; and while some branches of industry may attract more attention than others on account of their importance, it would seem that all have traveled along at about the same pace and made about the same progress, the match industry, like its neighbors, only keeping step to the music of the rapid march of industrial affairs. The progress made in the methods of producing fire quickly was for several centuries exceedingly slow, taking into consideration the fact that phosphorus was discovered in the eighth century by an Arab named Bechel. Owing, perhaps, to lack of proper chemical and mechanical appliances at that time, it dropped from sight, and was rediscovered in 1669 by Brandt. Both Bechel and Brandt discovered it in liquid human refuse after it had been changed by keeping. Later it was procured from human bones, and still later from all kinds of bones; and now it is extracted by electricity from mineral phosphates. It is exceedingly strange that, while its properties were well known for several centuries, its application to matches dates back only a little over half a century. It would be hard work to compute accurately the value to the human race of the introduction to general use of this useful little article.

It is estimated that five matches per day are used for each man, woman, and child in the United States, and that fifteen seconds are required to consume a match, while the time required to produce the same number of fires by the best-known methods before matches were invented would have been ninety hours per annum for each person. The difference between the two methods would figure out a saving, at five cents per hour, of over $270,000,000 per annum to the people of the United States.

The original discovery of the ignition of phosphorus and sulphur by friction was made by Godfrey Haukwitz in 1680. About one hundred and fifty years later, Walker, of Stockton-on-Tees, invented the friction-light. Two or three years prior to that the famous instantaneous-light boxes were in use. These were called Eupyrions and Prometheans, and consisted of sticks of wood tipped with sulphur and chlorate of potash, which ignited on being dipped into sulphuric acid. These instantaneous lights retailed at a very high price. The lucifer or improved friction-match succeeded them in 1833. The first patent granted in the United States for a friction-match was to Alonzo D. Phillips, of Springfield, Mass., October 24, 1836, and the manufacture in this country began in the same year.

The splints were whittled out by hand at first, and continued to be made in a crude way until 1842, when Reuben Partridge patented the first splint-cutting machine. The discovery of red or amorphous phosphorus was made by Schrotter, a German, in the early fifties; and one of its earliest users was Herr Lundstrom, of Jönköping, the original Swedish safety-match manufacturer, in 1855–56. A history of this industry in 1856 states that it had reached gigantic proportions in Sweden, Germany, and England. In the latter country there was an average daily output of 40,000,000 matches in that year. To-day the Diamond Match Company's largest factory, at Barberton, O., has facilities for turning out 100,000,000 matches per diem.

How quickly, in the familiarity of common use, has the little match lost its merited consideration as an important factor in human events, and how little do we realize its importance in commercial affairs! There are consumed in the United States 115,200,000,000 matches per annum, which, if put end to end, would reach a distance of over 4,000,000 miles, or span the earth 170 times. Allowing eleven matches to the inch in width when put side by side, they would make a band around the earth fifteen inches wide.

There are annually consumed in the production of matches in the United States, and in casing them, over 40,000,000 square feet of pine lumber one inch thick; 8000 tons of strawboard and paper are used in boxing and wrapping them for market; 3,500,000 pounds of paraffine and brimstone are used for saturating the ends of match-sticks; and 6,000,000 pounds of chemical compound are used for match-heads. About $7,000,000 are invested directly in the match business, and $5,000,000 are invested in lumbering and manufacturing enterprises, owned and operated by the match manufacturers to supply themselves with materials used in the making of matches. The annual product is delivered to the consumer for about $7,000,000. In the match business proper about 2200 people are employed, and as many more are employed in the manufacture of material for matches. The aggregate wages paid amount to about $1,500,000 per annum.

The production of matches has been attended with a great amount of misery which is incidental to the business. People of scrofulous or delicate constitution who are brought in contact with phosphorus in handling matches, or who daily inhale the fumes of phosphorus, are frequently attacked by a most distressing disease called necrosis of the bone. It usually attacks the lower jaw-bone; when it attacks the upper jaw-bone death is almost certain. In the early history of match making the business was conducted in the crudest way possible to imagine. It was driven by competition into the hands of the poorer classes of people in London and in the larger cities of the continent of Europe. The manufacture was in cellars; and so numerous became the cases of this most loathsome disease that the different governments drove the manufacturers out of the cellars and ordered that they work in better-ventilated buildings. Despite the growth of the business the evolution of machinery in the manufacture has very much lessened the number of people employed, and reduced the danger of this disease to the minimum.

From whittling out match-splints in 1833, when matches were first invented, there has followed a mechanical development (the several steps of which would be more interesting to the specialist than to the general reader, and will not be dwelt upon in this paper), until now the most perfect and modern machinery is used in their manufacture. The operation of these machines may be described as follows: The wood from which the match-splints are made is pine plank, two inches thick, which, after being thoroughly dried, is resawed into lengths from one and seven eighths to two and one half inches, representing the length of the matches to be made. The knots and cross-grained parts are cut out of the blocks, and only good straight-grained lumber is used. These blocks are then put into the automatic feeder of the machine, the paraffine and composition for the head of the match having been properly prepared and placed in their respective receptacles, which are so arranged that they can be replenished from time to time without stopping the machine. The knives or dies that cut the match-splint from the block are so placed in the head-block of the machine that when the splints are cut they are separated by a quarter of an inch, and placed or set in cast-iron plates made into an endless chain by link attachments. At each revolution of the machine forty-four matches are cut and set, the machine making from 175 to 250 revolutions per minute, its rapidity depending on the length of the match and other conditions.

From the cutting end of the machine the endless chain moves along over a drying or heating block prepared for this purpose, where the match-splint is heated to a degree nearly equal to that required to melt paraffine, so that the paraffine may not chill on the stick when the splint passes through it, but that the end may be thoroughly saturated. The chain continues to move on in its course to the composition rollers, where the match receives its head; thence on in a circuitous route, passing back and forth, coming in contact with blasts of cool, dry air for a period of one hour and a half, when it returns to the place of beginning, just before reaching which the matches are punched out of the chain by an automatic device into small paper or strawboard boxes varying in size, capable of containing from 65 to 500 matches, the boxes having been fed into the machine by an automatic device with such regularity that one might almost truthfully say that the matches were counted into the boxes; the chain continuing along to take other match-splints on their round, to be made complete matches and dropped in turn into other boxes. These boxes of matches pass from the machine to a rotary table, around which sit from two to four girls, who take the boxes, place the covers on them, and then pack them into cases.

The machines require just enough manual help to feed them the raw material and to take care of the manufactured product, and are so nearly perfect that it does not seem possible for much further development to be accomplished. The world is indebted for the present perfection, first, to the policy of the Diamond Match Company, which has kept employed, since its organization in 1881, a corps of expert inventors and mechanics for the invention and improvement of its machinery, at an expense of at least $50,000 a year; second, to the inventors themselves, chief among whom are E. B. Beecher of Westville, Conn.; McClintock Young of Frederick, Md.; J. P. Wright of New Haven, Conn.; Joseph Baughman of Akron, O.; Charles Palmer of Akron, O.; and John W. Denmead of Akron, O. The writer has occasionally added a thought in this development, especially as to the architecture of factories best adapted to match manufacture, and so arranged as to bring the danger from the use of phosphorus down to a minimum.

Coincident with this development of machinery for the manufacture of matches has been that of machinery for the manufacture of paper and strawboard boxes used in the match business, a large part of which machinery has been the creation of E. B. Beecher. Its operation is as follows: A roll of strawboard of proper width, lined with white or colored paper, is placed in the machine, which takes it and scores the board for the corners without cutting or breaking its fiber. The strawboard is then glued by an automatic device and folded into an endless tube, passing on in that form through printing-presses that print three sides of the tube. It is then cut into proper lengths. Passing on in the machine, it is sanded on the fourth side, which makes the rubbing surface for the ignition of the match. This forms the cover or outside of the boxes; these covers are turned out from the machine at the rate of 450 per minute. The boxes proper are made in a similar way, by machinery which folds and glues them in shape.

The immense saving to the world by the introduction of machinery for making match-boxes is indicated by the following facts: There are now used in the manufacture of matches in the United States at least 2,000,000 paper or strawboard boxes per day, which, if made by hand, as the greater part of them were twenty years ago, would require at least 1500 people; while now it requires to operate the machines that make these boxes not over 75 people. Besides this great saving of labor, a great saving in the use of strawboard and paper for labels, paste, etc., has followed the introduction of machinery, machine-made boxes being much lighter and stronger. A further economy has been achieved in the space required for the manufacture of boxes. Strange to say, in England and parts of the Continent handmade boxes are largely used, the material for them being weighed out and charged to people who call for the work and take it home to complete, returning the finished boxes to the factory in due time. This work is taken at prices which indicate, at least, that it is not done in brownstone houses. It is one of the strange sights to be seen in London and Liverpool, this giving out of material for match-boxes to the poorer classes of people. It is at once picturesque and disgusting. "May human life never be so cheap in America," is one's first thought on witnessing it.

Nature has queer ways of working out her problems. Perhaps it is this very cheapness of human life abroad that has prompted the better fed and housed Yankees to inventive habits. Certain it is that they have made greater progress in match making than any other people on earth. To-day the largest match-making firm of England or the Continent is using match machinery invented by Americans over thirty years ago, while Americans are using machinery that is making a saving in labor over that referred to of seventy-five per cent. The Diamond Match Company is now constructing in Liverpool, England, the largest match factory in the world, for the introduction of the latest and best-known methods for the manufacture of matches. It would not be strange if, with the cheap labor and the saving in cost of material, chemicals, etc., some of the products of these works should reach the eastern shore of this continent. Such has been the evolution of the match industry, with and without protection.

The effect of this automatic machinery of the match industry is easily summed up. In 1880, before the organization of the Diamond Match Company, there were in existence throughout the United States over thirty match factories, employing about 4000 people. The total product of all these factories at that time was 2,200,000 gross per annum, which constituted at least ninety-five per cent. of all the matches that were consumed in the United States, there being but very few imported; while now, with a much smaller number of people employed, four times as many matches are produced, the greater part of which are consumed in this country. Manufacturers' prices of matches have been reduced from fifty to seventy-five per cent. The consumption of matches has been increased much more than in proportion to the increased population of the United States, this result being largely due to the low prices at which they are sold.

A very large portion of the material used in the composition for the heads of the matches in this country is imported. Chlorate of potash, of which there are consumed in matches in this country 1,500,000 pounds per annum (besides several millions of pounds that are used for other purposes), is all imported—not one pound of the article is made in the United States; and the same is true of some other chemicals used, notwithstanding that they could be prepared here as cheaply as in Europe, barring the difference in the price of labor. With a judicious system of protection to those American industries which need it there is no reason why, in a few decades, we can not only be self-sustaining and independent as a manufacturing and commercial people, but be able to compete for the trade of the world on an equal footing; though we cannot expect to command for a long time yet much of the trade of other countries. The civilized nations of the world are each encouraging home industries by protective tariffs on such articles as require their fostering care, and are especially appealing to the patriotism of their people to patronize home industries. The sooner that the American people learn that foreign countries buy of us only such articles as they are forced to buy, so to speak, the sooner they will be prepared to save to themselves the greatest market on earth—that of their own country. Although we may pride ourselves on the great progress that has been made in the physical and commercial development of our country, there seems to be plenty of work yet to do.

The writer visited match factories last year in Belgium, Germany, Italy, France, and England, and he was unable to discover any material progress made by these different people beyond the processes in vogue in America twenty-five years ago. Of course, the people of those countries have not had the stimulus of high wages to prompt them to the use of labor-saving machinery. In Italy the writer visited a match factory where several hundred people were employed at wages that in our country, with our habits of living, would not furnish even the common necessaries of life. A large number of girls worked for wages not exceeding nine cents per day, and the most that was paid to girls in this factory was one franc per day. The writer's attention was naturally attracted to these people. One of the girls had on a knit blouse, so open and loosely knit as to disclose the fact that the wearer had a chemise underneath; a calico skirt, hooked together at the waist over the blouse; and a cotton underskirt that showed itself in spots. Her legs were bare, as revealed by the shortness of the skirt, which did not reach half-way below her knees; and on her feet were wooden sandals. The effect of the whole was plainly to outline her rounded contour. Such a costume would not be recommended to New York's four hundred, but it was none the less suggestive of comfort, as the weather was warm. It is probable that the whole outfit did not cost one dollar. Like their sisters of high society, some of these girls were better dressed than others.

If to do the greatest good to the greatest number be an economic principle, then the American people should be thoroughly satisfied with their match supply, matches being so cheap that they are often used for kindling-wood without materially affecting the expenses of the household. Such results could only be obtained by the best methods of manufacture and distribution. Before the business of manufacturing matches in the United States was so thoroughly organized by the Diamond Match Company matches were made by over thirty different companies, many of which did not know the first principles of the manufacture of good matches. Notwithstanding competition was then very sharp, the bulk of the product was sold at about three times the present price of matches, and in many cases the goods were utterly worthless.

The expense of conducting the business in those days was enormous, comparatively, and, of course, increased the price of the goods. In the city of Chicago five separate stores were maintained, with all the expenses incident to such establishments; and in other cities of the country there were stores in proportionate number to the amount of goods sold. Moreover, each manufacturer had from one to five traveling salesmen tramping over the country at large expense, not less than from $2000 to $3000 per annum each. The system has been so revolutionized that one store in each of the larger commercial centers supplies the public need for matches, with greater facility than in the olden times, and very few traveling men are now found necessary in this line of business. The public have received the benefit of these economies.

To still further lessen the expense of the production of matches, the management of the Diamond Match Company has adopted a policy, so far as it has been practicable to do so, to make the company as self-supplying and independent as possible, they having invested several millions of dollars in manufacturing many of the articles used in the making of matches, and in pine forests, and large mills for the reduction of pine-trees to lumber for splints by the most economical methods, in order that all possible waste may be avoided. These investments could be profitably made only by a company using such large quantities of these several articles as are used by the Diamond Match Company. A comprehensive system of factories to supply the want of matches has been advantageously distributed through the country. Nearly all of these factories have been modernized and brought up to a very high standard of efficiency. While concentration of capital in this business has brought down the number of factories to about twenty, the match business is in no sense a monopoly, and many times more people are now interested directly in the business than were before the Diamond Match Company was established in 1881. The company is rather in the nature of a coöperative company (although regularly chartered), in which every important person in the business from time to time, as he comes on the stage, is aided to the ownership of stock in the company. The liberality of the management in this particular has wedded to the business a corps of very able young men in each and every branch of their different factories and stores.

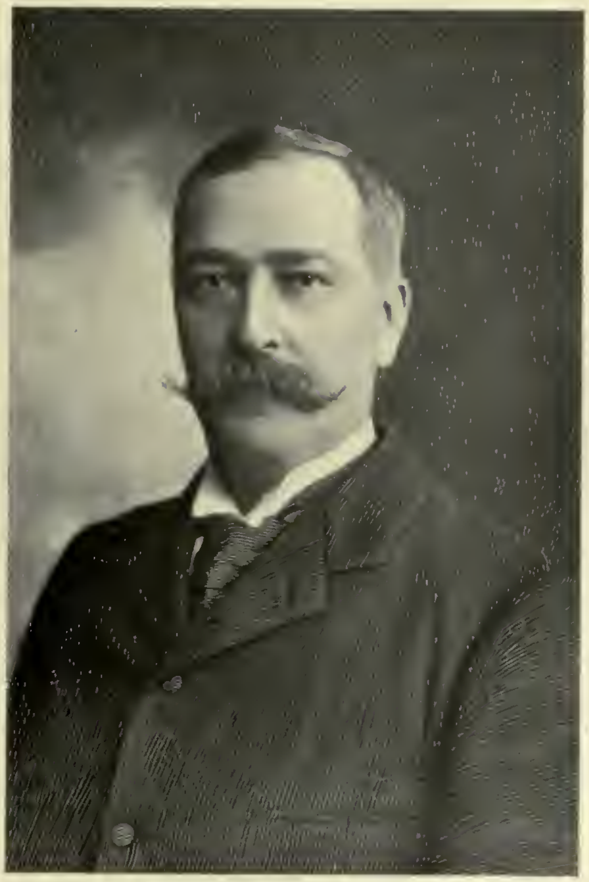
The difference between this company and a monopoly is illustrated by a comparison of it with a monopoly in the same line of business. The French government runs the match business as a government institution. The revenue or profit derived from it is somewhat over $4,000,000 per annum. The cost of matches to the French people is quite four times what is paid for better goods in America. The "Pall Mall Gazette" of recent date describes this monopoly in the following language:

"Those who have had occasion to travel much beyond Calais of late cannot fail to have been struck by the fact that, since the French match makers struck, matches in France have, in an unusually large number of instances, been found capable of doing so. The 'Matin' supplies an explanation of this phenomenon. The matches that have been striking were all made in Belgium. During the strike the French government has been drawing its supplies from Ghent. It appears Ghent can supply this sort of matches at £3 4*s.* 2*d.* per 1,000,000, whereas the match-wood turned out by the French factories costs not less than £5 8*s.* 4*d.* for about the same number of misfires. So the 'Matin' has been moved to make a little calculation. And, according to this, it would seem, if France were to give up the business altogether, close her factories, pay the hands to do nothing for the term of their natural lives, and run the Belgian articles, she would net an annual profit of £8000. This sounds very nice, and Mr. Ribot could do with the money, and there would not be nearly as many bad words about. But then, as another Paris journal points out, the thing would be unpatriotic, and when patriotism wants a light it will probably have to go on using those words, or learn the two-stick trick to get one."

One is a monopoly, run by the operatives, not by the owners; the other is a company largely owned by operatives, who carry on the business for their own benefit, the result being economies whereby the public is greatly benefited.

One of the greatest achievements of the Diamond Match Company was its last winter's lumbering operation, conducted by J. H. Comstock, who organized a force of men in October, and between the 1st of October and the 1st of April cut 185,000,000 feet of lumber in logs, having at one time in the woods over 6000 people and 1200 horses. The expense was over $600,000. This work was made necessary by the extensive fires of last fall in order to save the lumber. Such is the advantage of capital in preventing waste.

The writer, who has had forty years' experience in the match business, has not only seen it wonderfully developed, but he has been equally impressed with other lines of development that have had an effect on it. The method of distribution of matches in the early fifties was by canal or wagon—at least in the West, when there were but very few railroads in Ohio and west of Ohio, and the roads then run-



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ning would not transport matches, which were considered too dangerous.

It was only in the early sixties that railroads began to carry matches. The writer has been in every county in Ohio with a wagon, also in a large portion of Michigan, Indiana, West Virginia, and western Pennsylvania, on the mission of parceling out to the country stores small lots of matches, for which he did not always get cash. In fact, all cash was the exception, and the business was chiefly done in what then was called "barter"; that is, matches were traded for calico, cotton cloth, boots and shoes, tea and coffee, sugar, candles, and everything else that was useful in the home and could in turn be traded off to the hands in payment of labor. The cash received in those days for matches went to buy lumber, brimstone, phosphorus, and other chemicals used in their manufacture, which were all imported, with the exception of lumber. It was very little cash that labor received in the West "in those good old days." There was one notable exception when cash was paid out to hands, and that was when a circus was in town, the amount required being twenty-five cents per head. And all went, if it took the last cent.

The evolution from these methods to those of to-day is quite as remarkable as the evolution in mechanical development. Strange it is that a condition of trade could exist such as existed in this country in the fifties, when there were produced from the mines of the country so many, many millions of dollars of gold, all going out to foreign countries in the purchase of merchandise which we were unable to manufacture.

Prominent among the men who have developed the manufacture and distribution of 115,200,000,000 matches per annum (so that no person shall want for matches in the United States if willing to pay a very moderate price for them) are found William Gates (deceased), Frankfort, N. Y.; George Barber (deceased), Akron, O.; D. M. Richardson (deceased), Detroit, Mich.; John K. Robinson, Chicago, Ill.; E. B. Beecher, Westville, Conn.; L. W. Beecher, Westville, Conn.; James Hopkins, St. Louis, Mo.; William H. Swift, Wilmington, Del.; Joseph Swift, Wilmington, Del.; M. Daily, Philadelphia, Pa.; William M. Graves, Chicago, Ill.; George P. Johnson, New York City; E. G. Byam, Boston, Mass.; J. C. Jordan, Portland, Me.; James Eaton (deceased), Utica, N. Y.; Henry Stanton (deceased), Syracuse, N. Y.; James Clark (deceased), Oshkosh, Wis.; William H. and J. H. Moore, Chicago, Ill. These last two gentlemen became largely interested in the business in 1889, and have aided greatly in bringing it up to its present commercial importance.

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CHAPTER LXX

THE ICE INDUSTRY

THE use of ice as an article of commercial importance dates from early in the present century. It is to the people of America above all others that the credit must be given for its rapid development as an industry, hardly less phenomenal than the progress of steam, the improvement of the printing-press, and the introduction of electric and other inventive industries.

Prior to the beginning of the present century we learn little as to the use of ice. Dating back to the days of Job, we find him singularly oblivious to his opportunities when the Lord called his attention to "the treasures of the snow," "the treasures of the hail," "the ice," and "the hoar-frost of heaven." Galileo seems to have been equally inappreciative, notwithstanding that he is accredited with having been the first to observe that "ice is lighter than water; hence it floats." In the early ages of Greece and Rome it is shown to have been used, snow in the days of Seneca having been sold in the shops and peddled upon the streets of Rome. The snow thus used was collected on the dry plains of Hannibal's camp on the ancient Mons Albanus, where pits were dug, cone-shaped, about fifty feet deep and twenty-five feet in diameter at the surface, then filled with snow, and beaten down as hard as possible, the pit having been first lined with straw and prunings of trees. The extreme bottom of the pit was obstructed by a wooden grating, in order to form a drain; and more prunings being added, a thatched roof was put on, and a door, well covered with straw, left at the side, through which entrance could be effected for the purpose of cutting out with mattocks the ice thus formed. In the East Indies a somewhat analogous example appears, the pits there, however, being about thirty feet square by two feet deep, lined with sugar-cane or the stems of dried Indian corn about a foot thick. In these pits shallow earthen dishes are placed, which are filled at dusk with water that has been boiled, which readily freezes during the night; and at sunrise hundreds of laborers carry the thin sheets of ice thus formed to deep pits, ramming them down to force them to congeal into a solid mass. In China a like method is pursued.

In the reign of Henry III. of France, toward the close of the sixteenth century, the use of snow for cooling liquors at the tables of the wealthy became somewhat general, and its sale near the end of the seventeenth century was made a profitable trade in some parts of that country. From that time to the early part of the nineteenth century little progress was made in developing the use of ice, although some experiments were made in increasing refrigeration by mixing saltpeter and snow with ice, and in congealing by cold various juices, creams, and other luxuries. I refer to the original manuscript of an article prepared for the United States census of 1880 for thus much of "ancient history," as, strange to relate, the literature of the business may be said to be still in its infancy; and the absence of accurately compiled statistical information from the various sections of our own country, as well as others, prevents such a résumé as can be given from properly conveying a clear idea of the magnitude of this wonderful outgrowth of American enterprise.

When Daniel Webster moved to Marshfield in 1835 and cut his own ice, he had seen but the birth of this new child of nineteenth-century progress, and but little of its infancy, for it had not then developed into youth. The year 1805 may be taken as marking the first stage of its life, if we except the shipment made from New York in the year 1799 by a gentleman in Charleston, S. C., who chartered a vessel for a cargo which was cut on a pond near Canal Street, in the city of New York. In 1805 Martinique's hot sun destroyed the frigid cargo of 130 tons which had gone to its shores from Yankeedom in the little brig *Favorite* to assuage the sufferings on that fever-swept island. The ill results of that experiment, by which $4500 were lost, only temporarily disheartened its originator, Frederic Tudor, son of Judge William Tudor, who as a colonel had served on the staff of General Washington. The brig *Trident*, two years later, carried Mr. Tudor's second shipment from Boston, which arrived in Havana, but likewise proved unprofitable. The War of 1812 caused a cessation of his efforts, and not until the year 1816, after obtaining a concession from the Spanish government securing a monopoly in Havana, did he again venture to export from Charlestown, Mass., cargoes of ice to the South. Their successful sale justified further ventures to other Southern ports on our coast, and the Stars and Stripes for succeeding years waved over many an American ship freighted with frozen crystals which found a welcome in home and foreign ports as far as the East Indies. In 1817 and 1818 the trade was extended to Charleston and Savannah; in 1820 to New Orleans; in 1833 to Calcutta; in 1834 to Rio Janeiro. An illustration of the progress of ice exportation is furnished in the following table:

EXPORTATION OF ICE.

Year.	Number Cargoes.	Quantity. Tons.
1806	1	130
1816	5	1,200
1826	15	4,000
1836	45	12,000
1846	175	65,000
1856	363	146,000

In this latter year shipments had covered ports in the West Indies, South America, Ceylon, Calcutta, Bombay, Madras, Batavia, Manilla, Singapore, Canton, Mauritius, and Australia. In 1842, Gage, Hittinger & Company, of Boston, entered the field as exporters, and introduced American ice by the bark *Sharon* to the people of London. Mr. Lander, of Salem, followed them in this trade. In 1872 shipments had increased to 225,000 tons, and thus the trade continued until the year 1880, when the extraordinary failure of the ice crop opened the field in tropical countries for manufacturing ice. In that year the shipments by 1735 vessels from the Kennebec alone amounted to 890,364 tons.

Thus the irrepressible American was different from Job and Galileo; he saw his opportunities and made the most of them. In a few years the business was begun in Eastern cities, notably in New York, where it has since attained the most gigantic proportions. Previous to the introduction of Croton water into that city, the earliest efforts at gathering ice, excepting the first shipment in 1799 to South Carolina before referred to, were directed by a few butchers desirous of preserving meats for the wants of the small population. Their ice came from what was known as Sunfish Pond, on the outskirts of the city. In the year 1826 some ice was cut on Rockland Lake, the purity of this water particularly commending it. This ice was conveyed from Rockland Lake landing in a rude box, set upon a truck with wheels cut from logs of wood, to the sloop *Contractor*, commanded by Captain John White, and from the sloop it was trundled around ashore in a one-horse cart until sold. Later the steamboat that made a trip from Haverstraw and return in two days brought all the supply to the city customers. As in Boston, these pioneers thought ice could not be kept aboveground, and therefore stored it in a large hole twenty feet square by fifteen feet deep. Then followed the building of stone houses at the old red fort, Hubert Street, in New York City, and another at the foot of Christopher Street. This plan of storage was eventually abandoned, owing to the waste ensuing from frequent exposure of the ice while loading wagons. Thereafter followed, as the business grew, the erection of storehouses at the lakes and other places where ice was first gathered; these storehouses varying greatly in size, but ordinarily built about 100 or 150 feet in length by 36 to 40 and 50 feet in width, and containing rooms more or less in number for the separation of the ice. These rooms in some of the States are each called a house, although all are under one roof; while elsewhere an aggregation of rooms is designated a house. Thus an owner of a twelve-room house is spoken of in one section of the country as owning twelve ice-houses, and in another section as owning one house. The storage capacity of houses ranges from 10,000 to 90,000 tons, 30,000 tons being a fair average accommodation; and the total storage of natural ice for mercantile use may be safely estimated for the whole United States at 10,000,000 tons.

A lack of unity of interest and harmony in the trade, and a tendency to overestimate rather than underestimate the magnitude of individual operations, have resulted in promoting incorrect opinions as to the storage capacity, the consumption, and the capital invested. Thus, in some cases, chartered companies have been erected upon fictitious value, arbitrarily fixed without reference to intrinsic or market value, often comprising sums stated as consideration for "good-will," a rather valueless commodity in many cases. Shorn of these values, however, an estimate taken from the best information at hand, and from actual inspection of most of the large centers where the business is conducted, results in fixing the entire capital engaged in the ice business of the United States, inclusive of that invested in manufacturing ice, at not less than $30,000,000; and the production for commercial use at about 15,000,000 tons, about one half of the crop gathered being available for use, the waste by melting and chipping amounting to fifty per cent. No provision, however, is made in this estimate for the business conducted in the small towns and villages of the country, of which it is impossible to obtain statistics.

To move this great body of ice requires a large fleet of vessels—sailing vessels for export, and mostly ice-barges and other boats for the home trade. The railroads also, in many sections, are largely used for transportation, more particularly in the West, where the value of the ice dealers' patronage has been recognized in rates that make it possible for dealers to use cars in transportation profitably; whereas in the East this has generally been found to be impracticable, except where the railroad company has entered into competition with ice dealers to build up its own freight by controlling ownership of the ice plant. In the year 1878 large quantities were shipped in train-load lots by the Knickerbocker Ice Company, of New York, to Cincinnati and other cities in the West and South, twelve gross tons weighing out ten net tons, much to the surprise and admiration of buyers in those cities for the skilful packing. Ice was railroaded afterward in the same year to St. Louis from Maine —a longer distance; but the experiment was not repeated, owing to a waste of fifty per cent. The large fleets of ice-barges traversing the Hudson by day and night, in tow of steam-tugs, during the season of navigation, which is limited to an average calculated during fifteen years at 268 days, form a picturesque scene familiar to tourists on that river; and the great storage-houses so numerous on its banks between Rondout and Coxsackie have awakened their wonder, equipped as they are with elevators and chains, stored away during the summer, but which in winter run to the music of steam-power with the white blocks of crystal from the water to the interior of the houses. The electric power has not yet been put in service there, except for light while working at night. The movement of the large stock of ice required for New York and adjacent cities must of necessity be made in the limited period for water transit, the record of fifteen years showing a closing of navigation on the Hudson an average of ninety-seven days in the year. Over 1500 wagons and 3000 horses are in use for the distribution of ice in the cities of New York and Brooklyn alone, and the weekly pay-rolls in these two cities for laborers engaged in such work amount in the summer with the leading dealers to about $25,000 per week. To the yearly pay-rolls must be added the cost of towing, loading, and discharging barges, dock and stable rents, repairs and maintenance of boats, wagons, ice-houses, and other things in which the deterioration from usage is rapid, and it will be found questionable whether any other industry returns out of its receipts so large a percentage to the people from whom the revenue is derived.

The manufacture of ice-tools and machinery, as a necessary adjunct of the ice business, is made a specialty by some dealers in this country, who thus have attained not only a national but an international reputation for excellence of work. Mr. Nathaniel Wyeth, of Boston, who constructed the first double-walled modern ice-house, has the credit, in connection with Mr. John Barker, of the same city, of inventing many of the ice-tools, now numbering over seventy, which supplemented the primitive ax and hand-saw used in the early years of the business. The Norwegians were the first foreigners to recognize the advantage of American ice-tools and machinery, after the invention of ice-plows in the year 1839 (although the patent clearing-tooth was not invented until the year 1872); and it was not many years after the exportation of ice was shown by Americans to be practicable that certain of those Northmen visited this country to learn the method of harvesting, storing, and shipping, which business dealers in that country have since largely pursued. Some cargoes of Norwegian ice have found a ready market in the city of New York in seasons of scarcity, the first cargo arriving in the year 1880.

The production of cold by artificial means has attracted attention from a much earlier date than is generally supposed. The existence of porous clay vessels for cooling water in Egypt, Arabia, China, and other Eastern countries would indicate that this method antedated the use for like purposes of even ice itself, notwithstanding ice was already prepared in nature's own laboratory. In the southern part of the eastern hemisphere, where ice could not be found, the earliest process was the plunging of wine-bottles in water to lower the temperature of the wine; then succeeded the plan of wrapping them in wet cloths, thus applying the principle of evaporation, a principle still in existence combined with the use and solution of saline substances. When snow

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could be procured it was substituted for water, and eventually the application of salt was found to hasten evaporation. The use of ether was also known as productive of cold by evaporation shortly after its discovery; and in India it was common, owing to the cheapness of niter, to use a solution of niter and water also as a cooling mixture for wine. The becarros of Malaga and the alcarrazas of Spain are but modernized developments of those cooling vessels which the Saracens introduced, and faithfully attest the antiquity of the practice of artificial means of refrigeration. The record of early experiments for mercantile uses starts with the Italians in the sixteenth century. Lord Bacon later took some interest in the matter; and the record of the results of the experiments of Mr. Walker, of Oxford, England, in 1795, contains highly interesting tables of many freezing mixtures. Professor Leslie, of England, produced a considerable degree of refrigeration on the principle of including in the exhausted receiver of an air-pump sulphuric acid, a substance rapidly absorbing vapor. Later experiments were made by French and German inventors. The ether-machine followed, being patented in Connecticut in 1850; but a serious danger arises from the use of ether, owing to its liability to explosion in case of leakage. Other machines have been made using liquefied ammonia, and others sulphurous acid and various frigorific mixtures. More progress in these has been made by manufacturers in this country than elsewhere, particularly in the commercial use of cold air for refrigeration in breweries and places where cold air only is required, but with more varying success in the production of ice itself for consumption, except at points remote from the sources of natural ice-supply. Thus in the South, and notably at points away from the coast, machine-made ice has been handled to better advantage than the other; but the cost of manufacturing such ice, even without the additional cost of making a chemically pure article, precludes the prospect of ever bringing it profitably into competition with ice formed by nature's own hand.

America may well be proud of the ice industry, and may well claim its parentage. It brings comfort to the afflicted, it puts sweetness and purity in the place of decay, and by wasting gives up its own life to save lives greater and more valuable. It promotes the honest investment of capital, and feeds and clothes laborers by the thousands. On the fields adjacent to the city of New York alone it finds employment in the harvesting season for from 15,000 to 20,000 men, and in its distribution during summer for nearly 5000 men. The cost of harvesting goes to the laborer, thence to the merchant; the costly plants set as jewels among the farm lands, wherever located, reduce the taxes of other land-owners; and thus all classes reap a benefit from the money which stores, moves, and distributes the crop. It is a productive industry in the fullest sense, and as "blessed is he who makes two blades of grass grow where one grew before," so should this industry, in all the glory of its productive power and beneficial results, be fostered and classed among the thousand things which stir the pride of the American people in this nineteenth century.

Robert Maclay

CHAPTER LXXI

SODA-FOUNTAINS

JAMES PARTON, in his "Life of Thomas Jefferson," says of Dr. Joseph Priestley: "It is not true that no public memorial of Dr. Priestley has been erected. Every soda-fountain is his monument; and we all know how numerous and splendid they are. Every fountain, too, whence flows the home-made water of Vichy and Kissingen is a monument to Priestley; for it was he who discovered the essential portions of the process by which all such waters are made. The misfortune is, however, that of the millions of human beings who quaff the cool and sparkling soda, not one in a thousand would know what name to pronounce if he were called upon to drink to the memory of the inventor. And really his invention of soda-water is a reason why Americans should join in the scheme to honor his memory. He not only did all he could to assist the birth of the nation, but he invented the national beverage."

"Soda-water," or, more correctly, carbonated water, which is simply a mechanical mixture of carbonic-acid gas with water, was first made by Professor Venel, of Montpellier, France, whose researches were laid before the French Academy of Sciences in 1750, by mixing two drams of soda and "marine" acid in a pint of water contained in an ordinary glass bottle. Carbonic acid was discovered by the Belgian chemist, Van Helmont, in the early part of the seventeenth century. He coined the word "gas" to designate it. Lavoisier named it carbonic acid, and Priestley, in 1767, produced a carbonated beverage by pouring water briskly back and forth between two small vessels held in a layer of carbon dioxide on the top of the fermenting mass in a brewery vat at Leeds, England. Bergman, the Swedish chemist, in 1770 generated carbonic-acid gas from chalk by the use of "vitriolic acid," and invented a generating apparatus for the purpose. In 1810, Simmons and Rundell, of Charleston, S. C., were granted a patent for saturating water with "fixed air." John Matthews, of New York, in 1832 began the manufacture of soda-water, and apparatus with which to make it, and may fairly be termed the father of soda-water as it is known in the United States. Matthews, who learned his business in England under Bramah, manufactured generators of cast-iron lined with lead, in which he produced carbonic acid from marble-dust and oil of vitriol, purifying it by passing it through water in a purifying chamber, whence it was conducted into fountains of cast-iron lined with block-tin, in which the gas was combined with water by means of a revolving agitator, or by rocking the fountain, which, for this purpose, was mounted by means of trunnions in a cast-iron frame. His dispensing apparatus was a simple draft-tube projecting from a counter, beneath which the fountain was incased in ice, or the fountain and draft-tube were connected by means of a coil of pipe placed in an ice-box; the syrups for sweetening and flavoring being kept in glass bottles on the counter. Subsequently these bottles were mounted on a caster, and later they were inverted, mounted in rings upon a marble slab, and stopped from within by a valve upon the end of a rod which projected through a hole in the top of the inverted bottle.

The apparatus for manufacturing soda-water described above, with various modifications and improvements, is that most generally used to-day throughout the United States, and nearly all manufacturers use marble-dust and sulphuric acid for the production of carbonic-acid gas.

In 1844, A. D. Puffer, of Boston, began the manufacture of soda-water apparatus, and probably about the same time A. J. Morse, who in his day was one of Boston's leading coppersmiths, took up this branch of manufacture. Puffer invented the first cooler for soda-water upon which a patent was granted, and Morse manufactured a vertical copper generator and portable copper fountains or tanks for holding and transporting the beverage. In 1847, William Gee, of New York, who had been an apprentice under Matthews, established himself in business. He was an ingenious mechanic, and patented many minor devices in soda-water machinery and apparatus.

To G. D. Dows, an Englishman, who carried on a drug business in Boston, belongs the honor of inventing and patenting the first marble soda-water apparatus, the prototype of the modern soda-fountain. He began business in 1854. His apparatus was a marble box, containing a coil-pipe cooler for soda-water, and metal containers for syrups, and an ice-shaver, in which a block of ice was shaved into snow, the syrups and soda-water being drawn in a tumbler previously partly filled with shaved ice. This apparatus was distinguished by a row of silver-plated syrup-faucets, upon each of which an eagle was perched, serving as a lever for opening the faucet. His soda draft-tubes were provided with nozzles of soft rubber, which served to retain the gas in the water while being transferred to a water-bottle held against the rubber nozzle, the water being subsequently poured from the bottle into a tumbler containing the ice and syrups.

Later he invented the first double-stream soda draft-tube, which delivered the soda directly into the tumbler, thus doing away with the use of the bottle. This draft-tube furnished a fine forcible stream which stirred up the ice and syrup, and was provided with a "spoon" pivoted in the edge of the nozzle, which, when the tumbler was pressed against its projecting end, was forced beneath an inner nozzle, breaking the force of the fine stream and producing a large stream without force, which retained gas in the water without intervention of the water-bottle. Dows exhibited his apparatus at the Paris Exposition of 1867, and received medals and high commendation. About this time he established a branch house in London, which is still in existence. He was the first to manufacture a fine article of bottled ginger-ale in this country, and much of that now manufactured is made upon his formula. Among his early customers were Z. S. Sampson, of Court and Hanover streets, Boston, and Orlando Tompkins, who kept a drug-store at the corner of Washington and Winter streets, and who was the father of Eugene Tompkins, proprietor of the Boston Theater.

In 1863, being in need of a soda-fountain for use in my drug-store in Somerville, Mass., I invented and patented an apparatus styled the "Arctic," which subsequently attained a wide popularity, and led me to abandon the drug business to engage in its manufacture. Although a crude machine judged by modern standards, it was considered to be in advance of any in the market at that date. Its peculiar features consisted of cylindrical metal coolers, which possessed the advantage of producing soda-water of so low a temperature that the use of shaved ice, which had the effect of driving off the gas from soda-water drawn upon it, could be dispensed with. The syrup-containers were placed in the rear of the marble box, and connected with the syrup-faucets by means of coolers passing beneath the ice, producing chilled syrups. Syrup-faucets bearing a star and liberty-cap, doubtless remembered by many readers, distinguished this apparatus, which was noted for the coldness and consequent good quality of the beverage drawn from it.

My first catalogue was issued in 1864 from a little factory at 11 Haverhill Street, Boston, and was illustrated with woodcuts made by Kilburn, Boston's leading wood-engraver. It is curious to read in this book, in the light of subsequent developments, the statement of a conservative druggist: "Folks don't drink soda nowadays." Among my first customers were Henry C. Choate and John I. Brown & Son, leading druggists of Boston, and Southmayd, the leading confectioner of the city; also Ellis F. Miller, of Hanover and Union streets, a location which is still one of the leading soda-water stands of the city.

About this time Puffer introduced his apparatus with the "magic" draft-tube, from which soda-water and a variety of syrups were drawn through the same nozzle. This apparatus attained a wide popularity, and is known to New-Yorkers through its use by the celebrated Hudnut. During the years 1864, 1865, 1866, and 1867 my business extended, covering a wide range of territory; Frederick Stearns, of Detroit, F. E. Suire & Company, of Cincinnati, then the largest retailers of soda-water in the country, and Charles Lippincott, the largest soda-water manufacturer in Philadelphia, being among the users of and dealers in the "Arctic." The Lippincott business, which was established in 1832, subsequently took up the manufacture of marble soda-water apparatus, becoming one of the leading manufacturing houses in the line.

At this time, E. Bigelow, of Springfield, Mass., was manufacturing an apparatus which had at least one excellent feature—the "wonder" cooler, subsequently purchased, with other effects of the Bigelow Manufacturing Company, by John Matthews, on the failure of the company. The Bigelow apparatus was supplied with a piston-style faucet, which proved unsatisfactory and went into disuse when this company discontinued business. The Bigelow apparatus was in use by Hegeman & Company, of New York, in 1865.

In 1854, and subsequently, many inventions of both the elder and younger John Matthews were patented; among others the measuring syrup-tank of glass, still used by their successors. William Gee invented and patented the two-wheel soda draft-tube, the pipe-lined coupling, a blow-off cock for generators, and other devices, which subsequently, by purchase, became the property of the Matthews concern. This ingenious mechanic received a patent for the combination of a force-pump with a soda-fountain, for forcing water into the fountain against pressure, thus preventing the waste of gas consequent upon opening the fountain to refill with water; and this invention is the basis of the present splendid machine for filling portable fountains made by the Matthews Company. Another of his inventions is the draft apparatus of silver plate, made popular by Huyler, the confectioner, and used at all his stores. This apparatus, known as the "Monitor Crystal Spa," and made by the Matthews Company, consists of a central cylinder containing coolers and syrups, surrounded by a revolving caster supporting an array of glass syrup-bottles. Gee's manufacturing apparatus was used by the celebrated Dr. Hanbury Smith, of Union Square, New York, and his bottling apparatus by Comstock, Gove & Company, of Boston. John Matthews is referred to in the New York "Evening Mail," in 1868, as the "Neptune of the trade," and is stated to have the largest house in the business, employing 100 men and carrying on no less than sixteen distinct trades, the factory at First Avenue, Twenty-sixth and Twenty-seventh streets, where it is still located, supplying everything in the soda-water line, from a quart of syrup to a $1400 apparatus.

In 1868 my apparatuses were already being imitated by rival manufacturers, and from that time on the competition has been sharp. The first departure from the square white marble box was made by me in 1869, when the cottage style was introduced, and the design patented. Colored marbles were used in this design, the Tennessee, Vermont, and New York State marbles being used in addition to the white Italian. In this year I introduced the patent revolving tumbler-washer, and began the use of block-tin syrup-cans, which were a great advance in purity and durability over the syrup receptacles of copper, glass, and earthenware previously in use. In this year, also, I had the satisfaction of selling one of my fountains to Copeland & Tarbell, of Boston, who had at that time the finest confectionery establishment in the United States.

Joseph Hindermyer, of Philadelphia, was one of the early manufacturers of soda-water apparatus, and many ingenious devices originated with him. Among his appliances which came into general use was the ground-plug syrup-faucet, which, with many improvements and modifications, is still used by the majority of manufacturers of soda-fountains. At this time there were 1200 of my fountains in use, and I opened my first branch at Maiden Lane and Nassau Street, New York. In 1873 the first hot-soda apparatus was patented, and in 1874 a sliding valve, double-stream draft-tube, and the cup-cooler, the latter still being used in all apparatus of my make. In 1874, also, the first patent was granted under which the Matthews steel fountain was manufactured. The introduction of the steel fountain marked an era in the business, it being a vast improvement over the so-called portable cast-iron fountains, or even the lighter copper fountains, once so common and now so seldom seen.

The Centennial Exhibition at Philadelphia afforded an opportunity not to be overlooked for advertising the soda-fountain and popularizing soda-water as a beverage, and the exclusive privilege of serving it within the grounds was secured by Charles Lippincott & Company and myself for the sum of $50,000. The business done was enormous, and, although not profitable in itself, proved a valuable advertisement. Puffer in this year invented the arc, a small silver-plated counter apparatus, which has proved very popular; and Gee invented a self-closing acid-valve for carbonic-acid-gas generators.

Matthews in 1878 invented the solid-plunger syrup-pump, which, with modifications, is still extremely popular with bottlers of soda-water; and in 1880 the "sublift" syrup-valve for glass syrup-tanks, provided with measuring chambers, which form the distinguishing feature of this make of dispensing apparatus. In 1881 Matthews was granted the first of a series of patents for filling portable fountains with soda-water, which formed the basis of the so-called "new system" now coming into general use. Puffer in 1882 invented and introduced the revolving water-gauge, and the same year introduced the patented pressure-regulator, a useful device for preventing breakage of bottles when being filled with soda-water, lessening danger to operators from flying fragments of glass, and improving the uniformity of beverages. Roger Scannell, of Boston, in 1884 patented the first spray-carbonator, a simple

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and efficient device for combining gas with water without mechanical agitation.

An era of the business was marked again in 1885 by the invention of the drawer syrup-can, which was patented and introduced by me. This syrup-can, which differs from all that have preceded it in being horizontal and located below the ice-chamber, has become so popular that it has practically driven every other form of syrup-can from the market. Numerous patents have been granted upon imitations of it, and several suits for infringements are now before the courts. The heat-regulator used on my hot-soda apparatus was invented and patented in this year.

In 1886, Harry Robertson, of New York, patented a spray-carbonator containing some ingenious automatic features, which is manufactured by Witteman Brothers, of New York. In 1887, William P. Clark, of Medford, Mass., invented the latest of a series of double-stream draft-tubes, which were for many years, and are still, used exclusively on my fountains. This tube, which is a nice piece of mechanical construction, may be entirely taken apart without the use of a wrench, and draws alternately fine and large streams of soda by slight movements of a lever. Luther W. Puffer patented the non-clogging blow-off cock for generators in 1887, and F. Hazard Lippincott patented a removable glass syrup-jar, with a simple and ingenious device for detaching the cock from its lever by simply lifting it with the jar in removing the latter.

Early in 1891 the proprietors of the four largest concerns engaged in the manufacture of soda-water apparatus came together and organized the American Soda-Fountain Company, which purchased from the owners, at fair valuations, the four businesses represented. The company is capitalized at $3,750,000, one third of which is first preferred stock, bearing six per cent. dividend; one third second preferred stock, bearing eight per cent. dividend; and one third common, which to date has paid ten per cent., while a surplus of $300,000 has been laid aside. The company conducts its four branches as separate and distinct businesses under the old firm names of James W. Tufts, A. D. Puffer & Sons, Charles Lippincott & Company, and the John Matthews Apparatus Company. It has recently acquired by purchase the Hartt Manufacturing Company, of Chicago. The stock of the American Soda-Fountain Company is held by some 800 different owners.

The Hartt Manufacturing Company patented and introduced in 1891 a drawer-can which is dropped before withdrawing. This patent has already become a source of litigation, two suits for infringement having been brought under it. Henry Carse, of Rock Island, Ill., in 1892 patented a carbonating-machine for combining carbonic-acid gas and water by the spray process, which was introduced by the Hartt Manufacturing Company, and has attained considerable popularity. The Low Art Tile Company, of Chelsea, Mass., took up the manufacture of soda-fountains in 1891, abandoning its older business of manufacturing tiles for architectural and decorative purposes, and produced the first apparatus incased entirely in tiles.

F. H. Lippincott in 1893 patented the first tilting syrup-jar, which was closely followed by a similar device invented and patented by Herman Hoff, of the Hartt Manufacturing Company; and the same year I patented the "Cataract," the latest and most improved form of spray-carbonator. In this machine gas is admitted under high pressure to a vertical chamber, through a regulating valve which maintains a uniform pressure; by means of a pump, water is forced into the top of this chamber through a plate perforated with hundreds of tiny holes; and a revolving agitator in the lower part of the chamber completes the combination of gas and water. The quantity of water is governed by the action of a small vessel hung in knife-edge bearings and counterbalanced, the water flowing and ebbing in the vessel as its level varies in the mixing chamber, and gravity causing the vessel to rise and fall as its weight varies with the changing flow of water. The rock-shaft, upon which the vessel and its counterpoise are mounted, carries a belt-shipper, and its movement ships the driving-belt of the pump from the fast to the loose pulley, and vice versa, thereby alternately stopping and starting the pump. The action of this machine is entirely automatic, and adapts its output to the demand made upon it by the bottlers, working equally well whether supplying one or six bottling tables. I have recently completed for the Charles E. Hires Company, of Philadelphia, a machine consisting of three of these carbonators mounted in battery with two generators of the largest size, which is capable of supplying eighteen bottlers and turning out 3600 dozen bottles of beverage in ten hours. This is probably the largest machine in the world for the manufacture of soda-water.

Besides the patents described, hundreds of others have been granted for soda-water machinery, the American Soda-Fountain Company alone owning nearly 200 live patents. In addition to those mentioned previously in this article, there are scattered throughout the country numerous other concerns manufacturing soda-fountains, among which may be mentioned Otto Zweitusch, of Milwaukee; Bennett & Gompers, of New York; and the Robert M. Green Company, of Philadelphia. Wrought-iron portable fountains are also manufactured by the Iron-Clad Can Company, of Brooklyn.

The amount of capital invested in the business is hard to estimate, and also the number of people employed. The capital of the American Soda-Fountain Company has already been stated, and this company employs nearly 1000 hands, in addition to a force of about 125 traveling salesmen. The number of soda-fountains in use is estimated at from 50,000 to 60,000. Fully this number have been made and sold by the various concerns now forming branches of the American Soda-Fountain Company, and of these the majority are still in use. The dispensing fountains, which are generally made from foreign marbles, many being of rare Mexican onyx, vary in value from $100 to $10,000 each, bottling outfits of cast-iron and copper ranging at about the same values. The business annually done by the users of these fountains takes about the same range, though in exceptional cases it is much larger. Plows, who until recently was the leading dispenser in Chicago, sold $24,000 worth of carbonated beverages in a single year.

Without doubt the large consumption of this wholesome and agreeable beverage has an influence in promoting temperate habits among the people of the United States, by lessening the consumption of alcoholic drinks. That the use of soda-water increases largely year by year is shown by the annual sale of several thousand of the practically indestructible steel fountains used as portable containers. As a source of profit the soda-fountain contributes largely to the prosperity of its owner, and no retail drug or confectionery store can lay claim to be well appointed that is not supplied with one. The business of manufacturing soda-water apparatus is in a prosperous condition, and its prospects for the future are bright, although competition has forced prices to such a point that profitable business can be done only upon a large scale, involving the investment of enormous capital in plant and labor-saving appliances.

The cost of selling and collection is large, and payments are made in non-negotiable lien notes, and it is only by making them in very large numbers that soda-fountains can be profitably manufactured. The collateral branches, which include the manufacture of fruit-juices, flavoring extracts, syrups, bottlers' supplies, and the silver-plated furnishings of the soda-water counter, are in a flourishing condition. In conclusion I may say that soda-water, which a few years ago was a novelty and luxury, is now looked upon as a necessity, and bottled waters, plain and salted, as well as ginger-ale and similar sweetened carbonated beverages, are now commonly found upon the tables of a large percentage of our people.

James W. Tufts

CHAPTER LXXII

AMERICAN TEXTILE MILLS

ONE hundred years ago there were no textile mills, as we now understand the term, in the United States. Whatever our people did in the way of manufacturing their own clothing was mostly done in the household; the spinning-wheel and the hand-loom were utensils as familiar in the old-fashioned kitchens as the pots and kettles of the housewife. The homespun garments worn by our forefathers were fashioned out of wool grown on the home farm, carded by hand-cards, washed in tubs, spun and woven by hand, fulled and finished at home, cut up and sewed—all by the joint labor of husband, wife, sons, and daughters. The finer clothes worn in those days were all imported; and as the colonies grew and multiplied, and their consumption of English textiles increased, the manufacturers of the mother country foresaw a wondrous new market opening up before them. The desire to retain and increase that market for textiles, in the manufacture of which England already led the world, was far more prominent among the causes leading up to the American Revolution than the historians of that event have yet discovered.

The homespun garments of colonial days were plain in weave, and wore like iron; their ingredients were indicated in the name commonly applied to the cloth—"linsey-woolsey." It was a fabric of woolen weft, woven on a linen warp. Linen was much more commonly produced in the household than cotton fabrics, and wool was more in use than all other fibers combined. Cotton was a scarce commodity in colonial America until long after the Revolution. It possessed a value equal to that of wool, and sometimes very much higher. What little of it was used prior to the nineteenth century was mostly imported from the Barbadoes. When Samuel Slater started the first American cotton-mill at Pawtucket, in 1793, he insisted upon using cotton from the Indies, because of the poor quality of the cotton then raised at home. No one dreamed, when the "Shipping and Commercial List and New York Price Current" first made its appearance, that America was destined to become the cotton-producing country of the world; nor did Slater's little mill of 250 spindles, which had then been in operation five years, give signs that it was the germ of an American industry which would consume within the next 100 years more cotton than all the world was then growing. The history of the textile industries during the colonial period is nowhere suggestive of the development which confronts and amazes the student at the close of the nineteenth century, who finds them, with their subsidiary industries, employing more capital and creating a greater value of annual product than any other group.

Our forefathers realized how important it was that the colonists should learn to clothe themselves. They resorted to all sorts of expedients, some of which smack strongly of state socialism, to overcome the difficulties in the way. They offered bounties to increase the number of sheep and promote the growth of flax. In Massachusetts laws were passed making it compulsory that each family should spin a given quantity of yarn every year, under penalties of heavy fines. Gradually the household textile industries assumed an importance which alarmed the mother country, and the Lords of Trade attempted by various restrictive orders to prevent and harass a development which threatened to destroy the colonial market for the chief products of British industry. Parliament passed an act in 1774—which was shortly after the Arkwright inventions had inaugurated the modern factory system—forbidding the exportation, under heavy penalties, of any of the machines used in the cotton, silk, woolen, or linen manufacture. One smiles, in recalling this statute,—which remained in force, with certain modifications, until 1845,—at this evidence of a puerile hope that the English people could keep the fruits of inventive genius bottled up in their little island, so long as she permitted her sons to carry their brains across the water. Slater brought his spinning machinery in his head; in the same way Arthur Scholfield, three years later, brought the first wool-carding machine, which he built and put into operation at Byfield, Mass., in 1794, thus fixing the date of the beginning of the factory manufacture of wool, by machinery operated by power, in the United States. American machinists and inventors did the rest.

It is not to be denied, however, that this English statute did retard, embarrass, and make trebly difficult the early development of our textile factories. At the founding of the newspaper whose century of existence is celebrated in this volume, the American textile industries were easily one hundred years behind those of Great Britain.

It would be interesting, if space permitted, to follow the evolution of this household industry, by slow and gradual steps, into the highly organized factory system which marks the close of the nineteenth century. First came the neighborhood fulling-mill, utilizing the friendly services of the adjacent stream, and relieving the housewife of the labor of fulling and finishing the cloths and blankets accumulated by the busy shuttle during the long winter evenings. Then the carding-machine was added to the fulling-mill; the farmers for miles about brought their wool to be converted into rolls ready for the spinning-wheel. After Slater had successfully applied the Arkwright invention to the spinning of cotton at Pawtucket, here and there throughout New England little mills gradually appeared which spun both cotton and woolen yarns by water-power. Hand-looms were still used in all these mills until 1813, when Francis C. Lowell's invention of the power-loom led to the building of the Waltham cotton factory by the Boston Manufacturing Company, and the American textile mill first took on the characteristics which have since increasingly distinguished it.

Power spinning and weaving machines were rapidly applied to the manufacture of woolens, and it began to be seen that the household manufacture of textiles was disappearing before the greater economy and efficiency of the factory system. The transition was not rapid, and the ups and downs of our first textile mills were numerous and discouraging. The outbreak of the War of 1812, and the non-intercourse acts and Embargo which preceded it, were the most potent factors in completing the transition. The total suspension of importations threw our people suddenly upon their own resources for their entire supply of clothing. Cotton-mills and woolen-mills were quickly built. High prices and the promise of quick fortunes drew many men with little or no knowledge of manufacturing into the business.

All went well enough until the war ended; then collapse and ruin followed apace. The work of laying the solid foundations of textile manufacturing had all to be done over again. Imported cottons and woolens again invaded the market with a rush, and the domestic manufacturers found it impossible to compete with them either in quality or in price. Labor was unskilled and hard to get; knowledge and experience were sadly wanting; machinery was clumsy and defective; the country was poverty-stricken, and trade and the national finances thoroughly demoralized. Then first began the great battle in Congress, which has waged more or less intermittently ever since, for the protection of the domestic manufactures by means of tariff laws. The Tariff Act of 1816—the first of the series in which the principle of protection was recognized in the rates fixed as a distinct purpose of the law, conjointly with the raising of revenue—was much more favorable to the cotton than to the wool manufacture, because it applied the minimum principle to cotton cloths, which was in effect a specific duty of six and one quarter cents a yard, while the simple ad valorem rate of twenty-five per cent. was applied generally to woolen goods.

From the date of that law the cotton manufacture began a healthy development, and it naturally grew much faster than the wool manufacture. The later tariffs were in like degree, as a rule, more favorable to cottons than to woolens; partly owing to this fact and partly to other causes, such as the much more delicate, complicated, and expensive operations incident to the latter, the cotton manufacture has, at all times except during the Civil War, shown a greater prosperity, and on the whole a more rapid development, than its sister industry. But in both industries for many years it was an uphill struggle against great odds. Few fortunes were made; many were lost; and the courage and tenacity of those early textile manufacturers are worthy of a better eulogy than any yet written.

Since the year 1850 the development of our textile industries has been pretty accurately recorded by the Federal census, and it is therefore possible to measure, from that date, the degree and the character of the development. To give the reader a bird's-eye view of the growth of American textile mills in the last fifty years I reproduce here a table prepared by me for the Eleventh Census, in which the statistics of the three principal textile industries are presented chronologically in comparison with one another, and in a form more condensed than I have seen it elsewhere given. This table offers nearly everything in the nature of statistics with which it is necessary to burden this paper.

of the country, we have an additional product, as shown by the Eleventh Census, of $413,022,516; making the total value of the products of our textile mills, when they finally reach the market, the enormous sum of $1,134,971,778. This total is the

COMPARATIVE STATEMENT OF COMBINED TEXTILE INDUSTRIES IN THE UNITED STATES, 1850 TO 1890.

Industries.	Year.	Number of Establishments.	Capital.	Average Number of Employees and Total Wages.		Cost of Materials Used.	Value of Products.
				Employees.	Wages.		
Wool manufacture [1]	1850	1,760	$32,516,366	47,763	[2]	$29,246,696	$49,636,881
Cotton manufacture	1850	1,094	74,500,931	92,286	[2]	34,835,056	61,869,184
Silk manufacture	1850	67	678,300	1,743	[2]	1,093,860	1,809,476
Dyeing and finishing textiles	1850	104	4,818,350	5,105	[2]	11,540,347	15,454,430
Combined textiles	1850	3,025	112,513,947	146,897	[2]	76,715,959	128,769,971
Wool manufacture [1]	1860	1,673	42,849,932	59,522	$13,361,602	46,649,365	80,734,606
Cotton manufacture	1860	1,091	98,585,269	122,028	23,940,108	57,285,534	115,681,774
Silk manufacture	1860	139	2,926,980	5,435	1,050,224	3,901,777	6,607,771
Dyeing and finishing textiles	1860	124	5,718,671	7,097	2,001,528	5,005,435	11,716,463
Combined textiles	1860	3,027	150,080,852	194,082	40,353,462	112,842,111	214,740,614
Wool manufacture [1]	1870	3,456	132,382,319	119,859	40,357,235	134,154,615	217,668,826
Cotton manufacture	1870	956	140,706,291	135,369	39,044,132	111,736,936	177,489,739
Silk manufacture	1870	86	6,231,130	6,649	1,942,286	7,817,559	12,210,662
Dyeing and finishing textiles	1870	292	18,374,503	13,066	5,221,538	[3] 99,539,992	[3] 113,017,537
Combined textiles	1870	4,790	297,694,243	274,943	86,565,191	353,249,102	520,386,764
Wool manufacture [1]	1880	2,689	159,091,869	161,557	47,389,087	164,371,551	267,252,913
Cotton manufacture	1880	756	208,280,346	[3] 174,659	42,040,510	102,206,347	192,090,110
Silk manufacture	1880	382	19,125,300	31,337	9,146,705	22,467,701	41,033,045
Dyeing and finishing textiles	1880	191	26,223,981	16,698	6,474,364	13,664,295	32,297,420
Combined textiles	1880	4,018	412,721,496	384,251	105,050,666	302,709,894	532,673,488
Wool manufacture [1]	1890	2,489	296,494,481	219,132	76,660,742	203,095,572	337,768,524
Cotton manufacture	1890	905	354,020,843	221,585	69,489,272	154,912,979	267,981,724
Silk manufacture	1890	472	51,007,537	50,913	19,680,318	51,004,425	87,298,454
Dyeing and finishing textiles	1890	248	38,450,800	20,267	9,717,011	12,385,220	28,900,560
Combined textiles	1890	4,114	739,973,661	511,897	175,547,343	421,398,196	721,949,262

[1] Includes hosiery and knit goods.
[2] This item was not fully reported in the census of 1850.
[3] At the census of 1870 the value of the fabric itself was included, whereas in all subsequent censuses merely the values added to such fabrics by processes of dyeing and finishing are given.

Here we find, in the half-century, a growth in the value of products from $128,769,971, in 1850, to $721,949,262, an increase of nearly six times, and not less than ten times if it were possible to measure this product by quantity instead of by value. Even these figures convey an inadequate idea of the relative importance of our textile mills in the industrial economy of the nation, for these mills supply the materials for a great group of subsidiary factory industries, such as the wholesale clothing manufacture, the shirt manufacture, etc. When we aggregate these, and add to them the value of the products of the linen, jute, hemp, and bagging mills

largest in value of any single line of related industries. The total most nearly approaching it is that of the iron and steel industries, the multiform variations of which reveal a value of products, when aggregated from the census tables, of $1,096,163,056. These two industries include, therefore, two ninths of the total value of all the domestic manufactures reported by the Eleventh Census; and those of the textile mills and the factory products growing out of them are equal in value to one ninth of all our manufactures. Figures of this magnitude bring us face to face with the true relative importance of our textile mills in the industrial economy of the nation. Few people realize how vast and how varied it is; for they do not stop to think that, next to the food question, nothing comes so closely home to all the people as the question of what they shall wear.

The decrease in the cost of goods during the period covered by this table has been one of the most striking phases of the development. Unfortunately it is not a phase which statisticians have learned to measure in figures. This decrease in the cost of textile goods is due in some measure, of course, to the decreased price of the raw materials from which they are made; but in even larger measure is it due to the remarkable advance in the methods of manufacture—to the new and more perfect machinery employed, in the invention of which American mechanical genius has contributed certainly as much as any other people, and perhaps more.

All the fundamental inventions in spinning machinery were of English origin; so was the combing-machine and the power-loom. The English have a remarkable record in this respect, and the French and the Germans have also done much in the invention of labor-saving textile machinery. But the American record surpasses them all, in my judgment. The wool-carding machinery of all countries owes its chief improvement over the machines of a century ago to the invention of John Goulding, of Worcester, Mass., whose patent, dated 1826, dispensed with the splicing-billy and produced the endless roll or sliver. Michel Alcan, the distinguished French writer, describes it as "the most important advance in the wool manufacture of the nineteenth century." "It was not a step," he says, "but a flight."

The modern cotton-spindle, making 10,000 revolutions a minute, is an evolution of our own mechanics. General Draper, in his interesting paper on "The History of Spindles," has shown that the saving effected by the new forms of spindle invented and adopted in the United States since 1870, when 5000 revolutions a minute were the average speed, has been more than equal to the capacity of all the warp-spinning machinery in use in this country in that year. He adds the interesting fact that "to-day more than three times as much warp-yarn is spun in the United States as in 1870, a rate of increase without parallel since the earliest introduction of the cotton manufacture."

The Lowell loom was the first successful application of power to the weaving of cotton, the Crompton loom to the weaving of fancy woolens, and the Bigelow loom to the weaving of carpets. "Not a yard of fancy woolens," wrote Samuel Lawrence, "had ever been woven by power-looms in any country until it was done by George Crompton at the Middlesex Mills in 1840." Every carpet ever woven was woven by hand until Mr. Bigelow's power-loom revolutionized the industry. Beyond these fundamental machines the American mechanisms for expediting processes, for automatic devices, for dispensing with intermediate help, have been so numerous that they have completely transformed the *modus operandi* of textile mills throughout the world. These mechanisms are more generally in use to-day in the best American textile mills than in those of any other country. So far as mechanical equipment is concerned, our best mills, whether cotton or woolen, are fairly equal to the best in any foreign country.

It does not follow that textile manufacturing is done here, as a rule, with equal economy in cost; some of the reasons for this may be pointed out later. In structural equipment the modern American mill is in some respects superior to the average foreign mill. It is not so massive a structure, nor so solidly built, we using brick when the English generally use stone; but in the lightness and airiness of its rooms, in economy of arrangement, and in general completeness of equipment and care for the comfort and convenience of the operatives, it is generally superior. Since Mr. Edward Atkinson's successful efforts to introduce the slow-combustion construction, the liability to loss by fire is hardly greater, as the insurance statistics show, than it is abroad. Of course there are left many old-fashioned mill structures, built long ago, and often of wood, to which these remarks do not apply. But the lesson is fast being learned by our textile manufacturers that in these days of close competition and small profits successful manufacturing requires that buildings shall be of the latest design and the most approved arrangement, and machinery shall be not only modern in make, with every latest improvement, but must also be kept in perfect condition by constant renewal. Many parts of the machinery required for the equipment of our textile mills are still necessarily imported from England, because not made, or less perfectly made, in the United States. This is true of some varieties of cotton machinery, and of most of the preparatory machinery of the worsted manufacture. Our machine manufacturers have been advancing as rapidly in recent years as the textile mills themselves, and the time cannot now be far distant when every new mill built in America will be equipped throughout with American-made machinery.

The American textile mills now supply practically every variety of fabric made in the world, with the exception of linens and the very finest grades of other fabrics. In a single branch of textile manufacturing—flax—our efforts have been a failure by the test of experience, and are likely to continue a failure. But three establishments making linen goods reported to the last census, showing a capital of $900,000, and products valued at $547,278. These products were chiefly thread and twine, the latter for use in the shoe manufacture. Except crash goods, there are now no linen fabrics of any moment manufactured here. Great sums of money have from time to time been invested by daring manufacturers in constructing plants for the manufacture of linen fabrics. The result has invariably been disappointment and failure. If the obstacles were of a kind that ingenuity and perseverance could overcome, they would have been conquered. These obstacles are climatic in the first instance, flax being a fiber which requires more moisture than any other for its successful manipulation. Again, there is difficulty in obtaining a home supply of suitable raw material. Years of high protection have failed to persuade the American farmer into growing flax for fiber. The care, the skill, the trained labor required to grow and separate the best quality of fiber, discourage him, and the absence of any considerable home market removes the inducement which tariff protection would otherwise afford. The history of the linen manufacture in other countries seems to establish the fact that it is the one textile manufacture likely to remain segregated in a few localities like Holland and Ireland, where the fiber is grown on the spot, where the climate is peculiarly adapted, and where the help has acquired an expertness born of generations of experience. Moreover, linen is the one textile the consumption of which has not appreciably increased with the growing perfection of textile machinery. The quantity of linen fabrics made to-day is hardly larger than a century ago. The other fibers, less difficult to handle, more susceptible to cheap manipulation, continually encroach upon its uses.

Turning from this single failure, we find extraordinary success in every other department of textile manufacturing. Perhaps the most striking contrast to our experience with linen is that afforded by the silk manufacture. At first sight it would appear that this must be the particular textile industry which could not flourish in America. Since the whirlwind of speculative excitement over the culture of the silkworm which swept New England in the thirties, and wrecked the fortunes of many too credulous farmers, we have settled down to the conviction that America cannot grow raw silk in competition with China, Japan, and Italy. Moreover, the silk manufacture, like the linen, has always been highly specialized and localized. The city of Lyons, in France, had well-nigh monopolized the manufacture, so far as it had escaped from the hand processes of the Eastern nations. The skill and taste of generations have been concentrated upon the production at these centers of fabrics which in beauty of design, in richness of coloring, in delicacy of workmanship, alone among the fabrics made by modern machinery, rival the splendors of medieval textile art. England has for centuries struggled in vain to place her silk manufacture on equal terms with it. Nevertheless we have built up in America, in the last forty years, a silk industry which among machine-using nations is second only to that of France, and is to-day supplying our people with the bulk of the silken fabrics consumed by them.

We owe this great achievement largely to the energy and the genius of the Cheney family, father and sons, of South Manchester, Conn. The Cheneys began the manufacture of spun silk about forty years ago. About the same time, John Ryle, sometimes called the father of the American silk industry, had become superintendent of a little silk-mill in Paterson, N. J., which he afterward purchased and gradually enlarged. At first sewing-silks only were made, then ribbons were added, and in 1842 Mr. Ryle built a number of looms for silk piece-goods—the first to be successfully operated in America; and the industry in all its branches has since developed so rapidly there that Paterson, which calls itself the Lyons of America, now occupies to this industry the same relation that Fall River does to the cotton manufacture, and Philadelphia to the wool manufacture.

During the Civil War the high duties stimulated the silk industry and diversified its product. The making of plain grosgrain dress silks was then started, and at the present time brocaded silks and satins are manufactured on a large scale; indeed, there is no form of fabric into which silk enters which is not now produced in great variety. Especially noteworthy has been the recent development in the manufacture of silk plushes and all varieties of upholstery goods. The value of home-made silk goods was in 1880 just about equal to the foreign value of the goods imported. In 1890 the product had so grown that it was more than double the value of the imports, and more than double the value of the product in 1880. Mr. Briton Richardson, the secretary of the American Silk Association, has recently compiled statistics which show that in the five years since the census of 1890, the rate of increase has even accelerated. He points to one mill, erected in Paterson since that date, which is already the largest silk-ribbon mill in the world. There are other mills in that city, notably that of the Pioneer Silk Company, which is an outgrowth of the little mill operated by John Ryle, and now covers an acre and a half, which can nowhere be surpassed either in size or in completeness of equipment.

The cotton manufacture must, on the whole, be taken as the textile industry which best illustrates the possibilities of this group of manufactures in the United States. The number of cotton-spindles in operation in 1894 is estimated at 17,126,418, and this number has been considerably increased in 1895, particularly by new mills in the Piedmont region of the South. The manufacture is there conducted under so many advantages—particularly the cheapness of fuel and labor—that careful students of economic conditions predict that the manufacture of the coarser grades of cotton goods is destined to gravitate more and more to the Southern States.

New England, and especially Massachusetts (which is the largest cotton-manufacturing State, containing 7,160,480 out of the 17,126,418 spindles in operation), has done much to hasten and facilitate such a transfer by the enactment of harassing labor laws and by excessive taxation. She possesses no natural advantages for this particular industry, and her manufacturers have looked with some apprehension upon the rapid growth of the industry in the South, chiefly through the aid of New England capital. Thus far there has been no diminution in her machinery capacity, but, on the contrary, a steady increase, which, while relatively smaller than the increase in the South, continues to be actually greater. This is due primarily to the increased production of the finer grades of goods in New England, and, secondarily, to the rapid development of the country, with its enlargement of a market in which the South can share largely without injuring New England. Nevertheless the economic forces at work are of such a character that eventually a marked change in the geographical status of the industry seems inevitable.

From the national point of view, the important fact is that the growth of the American cotton manufacture for the last twenty years, both relatively and actually, has been greater than its growth in Great Britain, which reported at the last enumeration a total of 45,270,000 spindles. The whole of the remainder of Europe operates less than 30,000,000 spindles. These statistics place the American cotton manufacture second only to that of England, and reveal a steady gain even upon the island which manufactures cotton for all the world except the United States. The American market for American cottons constantly expands with the growth of our own country, while our foreign markets show little gain. The English market as steadily contracts, as English and native capital builds new cotton-mills in India and Japan for the supply of the vast markets of the East. The influence of this increasing competition, under circumstances which greatly handicap English manufacturers, is apparent in the values of the stocks of the Oldham Limited Companies, as they are quoted to-day, and in the gloomy talk of Lancashire manufacturers when they forecast the future. On the other hand, our own cotton manufacturers, as they emerge from the prolonged business depression, face the future with hope and courage.

The casual student of first-class English and American cotton-mills, while he will observe certain differences, will not be able to detect any point of superiority in the former over the latter. He will find the English mills much more closely specialized, and he will find a larger proportion of them engaged upon the finer grades of goods. He will observe, also, that in the English mill mule-spinning is the predominating method, especially for fine numbers; while in the United States ring-spinning strongly predominates. In 1870 the proportion was nearly equal between the two systems in American mills, there being reported by the census of that year 3,694,477 frame-spindles and 3,437,938 in mules; in 1890 there were 8,824,617 frame-spindles and 5,363,486 in mules; and subsequent development has accentuated this disparity. This is due to the extraordinary advances, already alluded to, in the mechanism of the ring-spinning frame, advances which are wholly of American origin, and which greatly cheapen the cost of production by increasing the product in proportion to the increased speed of the spindle. In mule-spinning, also, great advances have been made during the last fifteen or twenty years. Whichever method is employed, the development of the industry has reached that stage where success depends upon the closest attention to the mechanical details of manufacturing. The margin of profit in print cloths, for instance, has come to depend upon the saving of a fraction of a cent in the price of a pound of cotton, and the economy of another small fraction of a cent in converting that

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cotton into yarn and cloth. To realize these fractions, which mean profit or loss, machinery must be kept in the highest state of efficiency.

The improvements in spinning have been so rapid since 1870 that most of our large corporations have been compelled to replace their spinning-frames at least twice in that interval. The bulk of the frames now in operation have been introduced in the last ten years, and are of the highest efficiency. A similar statement can be made regarding no other branch of textile manufacture; and it is probably true that if the American woolen-mills had been forced, as the cotton-mills have been, to abandon machinery as soon as it became in any degree obsolete, their ability to face foreign competition would be more nearly in keeping with that shown by our cotton manufacturers. The conditions we have been narrating have thrown the cotton manufacture more and more into the hands of large corporations, which now almost universally conduct it. The wool manufacture, on the other hand, while it numbers some of the greatest corporations in the land, is still largely in the hands of individuals and partnerships, and the bulk of the mills are comparatively small in capacity. The more recent tendency in the wool manufacture, for obvious reasons, is strongly in the direction of the corporate form of management.

The quantity of fine cotton goods made in American mills continues to be very small in comparison with the whole production. Mr. Edward Stanwood, the expert who made the cotton report for the Eleventh Census, calculated that only 6.31 per cent. of the value of the total product could properly be classified as "fine or fancy woven goods"; and it follows that the bulk of our consumption of this class of cottons is still imported. In other words, there is ample room remaining for the further and higher development of the American cotton manufacture. Into this field we are entering with characteristic Yankee energy. Within comparatively few years mills have been successfully established in New England which spin yarns as fine as Nos. 150 or 200; and there are mills at New Bedford, Taunton, and elsewhere which make, in bewildering variety, fabrics as delicate in texture and as artistic in design and coloring as any which reach this country from the machine-using nations of Europe.

The range of products made in American wool factories is as wide as the multiform uses to which this most valuable of all the fibers is put. They divide themselves naturally into four great groups, leaving the hosiery and knit goods out of the classification: woolen-mills, worsted-mills, carpet-mills, and felting-mills. There are the various sub-classifications of spinning, weaving, dyeing, and finishing mills, although, as a rule, all these separate processes of the manufacture of wool continue to be carried on jointly in this country, as the related parts of the one operation of manufacturing. In this statement is embodied the chief point of difference existing to-day between the woolen-mills of America, and, in fact, all our textile mills, and those of England and the Continent. The reasons for it lie on the surface of things. The fact remains that American textile mills can never expect—the great body of them, at least—to successfully compete with foreign mills on terms which are fairly equal, apart from the difference in wages, until they have passed through the same evolution and approximated to the same methods which prevail abroad.

In so saying I am not passing a wholesale criticism upon our mills or their management. In the wool manufacture, as in the cotton and silk manufacture, we have many establishments which, in completeness of structure, in perfection of machinery, in all the details of mechanical equipment, and in sagacity of management, are nowhere in the world surpassed. Indeed, it is only in this country that we find, on a very large scale, textile mills in which are performed all the separate processes for the manufacture of great varieties of goods. Elsewhere they have learned that the greatest economy and the best practical results are secured by specializing the processes. Thus in Bradford, England, are enormous establishments which do nothing but comb wool into tops, either on commission or for sale. Other great mills do nothing but spin tops into yarn, and generally they confine their operations to a limited variety of yarns. Still others, buying their yarn, devote themselves exclusively to weaving. And, finally, a fourth class of establishments take the woven goods and dye and finish them for the merchants, who are the men who find the ultimate market for all the specialists who have been thus employed upon the goods.

In this specialization of the different branches of the work exists the characteristic distinction between the American and the foreign textile mills of to-day. Such investigation as I have been able to make of the two methods convinces me that the English is far superior to the American, and that ultimately we must gravitate into the former, if we are to cut any figure in competition for the world's markets. The manufacturer who devotes his whole energies to one particular thing, and studies to do that one thing as cheaply and as well as it can be done, can do it better and more cheaply than the manufacturer who is doing half a dozen different things at the same time. This is not a theoretical deduction, but an axiom founded upon prolonged experiment and experience. I have talked with manufacturers in Bradford who have tried both methods, and who say there is always a gain in economy when the weaver buys his yarns, instead of spinning them himself. Obviously the English method requires a smaller investment in plant, secures a simpler and more perfect autonomy in operation, involves less waste, and avoids the accumulation of superfluous raw material.

The American woolen-mill was evolved from conditions which rendered this specialization originally impossible. It was situated in some isolated spot, drawn thither by a superior water-power, with no railroad to facilitate quick transportation, and was necessarily a complete mechanical entity, however crude its machinery. In a word, it must perform under one roof all the processes necessary to convert the greasy wool into the finished cloth ready for the market. Thus there sprang up all over the country little woolen-mills, each one independent in itself; as the country grew some of these little mills became large mills; other large mills grew up beside them; gradually we had centers in which the wool manufacture predominated; but conditions were long in appearing which tended to that specialization of processes which has marked the English method from the very introduction of automatic machinery. It followed that the American mill owner, even of a small mill, was compelled to make a variety of goods, in order to use up advantageously all the grades of material which grew out of the sorting of his wool. Naturally he could not produce a variety of products as cheaply and as successfully as he could have manufactured one particular line upon which his whole attention was centered. These habits of manufacturing, forced upon us originally by the logic of the situation, are tenacious. We have been slowly breaking away from them, but it will be years yet before it is possible to fully outgrow them. In Philadelphia, which is the largest center of wool manufacture, the progress of the evolution is very perceptible. There they have top makers, yarn makers, dyers, and finishers, who do nothing else. And the result is apparent in the large number of small manufacturers in that city. The small amount of capital required to equip a little weave-shed permits enterprising superintendents and operatives to start in business for themselves. The comparative cheapness of production under such conditions enables them to hold their own against the big establishments with unlimited capital at their back.

The bulk of the small wool-manufacturing establishments in the United States are woolen-mills proper, as distinguished from worsted-mills. It is noticeable that the number and product of these woolen-mills decrease from census to census as the worsted manufacture gets more firmly established here, and the more popular worsted fabric comes into wider use. But there are certain lines of woolen goods in the manufacture of which American mills have earned a world-wide preëminence, and in which they are nowhere surpassed. Prominent among them are flannels and blankets of every grade and variety. The American wools are peculiarly suited for these goods, and for many years past our American mills have practically supplied the home market. Other mills make a specialty of woolen dress-goods for ladies' wear with equal success. The bulk of our woolen-mills are, however, engaged upon the manufacture of cloths for the million—cassimeres, beavers, satinets, cheviots, etc., the cheaper grades which enter into the consumption of the wholesale clothing-houses, goods in which, under the weight duties of recent tariffs, our American manufacturers have controlled the home market, and of which their production has been enormous. Many of these goods are woven upon a cotton warp, and into some of them enters more or less of the revamped wool known as "shoddy." We have much to learn, however, in the handling of this class of materials, before we shall equal the expertness of foreign manufacturers. It is to the success of our manufacturers in producing a handsome, durable cloth at cheap prices, that our people chiefly owe their reputation of being the best-dressed people on the globe.

The worsted manufacture was late in getting lodgment in the United States, and has been slow in assuming proportions commensurate with its importance abroad. Early in the forties there were two or three large worsted-mills erected in New England for the production of worsted fabrics or stuff goods for women's wear; but the manufacture made little headway until after the close of the Civil War, and it was not until about 1870 that we began making men's-wear worsted goods. Since then the development of the manufacture along both lines has been phenomenal. In 1890 we made over 73,000,000 yards of worsted dress-goods, valued at over $76,000,000; and we have to-day three or four mills, of the most modern equipment, which turn out these goods in larger quantities than any foreign establishments.

In the manufacture of fine men's-wear goods, both in woolens and worsteds, a few of our mills have been equally successful; their products sell side by side with the best makes of foreign goods, notwithstanding the lingering prejudice among fashionable Americans that only foreign-made cloths are fit to wear. Another obstacle is the high cost of labor, which counts against us more strongly in fine-wool goods than in the cheaper grades, or in cottons and silks, because of the much greater care and skill and labor that must be bestowed upon their finishing.

The manufacture of felted wool is comparatively small here and elsewhere. Thirty-five American mills produced a product valued at $5,329,381 in 1890, and the importations are comparatively insignificant in volume. Felted wool was the earliest form into which this fiber was manufactured, the primitive races discovering, before they learned to spin and weave, that peculiar characteristic of wool which causes it to mat together, by the application of heat, moisture, and pressure, into a firm and smooth texture, susceptible of a great variety of uses. Modern machinery has utilized this peculiarity for many purposes which, while limited, are economically important. Table-cloths and floor-coverings, and hats for men's and women's wear, are the most ordinary; but they are also used for shoe-linings, sheathing materials, polishing purposes, etc. The hat manufacture, formerly confined to wool for its raw material, has found that fur is better suited for this use; and the processes of manufacture are so different from those employed in spinning and weaving mills that the hat-manufacturing establishments, in which the United States has always been preëminent, are not ordinarily classed among the textile mills.

Perhaps our most notable achievement in the textile line has been in the carpet manufacture. Beyond question the United States is the greatest carpet-manufacturing nation in the world; if we leave out of account the hand-loom productions of the Eastern countries we excel all others not only in the quantity of our production, but in the variety of our carpets, in the excellence of design and workmanship, and in general adaptability to popular needs. One hundred and seventy-three American carpet-mills produced in 1890 carpets and rugs to the value of $46,457,083, employing 11,223 power-looms. Their production included two- and three-ply ingrains, Brussels, moquettes, tapestries, velvets, Smyrnas, and the higher grades of Axminsters and Aubussons. This product represented an aggregate of over 76,000,000 square yards of carpeting, which enter into the annual consumption of the American people. The popular reason assigned for this unique development is the general prosperity of our people, the high wages earned permitting families of all grades of life to indulge in the luxury of floor-coverings to an extent elsewhere unknown. Stimulated by the lucrative market thus offered, American manufacturers have made larger and more important contributions to the mechanism of the carpet manufacture than those of all other nations combined.

The real development of the machine industry dates from the successful application of power to the weaving of ingrain carpets by the late Erastus B. Bigelow, of Boston, in 1844. Subsequently he invented Jacquard looms for weaving Brussels and Wiltons, which produced carpets pronounced by the jury at the London Exposition of 1851 to be "better and more perfectly woven than any hand-loom carpets that have ever come under the notice of the jury." A still later invention of Mr. Bigelow's was for weaving tapestry carpets. His inventions are at the base of all the power-loom carpet-weaving now done in Europe. Subsequent inventors have greatly improved them, and have added new inventions, such as those for weaving Axminsters, and Smyrna rugs. By their skill and enterprise the American carpet manufacturers have not only retained the control of their own market, except in the matter of the Eastern hand-made rugs, but they have in some instances successfully forced their products upon the European markets.

In one other branch of the textile industry progress in the United States has outstripped the world—the hosiery and knit-goods manufacture. More machine-made knitted goods are turned out annually here than in all other countries combined. The explanation is somewhat the same as in the case of carpets. Our people wear more underwear than other people; they are not only obliged to wear more for climatic reasons, but they can afford to wear more; and the general desire for personal comfort in wearing apparel results in an enormous distribution of the products of these mills. The beginnings of the industry are well within the lifetime of many manufacturers still living. Until 1832 the knitting of socks and stockings remained mostly a household industry—the only form of textile work which the machine had not wrested from the housewife. In that year Egbert Egberts successfully applied the principle of knitting by power, at Cohoes, N. Y.

His machine was simply the square stocking-frame of William Lee adapted to power. From that adaptation dates a revolution in underwear, which had previously consisted wholly of flannel, fashioned and sewed at home, according to the individual needs. The revolution gathered momentum gradually, as invention after invention—almost all of American origin—perfected the knitting-machine; but once the new industry was fairly and firmly established, it spread with amazing rapidity. In the decade between 1880 and 1890 the number of knit-goods mills doubled, and the value of the annual product jumped from $29,167,227 to $67,241,013.

The great variety of goods made facilitates the tendency, peculiar to this industry, toward the building of comparatively small mills, requiring but moderate capital; and it happens in consequence that these mills spring up all over the country, and can now be found in nearly every State. Many of them employ only cotton as a raw material; others use chiefly wool; and still others manufacture what are known as merino knit goods or mixed goods—cotton mixed with wool in proportions varying from fifty to seventy-five and ninety per cent. of cotton, according to the particular market sought. The tendency to the larger use of cotton in these goods is perceptible, not necessarily because of greater cheapness or a desire to adulterate, but because the liability of wool to shrink, and its excessive warmth, lead many to prefer undergarments in which cotton is an equal or predominating material.

In 1858 Mr. E. E. Kilbourne invented a machine for automatically knitting full-fashioned underwear; and this machine has gradually wrought a second revolution in the industry. The amount of hand labor now done is reduced to the minimum—to the mere sewing on of buttons, so to speak.

Having said much in this paper about the enterprise and mechanical ingenuity of American textile manufacturers, I may be pardoned for concluding with an allusion to an obvious deficiency, as applied to the industry as a whole. They have left little to be desired in the direction of cheapening textile products without deteriorating quality. They have built and equipped mills which rank with any in the world. They have planted on this continent machinery enough to supply all the textile wants of our people, except in a comparatively few lines of very fine fabrics. They have managed these mills with rare business sagacity, and as a rule with notable financial success. They have taken one specialty after another which had never been attempted here, and transported its manufacture from across the water, literally inventing anew the necessary machinery, as in the case of braids and plush goods, when they could not obtain it otherwise. They have taken these several textile industries, which have been localized and specialized in Europe for generations, and in less than half a century have made them one of the chief corner-stones of our national wealth. They have contributed far more than their share to the mechanical development which makes the labor of a single operative stand for that of a regiment of hand-workers in the eighteenth century. They have failed only in contributing their equal share to the artistic side of textile industry. They have been imitators instead of originators, although justice compels us to add that there are among them many striking and gratifying exceptions to this rule. But American-made goods do not bear, generally speaking, any distinctive artistic characteristics which distinguish them as American-made; and, generally speaking, they are inferior in this respect to the best products of foreign looms.

All this is natural—natural to a new country in which utility everywhere predominates over the ornamental. The next great forward step in our textile manufactures must be in the artistic rather than the mechanical direction, for there we recognize its weakest point. In the designing of patterns, in the use and application of dyes, in all that goes to impart to fabrics the artistic element, to lift the manufacture into an art, our textile mills are still far from the top of the ladder. This deficiency is not in any sense peculiar to the textile industries. It is an educational deficiency in which our people as a whole may be said to share. It is incidental to a crude country of limited facilities in art directions. What needs to be done is to supply those facilities; and the time is at hand when our manufacturers should themselves take the initiative in that work. All over Europe there exist technical schools for the training of textile workers,—weaving-schools, designing-schools, dyeing-schools,—in which those who manufacture goods are trained by the best instructors; and the result is not only better workmanship, but more beautiful and more artistic tissues. We have but one such institution in America—the Philadelphia Textile School, which is doing a noble work in elevating the standard and educating the taste of American manufacturers. We need more like it, need them badly, and need them at once.

CHAPTER LXXIII

AMERICAN CARPETS

A HUNDRED years ago very few woolen carpets were in use on Manhattan Island. A few wealthy people had Turkish rugs, and some ingrains were imported; but they were so rare that children were cautioned to tread lightly on them when permitted on state occasions to enter the carpeted room. No carpets were made here, except "rag carpets," the striped combination of rags and list which the Knickerbocker housewives wove at home, and which are still made in small quantities both in farm-houses and in factories. The first carpet dealers in New York of whom we know anything were J. Alexander & Company, whose advertisement in Parker's "New York Gazette; or, The Weekly Post-Boy," on Monday, June 30, 1760, reads as follows:

"J. Alexander & Company have removed their store to Mr Haynes's house on Smith St., where Mr Proctor, watch-maker, lately lived, where they sell Check Handkerchiefs, linens of different kinds, Lawn and Minonets, Scot's Carpets, broad and narrow cloths, Shoes of different kinds, made shirts, Hats, Stockings, with several other goods; Eine's Scot's barley and Herrings. Also a choice parcel of Old Madeira Wine in Pipes."

In the following year they offered for sale Turkey carpets, and two years later state that they "have imported some English and Scot's carpets and Hair Cloth for Stairs and Passages." They were then located "in the house right opposite Mr Donald Morison Ship Chandler House, betwix the Fly and Burling Slip." Judging from their advertisements in the papers of the day, they were not only the pioneers in the carpet business, but also the originators of the modern department store.

From this time on the use of carpets began to increase and the business to grow, until, according to the city directories, there were last year 304 firms engaged in the sale of carpets in New York and Brooklyn, the amount of capital invested being many millions. It was not until many years after carpets were first used in the colonies that the manufacture was introduced here, and the colonies had then become the United States. In 1791 William Sprague began to make Axminsters in Philadelphia. One of his first productions was a pattern which represented the coat-of-arms of the young Republic. The carpet was probably not wonderful, but it has achieved fame, not so much on account of the fact that it was our first attempt, as because it was the first article to which the principle of tariff protection was applied. Alexander Hamilton was Secretary of the Treasury, and in a report on manufactures sent to the House of Representatives in 1791 he recommended that a duty of two and one half per cent. be laid on carpets. To quote his own words: "To which the nature of the articles suggests no objection, and which may at the same time furnish a motive the more to the fabrication of them at home, toward which some beginnings have been made." (December 5, 1791.) The proceeds of this duty he proposed to use as a bounty to encourage the growth of wool in the United States.

Early in the century the manufacture of ingrains was begun, and has continued steadily increasing in amount ever since. Probably the first ingrain mill in the United States was that of George M. Conradt, who came to this country from the kingdom of Würtemberg, and settled in Frederick County, Maryland. The factory was a stone building, and was still standing not many years ago. The carpets were made in a hand-loom on a drum having rows of pegs somewhat like the cylinder of a music-box. This drum worked the harness. Jacquard's great invention was made in 1800, and soon after began to be applied to the weaving of carpets in this country. Among the early mills was one owned by Henry Burdett, which was located at Medway, Mass. Alexander Wright was the superintendent, and the concern is notable as having been the starting-point of what became later the great corporation known as the Lowell Manufacturing Company, whose carpets afterward were the standard goods of the country. In 1825 Wright endeavored to gain information touching the jealously guarded secrets of the Jacquard machine, then in use in the manufacture of ingrains in Philadelphia, which city seems to have been the second starting-point for the manufacture of ingrains. He was unable to gain access to the mills, and sailed for Scotland, whence he soon returned with the best looms he could procure. He also brought over with him William and Glaude Wilson, to aid in operating the machinery. Glaude Wilson was a skilled mechanic, and devised improvements in the Jacquard loom, simplifying its construction and rendering it more certain in operation. He resided many years in Lowell, and lived to see the Lowell Company become one of the most important manufacturing establishments in the country.

While the Medway experiment was going on, a charter had been granted to the Lowell Manufacturing Company, and on February 22, 1828, its organization was completed. In those days directors' meetings were held at seven o'clock in the evening. Whitney, Cabot & Company were appointed to build the mills, employ the labor, and afterward sell the goods. The Medway mill and machinery were sold to the Lowell Company, which kept the looms in operation in that place until its own factory at Lowell was finished. Alexander Wright, referred to above, was the first superintendent. For a long time the enterprise was regarded as an experiment, and many believed that the demand for carpets would not justify paying for the skill necessary to make them. The hand-looms of those days were by no means as perfect as the hand-looms of our time. The Lowell Company, however, persevered, and ingrain factories continued to spring up in various parts of the country. The progress was slow, and with the exception of the Hartford Carpet Company, then operating as two separate concerns, very few of the firms which afterward became famous started until many years later.

E. S. Higgins & Company began to manufacture ingrains in New York in 1841. Alexander Smith began at West Farms in 1844. Robert Beattie started in New York in 1840. John Bromley did not set up his looms in Philadelphia until 1845. This city now has some of the finest factories in existence, and its production is larger than that of all the rest of the country combined. More yards of ingrain carpets are made there than in any other city in the world, and the goods range from the highest to the lowest grade. The imports from England and Scotland continued to be heavy in spite of distance and duties, as up to 1850 hand-looms only being in use, the product of these and the other mills using these looms was necessarily very limited, and we had to overcome the prejudice against domestic goods.

Meanwhile Alexander Smith and J. G. McNair had devoted much time and labor to the invention of a patent process for weaving tapestry ingrains. They succeeded in producing a carpet which filled a want of the times for a strong and durable fabric in which a large variety of color could be introduced. The Crossleys, of Halifax, England, purchased the rights to the invention, paying a royalty of a penny a yard for England. Templeton, of Ayr, paid £200 and a like royalty for Scotland. The goods became enormously popular, and Stephen Sanford, of Amsterdam, N. Y., also secured the right to manufacture them. The fame of the carpets spread so rapidly that it did much to stop the importation of foreign ingrains.

Erastus B. Bigelow, a young medical student of Boston, who was but twenty years of age, had seen somewhere the manufacture of coach-lace by hand. He was without mechanical training, and, in fact, had never read a book on the subject; but in forty days after he took up the idea he perfected a power-loom by which coach-lace weaving could be done. At a single stroke he so reduced the cost of weaving this class of goods that what had previously cost twenty-two cents a yard was reduced to three cents. This invention brought him into notice, and he set to work to devise a power-loom for ingrain-carpet weaving. Before the year was out he succeeded. At this time eight yards a day was the product of the ingrain hand-loom. Mr. Bigelow's loom at once increased the product to ten and twelve yards, and, after some defects had been remedied, rolled it up to twenty-five yards a day, thus stimulating successive inventors of power-looms, such as Duckworth, Murkland, Crompton, and others, who have multiplied the result, so that the product now reaches to from forty to forty-five yards a day, although the hours of labor have been materially shortened.

But Mr. Bigelow did not rest here. In 1848 he set to work to invent a power-loom for the weaving of Brussels and tapestry carpets. At this time the product of a long and hard day's labor for a weaver, including a boy to draw the wires, was seven yards of Brussels carpet. At once Mr. Bigelow raised this to over twenty-five, some modern machines now getting fifty-five yards of production in a day. Prior to the perfecting of this invention, he had, with his

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brother, Horatio N., organized the Bigelow Carpet Company, which has the honor of being the original power-loom manufacturer of Brussels and Wilton carpets. The company has been very successful, and now ranks among the foremost concerns in the world. The Crossleys, of England, promptly purchased, at a cost of £20,000, the right to use the Bigelow loom in England; and A. & E. S. Higgins, of New York, and the Roxbury Carpet Company, of Massachusetts, also secured the exclusive use for the United States for tapestry and velvet during the term of the patent. Mr. Bigelow, of course, reserved the right to manufacture Wiltons and Brussels on his own loom. It has been my experience, in a connection of over thirty years with the trade, that the Wiltons, velvets, Brussels, and tapestries made at that day by these establishments would compare favorably in durability of wear and stability of color with the same grades of any country in the world.

The success of Mr. Bigelow's looms stimulated others to like inventions. The manufacture of Axminster and moquette carpets by hand in foreign countries was one of the slowest of trade processes. In this two men and a boy were employed at one loom, and could make but one and one half yards of French moquette in a day. In 1860, Alexander Smith and Halcyon Skinner, of Yonkers, invented an Axminster and moquette power-loom which was perhaps more striking in its ability to increase the productive capacity of labor than was that of Mr. Bigelow.

This was the beginning of a second era in the trade. The invention increased the production to about eleven yards per day, the loom being attended by a girl. Its merits were universally conceded, and foreign and domestic manufacturers were glad to pay large royalties for its use. The Alexander Smith & Sons Carpet Company became one of the most famous in the world, and its plant in Yonkers is to-day the largest of the kind in the country. How thoroughly American invention and American mechanical skill have gained control of the home market can easily be understood from a few figures, which I present as follows:

In the year ending June 30, 1870, there were entered at the port of New York alone body Brussels and tapestry Brussels valued at $1,355,832; in 1894 there were imported in the entire United States body Brussels and tapestry Brussels valued at $58,-208. In 1870 the manufacture of carpets in the United States amounted in value to $21,761,573; in 1890 the value of the carpets made in the United States was $47,770,193.

The number of firms engaged in the various departments, with the approximate number of power-looms employed, was last year as follows:

PRODUCTION OF CARPETS.

Varieties.	Manufacturers.	Power-Looms.
Ingrains	89	4,800
Brussels and Wilton	16	1,200
Tapestry and velvet	14	1,700
Axminster and moquette	6	600

These firms were capable of producing 100,000,-000 yards, of the value of $50,000,000. There are also many hand-looms on ingrains, and many manufacturers of damasks and Venetians, Smyrna and other rugs and mats.

On the artistic side the improvement has been equally as great. At the outset most of our designs were copied or adapted from foreign patterns. It was only a few years ago that a foreign manufacturer, to whom I showed a sample of the first piece of tapestry produced by Stephen Sanford, remarked, after examining the fabric closely, "Well, you may be able to manufacture the goods, but you can't design them." In less than five years from that time, the same gentleman, on his way to Canada to sell goods, proposed to me to exchange samples, that he might take orders from the American patterns. After looking through his line I thanked him, with the assurance that I could find nothing there that could compare favorably with the discarded designs of last season's patterns of our domestic manufacture. In the fully equipped studios of the Bigelow, Lowell, Smith, Hartford, Higgins, and the Philadelphia companies a large proportion of the designers are Americans, and the proportion is steadily increasing. The American dealer of to-day has to overcome very little prejudice against either the fabric, color, or pattern of American carpets, and it is long since I have heard a customer ask, "Is it English?"

Were I able to give the exact amount of money expended each year, from the time the wool leaves the sheep's back until the carpet reaches its resting-place upon the floor of our homes, to be trodden upon, beaten, and sometimes abused, notwithstanding the fact that there is no article which goes so far to make the home comfortable and attractive, the figures would be astonishing. The people employed in designing, manufacturing, and selling this article to-day would form a sufficient population for a young republic, with abundant capital to carry on the government.

The skill and inventive genius in carpet manufactories have so built up the home industry of the United States as to give employment to a vast army of operatives, and reduced the cost of the manufactured article to such an extent that the humblest citizen is enabled to have a floor well carpeted with fabrics that are attractive, and even artistic; and, with the thrifty housewife, the addition of a rug or two upon the carpet and a good lining underneath is necessary, in her estimation, to sustain her status as one of the social leaders in her humble sphere.

In no other time and no other country has such comparative luxury been within the reach of modest means. The white and well-scrubbed floor of the Holland frau, the polished oak and tiling of France, Germany, Italy, Austria, and the other countries of continental Europe, have given no precedent for the American indulgence in carpets; and even England, outgrowing the rush and straw strewn floors of the time of Erasmus, has not yet learned to fill the great gap between the velvet pile carpets of the homes of the nobility and the bare boards of the Whitechapel tenements. It is in this respect that the United States stands forth preëminent. There are carpets for all, and from the days when the grandmothers wove their rag carpets, to the present, when a far superior article is turned out from nearly every factory in the country, at a cost cheaper even than that of the home-made article, there have been few American homes too poor to enjoy the comfort of neat and pretty floor coverings.

Sheppard Knapp

CHAPTER LXXIV

THE CORDAGE INDUSTRY

THE infancy of this industry was marked by great feebleness, but perhaps not more so than the average of American manufactures. Rope making formed one of the principal branches of business from the early days of the colonies, and a ropewalk appears to have been first set up in 1642, in Boston, Mass., twelve years after the town was founded. In this connection it is interesting to note that in 1638 Boston was "rather a village than a town, consisting of no more than twenty or thirty houses." Prior to that time nearly every kind of rigging and tackle for vessels was brought from England.

With the building of the first ship in Boston, the *Trial*, of 160 tons, and probably on account of its construction, John Harrison, a rope maker, was invited to Boston from Salisbury, "on mocon of some gentlemen of this town," and he set up his ropewalk or "rope-field," ten feet ten inches wide, on the land adjoining his house on Purchase Street, at the foot of Summer Street. The work was done in the open field. Posts were set in the ground firmly enough to permit the suspension of cords and rope of no inconsiderable circumference.

Harrison was granted a monopoly of the business until 1663, when permission was granted to John Heyman to "set up his posts," but with "libertie onely to make fishing lines"; but even this license was found so to interfere with Harrison—who was now advanced in years and had a family of eleven persons—that it caused him to fear that he could not support them, and Heyman's permit was accordingly withdrawn. An additional argument employed to bring about this revocation was the scarcity of hemp! After Harrison's death ropewalks multiplied in number, and at the West and North Ends of the town in sixty years there were fourteen ropewalks. In 1793 the industry was thriving, no doubt greatly fostered by a bounty granted by the General Court.

In a great fire, July 30, 1794, seven ropewalks were destroyed; and the selectmen provided that no more should be constructed in the heart of the town, and tendered the use of the low land west of the Common, where six others were at once constructed, 20 to 24 feet wide and 900 feet in length. These were also destroyed by fire in 1806. Five were rebuilt, and were all once more burned in 1819. The elder Quincy, in the first year of his mayoralty, with his usual energy and sagacity, promptly removed all of these, with marked improvement to the neighborhood, and the land was purchased for $55,000 on February 25, 1824.

So much for the early beginnings of this industry. It is with a smile that we read that "in the Federal procession of 1788 the men employed in this industry outnumbered any other class of mechanics in Boston," and that in 1794 "over fifty men were employed in this branch alone." The work in the old ropewalks, although done mostly by hand, was in some cases supplemented by horse or water power. The workmen resented the employment of any hands who had not served a regular apprenticeship at the trade, and there was bitter opposition to the introduction of machinery.

Besides the ropewalks previously mentioned, Nantucket had, in the height of her prosperity, three, none of which now exists. Newburyport had a good-sized ropewalk for those days. There was one at Castine, Me. One was on Broadway, New York, before the Revolution, and others were found in other parts of the country. Early in the century Samuel Pearson owned and operated one in Portland, Me. His two sons, Samuel and George C. Pearson, having learned the trade with their father, were afterward interested in steam plants at and near Boston. Still later they started the Suffolk Cordage Company, which grew into the Pearson Cordage Company, now one of the largest mills in the country.

Shortly after the death of his father (Samuel), Mr. Charles H. Pearson, who had been identified with him and the other son, became connected with the Boston Cordage Company, and still later with the Standard Cordage Company. Mr. Samuel Pearson made many inventions in rope-machines and in regulators for spinning.

Mr. A. L. Tubbs, of California, bought most of the machinery in one of the old Boston mills and shipped it to California. He started the business on the Pacific coast, and at the present day controls the two or three factories now located there.

Up to about 1850 it was the custom to import spun yarns to be made into cordage. These yarns were chiefly spun by Russian serfs, and could be furnished for less money than similar ones made here; but the introduction of improved machinery gradually cut off these importations, and hardly any spun yarns were bought after 1865.

The period between 1830 and 1850 witnessed the starting of what may be termed the modern factory, in distinction from the crude and primitive mode of manufacture before existing. The difference between the two methods was this: In the old-fashioned ropewalk the twisting of fibers was done by a man walking backward down the walk, spinning from the hemp round his waist, the twist being imparted from a wheel turned by a boy. The possible length of the rope could thus be no greater than the length of the building or ground. Longfellow's description, in his poem on "The Ropewalk," is too fine to be omitted, even in a commercial article:

> "In that building, long and low,
> With its windows all arow,
> Like the port-holes of a hulk,
> Human spiders spin and spin,
> Backward down their threads so thin
> Dropping, each a hempen bulk.
>
> "At the end, an open door;
> Squares of sunshine on the floor
> Light the long and dusky lane;
> And the whirring of a wheel,
> Dull and drowsy, makes me feel
> All its spokes are in my brain."

In the modern factory the twist is imparted by rapidly rotating machinery similar to that used in cotton and woolen mills, making it possible to spin a rope of several thousand feet in length on an upright apparatus occupying but a few square feet. For some purposes, however, the ropewalk rope, as it is called, is still held to be superior to that manufactured by the other process. When rope was made without use of the ropewalk it was the custom to call it "patent cordage," to distinguish it from the old style of ropewalk rope, and the name is still used by some firms.

The inventions and patents of most consequence and in most general use are those of John Good, of New York City, whose spreaders and breakers did away with the use of lappers, and whose nipper and regulator on spinning-machines have given universal satisfaction, although with the perfecting of "preparation machinery" the use of a regulator has in many instances been discontinued.

The era of the largest mills commenced in 1878, after the invention of the self-binding harvester. Among the factories started during the period alluded to were Sewall, Day & Company of Boston (1835); Pearson Cordage Company of Boston; J. Nickerson & Company of Boston; Weaver, Fitler & Company of Philadelphia (afterward and at the present day Edwin H. Fitler & Company); Plymouth Cordage Company of Plymouth, Mass.; Hingham Cordage Company of Hingham, Mass.; New Bedford Cordage Company of New Bedford, Mass. (1842); Baumgardner, Woodward & Company of Philadelphia; J. T. Donnell & Company of Bath, Me.; William Wall & Sons of New York City; Lawrence Waterbury & Company of New York; Tucker, Carter & Company of New York; Elizabethport Steam Cordage Company of New York; Thomas Jackson & Son of Easton, Pa.; J. Rinek's Sons of Easton, Pa.; and John Bonte's Sons of Cincinnati.

The demand for cordage in those days being largely for export and the use of ships, it will be noticed that the manufacture was mainly confined to Atlantic seaports. In later times, with the decline of American shipping, the substitution of wire for hemp standing rigging, and especially after the great demand for binder twine, all this was changed, and factories rapidly multiplied in the West, Peoria, Miamisburg, Akron, and Xenia taking an important part in the business.

As late as the year 1843 the total quantity of Manila hemp manufactured in the United States was only 27,820 bales or 7,511,400 pounds. This amount of hemp could, in 1895, easily be brought from Manila in three sailing-ships or in two steamers—the latter capable of making the voyage in fifty or sixty days by the way of the Suez Canal to New York, Boston, or Philadelphia. Moreover, one of half a dozen of the larger mills in the country could, in 1895, manufacture the whole quantity of Manila hemp used in the year 1843 in the space of fifty days, by running night and day.

In 1863 the business had increased to five times its size in 1843. With the War of the Rebellion came a great demand for cordage; and as hemps rapidly advanced in price, in common with all other staples, it was an era of great prosperity for the cordage industry. Orders were so numerous that it was deemed a favor to a customer to supply him; and it is within the knowledge of the writer that the profits of one Eastern factory during that epoch amounted in one year to $520,000, nor was its experience at all exceptional.

It was in 1860 that the first importations of Sisal hemp were made. Commencing with the manufacture of about 200 tons in that year, its use rapidly extended, and it became in a few years an important factor in the trade. In ten years its importation amounted to 3500 tons, in twenty years to 13,000 tons, in thirty years to 34,000 tons, and in thirty-five years to 50,000 tons.

With the extension of the business and the increase of factories, both in number and importance, there was found to be a necessity for some regulation of the prices of cordage. The first agreement between the cordage manufacturers was entered into on February 23, 1861, the object being to correct certain abuses which had prevailed among firms engaged in the trade. Weekly meetings were held by the manufacturers in their respective cities, and opportunity afforded for any complaints or any suggestion about the condition of trade and the regulation of prices. The object, as stated by one of the Eastern manufacturers, was "to look each other in the face and maintain prices." Various amendments were from time to time made in this agreement of 1861, but in July, 1874, a careful revision was made and the manufacturers pledged themselves, "as men of honor and integrity," to the true and faithful observance of the rules. A stronger agreement was made in April, 1875; but complaints of underselling, answered with various excuses, were frequent, and, there being no pecuniary penalty, the ingenuity of the manufacturers finally hit upon what was known as the "pool system." This went into operation on January 1, 1878. The business was divided among the manufacturers in proportions which seemed just, and when the business of one concern exceeded during any month the proportion which its share bore to the total business done according to the returns, it would pay in so much per pound on the excess. In case a concern fell short it would be a recipient to that extent.

It was supposed that this arrangement would act as a preventive to the cutting of prices, and it undoubtedly had that effect to some extent. The novelty of the plan was also in its favor, and on the whole it worked well enough amply to repay the great amount of labor expended in securing its adoption. The percentages ranged from eleven and one fourth to one per cent.

In 1880 the amount of the pool was reduced from two cents to one cent per pound, and in June of that year to one-fourth cent; in January, 1881, the pool was abolished. In April, 1882, it was deemed best to reëstablish it, and on the 28th of June the proportions were again agreed upon for three years. At the expiration of that time the new concerns which had grown up were taken into the association, and after much labor, lasting from February to July, 1885, a new pool was formed, and the proportions as fixed by the committee were accepted.

No one who was present will ever forget the magnificent banquet given at Long Branch, on the 29th of July, 1885, to the members of the association, by the Hon. Edwin H. Fitler, of Philadelphia, who, as president for many years, had been untiring in his efforts to unite the members and preserve harmony. Equal honor should be awarded to Mr. Frederick Davis, of Sewall, Day & Company of Boston, and to Mr. D. B. Whitlock of New York, for many years secretary of the association, who died in 1888.

In April, 1887, before the expiration of the time agreed upon at the formation of the last pool, it was broken up; and the next event of great interest was the formation and incorporation of the National Cordage Company. This was composed of the four leading concerns in New York City; and although their circular, dated August 1, 1887, announced that their "large facilities and long-established reputation were a guaranty that they could fulfil all that they promised to do," yet the successful accomplishment of their aims would have demonstrated that the age of miracles was not wholly past. The projectors were, no doubt, sanguine enough really to believe that it was possible to control the product and prices of Manila and Sisal hemp, but the attempt was a failure. An effort was made to subsidize the houses and brokers engaged in the trade, but they did not remain subsidized, and the scheme would not work. In some remarks made by the writer, May 27, 1886, in the Old South Church, Boston, at a meeting called to discuss the Morrison tariff bill, he said: "The day of monopolies in this country is past, and there is no danger but that the competition among ourselves, with the wonderful and ever-increasing labor-saving appliances and economical devices of the present day, will keep down prices, in our own products at least, to a reasonable point."

Thus it was with the attempt alluded to. The time had gone by for any such arrangement to be more than temporary, and measures to undermine the project were taken by those who did not propose to give up their individual judgment in purchasing raw material; and it is not strange that, with the immutable laws of trade working in their favor, these measures were at once and continuously successful. The National Cordage Company was in the position of a whale attacked by swordfish. The whale was only one organization, and was cumbersome and unwieldy; the swordfish were numerous and extremely lively in their movements, and the result of the conflict was what might reasonably have been expected. The whale was exhausted by his attempts to maintain his ground, and what was bad rapidly became worse. In January, 1890, the National Cordage Company made an attempt to have all the manufacturers outside of their organization join them. But no one who joined the National knew the terms made with his neighbor, and it was not long before distrust and suspicion ruined the whole project. On the 4th of May, 1893, the National passed into the hands of receivers, although they had paid eight per cent. dividends from 1891 on their preferred, and from nine to ten and one half per cent. on their common stock, dividends having been declared on both three days before their failure.

It is too early to write the history of the United States Cordage Company, which organization succeeded the National Cordage Company. Circumstances scarcely controllable by any one resulted in disaster, and, in fact, its career was never much more than a continued liquidation. A fall in the prices of raw material, unexpected and unprecedented, together with other misfortunes, culminated in the appointment of receivers, June 3, 1895.

For the future the prospect is brighter, and with lower fixed charges, strict economy, judicious purchases of the raw material as needed, a substantial cash capital, and especially with the stock of binder twine in the country practically used up for the first time in five years, we may hope that the interest on the bonds may be easily earned and the industry again give fair results.

The figures given below are the aggregate of the sworn returns of rope delivered by the members of the United States Cordage Manufacturers' Association.

MANUFACTURED IN 1878, 1879, AND 1880, IN POUNDS.

Year.	Manila.		Total.	Sisal.	Total.	Grand Total.
1878	Home Trade	26,483,833		14,085,037		
	Export	4,213,964	30,697,797	1,878,825	15,963,862	46,661,659
1879	Home Trade	33,839,404		19,672,800		
	Export	4,360,127	38,199,531	1,936,093	21,608,893	59,808,424
1880	Home Trade	40,729,619		23,945,019		
	Export	3,840,748	44,570,367	1,965,075	25,910,094	70,480,461

MANUFACTURED SINCE 1880.

Year.	Manila.		Sisal.		Grand Total.
	Bales.	Pounds.	Bales.	Pounds.	Pounds.
1881	216,706	58,510,620	100,777	38,803,060	97,313,680
1882	193,873	52,345,710	102,067	40,826,800	93,172,510
1883	184,489	49,812,030	115,239	46,095,600	95,907,630
1884	202,208	54,596,160	161,800	64,720,000	119,316,160
1885	190,960	51,550,200	178,650	69,673,500	121,232,700
1886	177,221	47,849,670	204,008	78,013,230	125,862,900
1887	260,000	70,200,000	205,000	76,875,000	147,075,000
1888	340,000	91,800,000	190,000	71,250,000	163,050,000
1889	320,000	86,400,000	220,000	83,600,000	170,000,000
1890	260,000	70,200,000	190,000	68,400,000	158,600,000
1891	330,000	89,100,000	240,000	86,400,000	195,500,000
1892	332,000	89,640,000	342,000	123,120,000	233,160,000
1893	350,388	94,604,760	310,369	114,836,530	231,441,290
1894	334,377	90,281,790	308,193	110,949,480	211,231,270

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Canada is included in the years 1892, 1893, and 1894, but not before, on manila. In 1890 and 1891 New Zealand added 20,000,000 pounds to the consumption for each year; 1892, 20,400,000 pounds; 1893, 22,000,000 pounds; and 1894, 10,000,000 pounds.

There are about 10,000 spindles in this industry at the present time, two thirds of which are ample to supply the wants of the country. The annual product amounts to $12,000,000. The figures given below were collected with much care, and will give an approximate idea of the growth of this industry. Other fibers, such as Russian and Italian hemps and jute, have at times been used to a considerable extent, but the writer believes that the figures he has collected practically give what is needed for statistical purposes.

Early figures of this trade are as below:

TABLE OF QUANTITIES OF MANILA, SISAL HEMP, ETC., MANUFACTURED IN THE UNITED STATES, 1843 TO 1877.

Year.	Manila.		Sisal.			Total Pounds.
	Bales of 270 Lbs.	Pounds.	Bales.	Size of Bales in Pounds.	Pounds.	
1843	27,820	7,511,400	......	...	....	7,511,400
1844	48,830	13,184,100	......	...	....	13,184,100
1845	47,438	12,808,260	......	...	....	12,808,260
1846	46,343	12,512,610	......	...	....	12,512,610
1847	39,111	10,559,970	......	...	....	10,559,970
1848	62,120	16,772,400	......	...	....	16,772,400
1849	48,726	13,156,020	......	...	....	13,156,020
1850	72,769	19,647,630	......	...	....	19,647,630
1851	60,888	16,439,760	......	...	....	16,439,760
1852	87,166	23,534,820	......	...	....	23,534,820
1853	106,376	28,721,520	......	...	....	28,721,520
1854	90,174	24,346,980	......	...	....	24,346,980
1855	100,760	27,205,200	......	...	....	27,205,200
1856	114,203	30,834,810	......	...	....	30,834,810
1857	119,156	32,172,120	......	...	....	32,172,120
1858	110,682	29,884,140	.....	...	....	29,884,140
1859	129,321	34,916,670	......	...	....	34,916,670
1860	143,618	38,776,860	1,393	320	445,760	39,222,620
1861	105,322	28,436,940	627	...	200,640	28,637,580
1862	120,878	32,637,060	1,356	...	433,920	33,070,980
1863	132,358	35,736,660	1,995	325	648,375	36,385,035
1864	135,304	36,532,080	2,774	330	915,420	37,447,500
1865	128,508	34,697,160	2,797	335	936,995	35,634,155
1866	140,330	37,889,100	5,120	334	1,710,080	39,599,180
1867	134,253	36,248,310	6,871	340	2,336,140	38,584,450
1868	141,962	38,329,740	9,406	340	3,198,040	41,527,780
1869	136,483	36,850,410	16,646	350	5,826,100	42,676,510
1870	133,338	36,001,260	19,893	...	6,962,550	42,963,810
1871	157,342	42,482,340	16,733	352	5,890,016	48,372,356
1872	155,173	41,896,710	22,479	359	8,069,961	49,966,671
1873	150,629	40,669,830	22,402	360	8,064,720	48,734,550
1874	137,608	37,154,160	30,527	350	10,684,450	47,838,610
1875	125,904	33,994,080	31,313	402	12,587,826	46,581,906
1876	132,231	35,702,370	41,864	389	16,285,096	51,987,466
1877	146,715	39,613,050	51,538	404	20,821,352	60,434,402
	3,769,839	1,017,856,530	285,734	...	106,017,441	1,123,873,971

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CHAPTER LXXV

HIDES AND LEATHER

THERE is probably no industry in which the advance in scientific attainments and business methods during the last one hundred years has been greater, or has wrought more important changes, than in the manufacture of leather; and there is likewise no product except those of agriculture, the application of which to the uses of mankind is of greater antiquity. From the earliest period known to history the skins of animals, however crudely prepared, have contributed to the necessities and comforts of man, and, at the present day, there is no product which contributes more luxury to enlightened humanity than "hides and leather." Dr. Campbell, in his "Political Survey of Great Britain," aptly says: "If we look abroad on the instruments of husbandry, or the implements used in most mechanic trades, or the structure of a multitude of engines and machines; or if we contemplate at home the necessary parts of our clothing,—breeches, shoes, boots, gloves,—or the furniture of our houses, the books on our shelves, the harness on our horses, and even the substance of our carriages, what do we see but instances of human industry exerted upon leather? What an aptitude has this single material in a variety of circumstances for the relief of our necessities, and supplying conveniences in every state and stage of life! Without it, or even without it in the plenty we have it, to what difficulties should we be exposed!"

The art of tanning is one of very great antiquity, and it is difficult to resist the temptation to refer, however briefly, to the fact that the ancient Egyptians inscribed on their tombs tableaux which referred to the tanner; that the Jews, after the exodus, practised the knowledge learned of the subjects of the Pharaohs in preparing the rams' skins for the service of the tabernacle; that in the sepulchers of ancient Mexico there have been found bronze leather slices similar to the Egyptian, indicating a knowledge of leather working by a people possibly coeval with those of the Eastern continent. For hundreds of years there appears to have been no marked improvement in the tanning of leather, although there are evidences of attempts to beautify it, for there are specimens of embossed leathers made by the Moors centuries ago. There is no accurate way of ascertaining the nature of the preparation by the ancients, but they subjected the skins to some treatment to prevent putrefaction. There is probably no vegetable growth containing tannin which has not been tried and found favor; but of all these oak-bark has held undisputed sway as the best tanning agent for many years.

It is only within the last sixty or seventy years that the manufacture of leather has taken great strides, and, like many other industries, its advance was made by the energy, inventive genius, and business ability of the American people. Originally the small tanners depended for hides upon the surrounding country. With the advent of the canal, and later the railroad and steamship, together with the application of chemical science, the tanner of to-day is dependent upon no one country or any special animal for his raw material, for the birds of the air and the creatures of the ocean assist in contributing to his needs in the present age. Hides, as the term is accepted to-day, can be divided into three classes: (1) hides proper, comprising the skins of the larger animals, such as those of oxen, cows, and horses; (2) kips, or the skins of small or yearling cattle, exceeding the size of calfskins; (3) skins, including those of calves, sheep, goats, deer, pigs, seals, and various kinds of fur-bearing animals, which latter, of course, usually retain their hair after tanning.

The heavy hides are converted into sole, belt, and harness leather. Calfskin is a principal material for the manufacture of upper leather for shoes and boots, and is much used for bookbinding. Sheepskins are used for a variety of purposes, such as linings for shoes, bellows, whips, aprons, cushions and covers, gloves, women's shoes, etc. Goatskins are used almost exclusively for gloves and ladies' shoes. The morocco leather, so extensively made until recently, has almost entirely given way to the "glazed kid" of the present day. Hogskins are useful for saddle-leather, traveling-bags, etc. Dogskins, being thin and tough, are valuable for gloves. Porpoise-skin, on account of its durability, is used for shoe-strings. It may be interesting to note that among the other creatures who contribute their skins to the tanner are found the buffalo, kangaroo, alligator, deer, hippopotamus, elephant, rhinoceros, walrus, and even the shark.

From the best records obtainable, it appears that the first tannery in this country was operated about the year 1630, in Virginia; and a year or two later the first tannery in New England was established in the village of Swampscott, in Lynn, Mass., by Francis Ingalls, who came from Lincolnshire, England. The vats used by him were filled up in 1825. The industry was much encouraged by the colonial authorities, and there are many records of laws made regulating the manufacture of leather and the saving of skins for the tanners, under heavy fines for non-compliance. In 1646 a law was made in Massachusetts prohibiting the exportation of raw hides or unwrought leather, under heavy penalty alike to the shipper and the master of the vessel. It is a fact, and probably a consequence of these laws, that in a little more than twenty years, or about 1651, leather was relatively more plentiful here than in England.

A noted leather manufacturer, who left a considerable impress upon the business in the beginning of the period covered by this work, was Colonel William Edwards. He commenced business in Hampshire in 1790, before he was twenty years of age, and sent the first tanned leather from there to the Boston market in 1794. He began a series of improvements in the mechanical branch of the art, which were adopted and extended by others, and infused a greater spirit of enterprise into the business. His new ideas in mechanism and in the arrangement of the tannery were among the earliest and most important of the advances in leather manufacture. Probably the first incorporated company in the business was the Hampshire Leather-Manufacturing Company, of Massachusetts, established in 1809, with a capital of $100,000, chiefly owned by merchants of Boston, who purchased the extensive tanneries of Colonel Edwards and his associates at Northampton, Cunnington, and Chester. These works had a capacity of 16,000 full-grown hides a year.

In 1810 tanneries were established everywhere, the bark being cheaper by far than in England; and 350,000 pounds of American leather were annually exported, although some particular kinds of English leather and morocco were imported. The value of all the manufactures of hides and skins at this time, according to the census of 1810, was $17,935,477. The actual amount was probably over $20,000,000, as this census was very crude and incomplete. Only the manufactures of the loom, including wool, flax, hemp, and silk, exceeded in importance and amount at this time those of hides and skins. The business increased gradually and steadily until, in 1840, there were about 8000 tanneries in the United States, with a capital of $16,000,000, and employing about 26,000 hands. In 1850 the capital employed was over $20,000,000, and the value of the product of hides and skins alone was $38,000,000, which in 1860 had increased, including morocco and patent leather, to $72,000,000. In 1870 there were 7569 establishments, employing 35,243 hands, whose wages amounted to $14,505,775; the capital engaged was $61,124,812, and the product was valued at $157,237,597.

The number of establishments making leather was enumerated so differently by the census of 1890 and that of 1880 that the statistics do not furnish a reliable basis of comparison. In the census of 1880 the enumerators evidently included all the small tanners and curriers, making an aggregate of 5424 establishments. In 1890 they as certainly included only the large establishments, for they report 1596. The figures of 1880 are the more nearly correct.

THE LEATHER INDUSTRY, 1880 TO 1890.

	1880.	1890.
Capital	$67,100,574	$81,261,696
Number of employees	34,865	34,348
Wages paid	$14,049,656	$17,825,605
Cost of material used	145,255,716	100,114,806
Value of product	184,699,633	138,282,004

The very great difference between the two years in the cost of material used and the value of product is attributable to the remarkable decline in prices, which were at a maximum in 1880 and at a minimum in 1890.

It will be observed that the number of persons employed was a little larger in 1880 than in 1890. The explanation of this is found in the introduction of machinery, making fewer hands necessary to perform the same service. Long after all other important industries had been revolutionized by the introduction of machinery, tanning and leather manufacturing continued to be done by manual labor. Inventions in this line were generally frowned upon. Formulæ and processes had been transmitted from father to son for generations, and it was considered impossible to make leather in any other way. While these barriers have been gradually removed, and inventive genius appreciated, yet it is only within the last ten or fifteen years that the most radical changes are recorded and the old traditions done away with.

Among the first patents taken out for the application of a special process in the manufacture of leather was one, in 1823, by which the tanning liquor was forced through the skin by hydrostatic pressure. A modification of this was introduced by William Drake, in 1831, by which two skins were sewed together, the liquor being put in the vessel thus formed, and allowed to remain until the tanning was completed. In 1826 a patent was issued for suspending the hides in a close vessel, from which the air was removed by an air-pump, and the conversion of hides into leather much accelerated. To enumerate the patents would require too much space; but I give below the dates when the first patent was issued for each of the details which enter into leather manufacture, and also the number of patents in each item up to the present time. The total is approximated, as I have not at hand the records of the last several years.

LEATHER PATENTS.

Purpose for which Issued.	Date of First Patent.	Approximate Total Number of Patents to Date.
Processes and apparatus for leaching and making extracts from tan-bark	Aug. 10, 1791	100
Bark-mills	July 19, 1794	100
Processes employing apparatus for tanning leather	July 9, 1808	100
Leather-splitting machine	July 9, 1808	75
Unhairing-machine	July 12, 1812	75
For rolling leather	Oct. 19, 1812	25
Sconring and setting machine	Nov. 21, 1831	70
Tanners' vats and handling appliances	Jan. 9, 1834	75
Machines for boarding and graining leather	March 25, 1835	35
Compounds for depilating hides and skins	June 30, 1836	60
For fleshing-machines	June 17, 1837	25
Compounds for bating hides and skins	Feb. 3, 1838	40
Whitening, buffing, and shaving leather	May 10, 1838	30

LEATHER PATENTS.—*Continued.*

Purpose for which Issued.	Date of First Patent.	Approximate Total Number of Patents to Date.
Compounds and materials for tanning and tawing leather and preparing raw hides	July 12, 1838	175
Processes for tanning leather	Aug. 1, 1838	275
For cnrrying leather	Ang. 1, 1838	25
Machines for stoning, polishing, finishing, glassing, glazing, flinting, creasing, and dicing leather	March 15, 1845	75
Compounds for coloring and polishing leather	Oct. 9, 1847	40
Methods for manufactnring enameled, japanned, and patent leather	Jan. 9, 1855	20
For stuffing leather	Feb. 6, 1855	20
For pebbling leather	May 6, 1856	30
For employing mineral substances for tawing hides and skins	Ang. 4, 1857	20
For stretching leather	Feb. 8, 1859	40
Bark-rossing machines	Jan. 9, 1863	10
For preserving hides	Sept. 11, 1866	15
Machines for shaving or making leather of uniform thickness	Sept. 24, 1867	5
Apparatns for blacking leather	Sept. 20, 1870	15
Measuring-machines	Ang. 28, 1877	25
Striking-out machines	March 27, 1883	4

The number of cattle killed in the United States whose hides furnished raw material for the tanner is not recorded prior to 1868; but since that time the Department of Agriculture has a cattle census taken each year. As the number killed is about one fourth of the total, the following figures are approximated. The number of cattle (cows and steers) killed in the United States in 1868 was 5,100,000; 1870, 6,400,000; 1875, 6,800,000; 1880, 8,300,000; 1885, 11,000,000; 1890, 13,200,000; 1894, 13,250,000.

The imports of all kinds of hides and skins into the United States from 1821 to the present time (year ending June 30th from 1850 to date; prior to 1850, September 30th) were valued as follows:

IMPORTS OF HIDES AND SKINS.

Year.	Goatskins.	All Others.	Total.
1821	Not classified	Not classified	$892,530
1830	"	"	2,409,850
1840	"	"	2,756,214
1850	"	"	4,799,031
1860	"	"	10,524,706
1870	"	"	13,003,560
1880	"	"	30,002,254
1883	"	"	27,640,030
1885	$4,197,376	$16,388,904	20,586,280
1890	9,106,082	12,775,804	21,881,886
1893	12,844,245	15,503,647	28,347,892
1894	8,583,211	8,202,941	16,786,152
1895	10,954,827	15,168,115	26,122,942

Robert H. Foerderer.

No hides were imported and none were wanted until about 1815; the largest tannery in the United States at that time turned out 10,000 hides a year.

The imports and exports of tanned leather in the last twelve years are shown to better advantage by being placed side by side, and no better illustration can be given of the superiority of the American article, and the progressiveness and persistence of the American manufacturer:

EXPORTS AND IMPORTS OF LEATHER.

Year ending June 30.	Imported.	Exported.
1884	$7,258,799	$6,792,574
1888	6,829,722	7,952,169
1892	6,689,506	9,913,369
1895	6,606,838	12,958,312

An interesting phase in the history of any industry for the past one hundred years is developed in the consideration of the duties levied from time to time, and the changes made by the government during that period. In the leather industry this subject is embraced in the following:

TARIFF RATES ON LEATHER, 1789 TO 1894.

Year.	Raw Hides and Skins.	Leather (All Kinds).	Sole Leather.	Upper Leather.	Calfskins.	Patent Leather.
1789	Free	7½%	....	......	....	....
1792	"	10 %	....	......	....	....
1795	"	15 %	....	......	....	....
1804	"	17½%	....	......	....	....
1812	"	35 %	....	......	....	....
1816	"	30 %	....	......	....	....
1836	"	28 %	...	......	....	....
1841	"	26 %	. .	......	....	....
1842	5%	......	23%	8c. per lb.	....	....
1846	5%	......	20%	8c. "	20%	....
1857	4%	......	15%	8c. "	15%	....
1861 (March)	5%	......	20%	8c. "	25%	30%
1861 (December)	10%	......	20%	8c. "	25%	30%
1863	10%	......	35%	8c. "	30%	35%
1866	10%	......	35%	8c. "	30%	35%
1873	Free	......	15%	25%	25%	35%
1883	"	......	15%	20%	25%	35%
1890	"	......	10%	20%	20%	20%
1894	"	......	10%	20%	20%	20%

In the gathering of statistical information for this article I am much indebted to Mr. F. W. Norcross, of the "Shoe and Leather Reporter" of New York.

The various tannages are oak-bark, hemlock-bark, union, Dongola, alum, chrome, combination, electric, sumac, and gambier, in addition to which there have been experiments without number. In the tannage process of sole-leather almost the only change which has taken place is a slight diminution of the time required. This has been accomplished wholly by mechanical improvements. Experiments are constantly being made, however, and it is believed the day is not far distant when sole-leather will be turned out in as many days—perhaps hours—as it now takes weeks. In the lighter skins the change has already been radical. About 1880 Dongola kid was first put on the market, being the result of a discovery by James Kent, of Gloversville, N. Y., which completely revolutionized the manufacture of kid or morocco. As far back as 1856 the system of tanning or tawing by the use of chromium compounds was discovered by a German chemist; but all the early experiments failed because the tannage could not be made permanent. A remedy was finally found in hyposulphite of sodium, by which the tannage was made lasting. The discovery of the remedy and its successful application were made in Philadelphia, and were the means of creating in that city within five years what is to-day the largest and best equipped leather manufactory in the world.

The future of the great leather industry is dependent entirely upon skill and a knowledge of chemical and scientific principles. Upon these depend the acceleration and cheapening of the tanning process. Our leather manufacturers must aim to be more than good machinists; they must be practical and thorough chemists. Already they have done much; and to one who knows them, and what their broad-minded and progressive efforts have done for hides and leather, the future of that industry can never be in doubt. It will take its place far up in the ranks of the great industrial enterprises of America.

Robt. H. Foerderer.

CHAPTER LXXVI

AMERICAN RUBBER MANUFACTURES

THE rubber industry in the United States can hardly be said to have had any real and tangible existence until the discovery of the process of vulcanization, a little over fifty years ago. It may, however, prove not uninteresting to go back a half-century earlier, to the very beginnings of rubber history in this country; for the first half-century of this industry, though it achieved little else than failure, is, perhaps, fully as instructive as the last half-century, which has been marked with such constant and conspicuous success.

The first rubber ever imported into this country was brought into Boston in the year 1800. By a singular coincidence, Charles Goodyear was born this same year—the man who was destined to convert this useless sap of the Southern forests into a product that should contribute in a thousand ways to the comfort and wealth of humanity, and to the progress of science and art. While rubber was unknown, prior to this time, in the United States, it was by no means a product of recent discovery. Columbus found the natives of South America using it; and the Spanish soldiers, who followed in his wake, smeared their cloaks with the liquid gum, to make them waterproof. French savants, visiting the New World in the earlier part of the last century in quest of scientific information, took back accounts of the strange forest-trees whose sap could be molded into shoes which were as flexible as leather and as impervious to water as metal.

It was not, however, until 1770, that rubber was utilized in any civilized country; then a few pieces of it were sent to England to be used by artists for erasing pencil-marks. It is a singular fact that rubber derives its name from this trivial circumstance, the name "India" coming either from the fact that it was gathered by the Indians of South America, or, possibly, because some of the early importations into Europe came from India.

It may not be uninteresting to take a hurried glance at the nature of this substance, its origin, and the method of its collection. Rubber, in its crude state, is the sap of a tree which grows in great luxuriance in hot climates and in localities that are subject to annual inundation. This tree grows chiefly in Central and South America, western Africa, British India, and the Indian Archipelago. Two thirds of the rubber product of the world, however, comes from the Amazon region, and is known as "Para" rubber, deriving its name from the city of Para, at the mouth of the Amazon River, whence it is exported. The botanical name of the South American species is *Siphonia Elastica;* of which there are several varieties, ranging in height from forty to eighty or ninety feet.

The methods of gathering differ somewhat in the different countries. For instance, in Peru and in Central America the destructive method of felling the tree is pursued, cutting it into pieces, and letting the sap run into a hollow, from which it is gathered. The method in vogue along the Amazon, briefly, is this: Shortly after the rainy season is over—that is, in midsummer—the rubber gatherers take to their canoes, paddle up the tributary streams of the Amazon, build their little huts, and then start into the forest, making small incisions, with a little hatchet made for the purpose, in the bark of the rubber-trees, cutting each tree in a half-dozen or more places, according to its size. Beneath each incision a small clay cup is placed, being made to adhere by a daub of clay. Later in the day, the gatherer goes his rounds and empties the contents of each cup into a calabash, or earthen jug, which he carries back to camp. Then, building a fire of palm-nuts, he dips a wooden paddle into the adhesive sap and cures layer after layer in the dense smoke, continuing this process until the lump of cured rubber at the end of his paddle becomes inconveniently heavy, when it is cut open and put aside, ready for shipment. The sap of the tree, before it is cured, has the color and the consistency of milk. Its color as it comes to this market is generally a dark brown, the change being effected by the smoke to which it is subjected in curing.

The first rubber imported into this country, in 1800, came in the form of bottles, and was looked upon simply as an interesting curiosity. During the next twenty years, sea-captains coming from South American countries were constantly bringing with them specimens of "gum elastic," as it was then more generally called, not as an article of commerce, but simply as the strange product of a distant land. It was natural, however, that a material so pliable and elastic and so impervious to water should suggest to the active American mind great possibilities in the way of usefulness. But it was not until 1813 that this activity had any palpable result. In that year a patent was granted to one Jacob Hummel, of Philadelphia, for a gum-elastic varnish; of which, however, there seems to have been no further mention. Some ten years later, in 1823, a Boston sea-captain, coming from South American ports, brought with him a pair of gilded rubber shoes which excited the greatest interest. Two years later, 500 pairs of rubber shoes, made by the natives along the Amazon, were brought into Boston, this time without the fantastical refinement of gilding. They were exceedingly thick, clumsy, and unshapely shoes, and yet they sold readily, bringing from $3 to $5 per pair; for, with all their heaviness and awkwardness, it was found that they were a secure protection against dampness. This was the entering wedge for the Para rubber shoe. The next year more came, and each year the number increased, until during the next fifteen years probably over 1,000,000 pairs of these shoes were brought into this country and sold at these very considerable figures.

It naturally suggested itself to a great many enterprising minds that if rubber, when crude, had so little value (such lots as had already been imported had sold at five cents a pound), and when manufactured into shoes commanded so high a figure, there must be an excellent profit in rubber manufacture; and so people began to study the rubber problem. Among them was Mr. Chaffee, a manufacturer of patent leather in Roxbury, Mass. It occurred to him that if he could manufacture a leather with a varnish of rubber, which would give not only a smooth and finished surface, but would render the leather impervious to water, he would have a material of obvious usefulness. He began to experiment. This was in 1831. He soon discovered that by dissolving the crude rubber in spirits of turpentine and adding a quantity of lampblack, he obtained a varnish which, when spread over leather or cloth, gave a hard, smooth, impervious surface. He was enthusiastic over his discovery, and so were his friends. A company was formed, and the Roxbury India-Rubber Company, the first to engage in rubber manufacture in the United States, was organized and received its charter in 1833. The prospect for a very large and lucrative industry appeared most promising. They began to make not only rubber-coated shoes, but rubber cloth, rubber life-preservers, and various other articles. Other companies were started in the vicinity of Boston and New York, and several millions of dollars were invested in this enterprise. In fact—to borrow a modernism—rubber "boomed"; for here was a new product made of the sap of a forest-tree, the supply of which was inexhaustible, and the uses of which, when manufactured, promised to be almost infinite.

In the winter of 1834, President Jackson visited Boston, and the managers of the Roxbury Company, having an eye to a good advertisement, presented their distinguished visitor with a suit of rubber clothes, which he put on—the day being rainy—and wore as he rode on horseback through the streets of Boston. It may well be imagined that the fame of india-rubber was notably increased thereby, and the demand for these goods became greater than ever.

Charles Goodyear, who was then a bankrupt hardware merchant of Philadelphia, had read about this wonderful new product and was greatly interested therein. Born in New Haven, the son of a Connecticut manufacturer, he had acquired by inheritance and by association a very considerable inventive ability. He had been in partnership with his father, conducting a branch store in Philadelphia for the sale of their Connecticut-made hardware; but owing to an over-extension of credits the firm had become insolvent, and Goodyear, then a young man but a trifle past thirty, found himself out of business and out of health, with a large load of debt upon his shoulders. He thought he saw in this new product, then being put upon the market, an opportunity to retrieve the family fortunes. Accordingly, on his next visit to New York he called at the office of the Roxbury Rubber Company and examined some of their goods, and particularly their life-preservers. He showed so much intelligence, in some improvements he suggested, that the agent, struck by his perspicacity, confided to him that the whole rubber industry, notwithstanding its seeming prosperity, was but a bubble that must burst—that the rubber shoes, and blankets, and coats, which the factories had sent out in such large quantities were being daily returned to them, as the rubber melted and stuck in summer, and stiffened and cracked in winter. The man who could remedy these difficulties, said the agent, had a fortune in his grasp. Goodyear went back to Philadelphia determined, if possible, to solve the rubber problem.

It was a singular augury of the years before him that his first experiment in rubber was begun in a debtors' jail. Here, with a little lump of rubber, and with no other tools than his fingers, he began those experiments which were to continue until his death, some twenty-seven years later, and which, though for the most part carried on under circumstances of the utmost privation, were destined to add hundreds of millions to the wealth of the world.

The agent of the Roxbury Rubber Company proved a true prophet, for the great rubber industry which had sprung up so rapidly soon came to naught. The boots and shoes, and rubber clothing, and other articles made of the wonderful new product did not stand the test of actual service. The factories were soon closed and the entire investment an utter loss. But this general disaster did not discourage Goodyear. In a certain sense he was assisted by the absolute collapse of the enterprise, as it made crude rubber so apparently useless and so cheap that even a bankrupt in a debtors' prison could get all he wanted.

From this time, in 1835 and 1836, when in the entire industrial vocabulary there was no other word so despised as "rubber," until twenty-five years later, the history of the rubber industry in the United States is little else than the personal history of Charles Goodyear. There are many other names connected with rubber development, but they are all simply incidental; the one persistent, potent force was Charles Goodyear. Taking up the rubber problem as a possible means of paying his debts, he became so absorbed in the pursuit, so dominated by it, that from that time to the day of his death it was the one all-engrossing purpose of his life, from which no straits of circumstances, no distress of physical pain, no enticements of wealth, could serve to swerve him. It is impossible in the limited scope of this article to follow Goodyear through the ten years of trying and unceasing labors which were ultimately crowned by the discovery of the vulcanization process. They were ten years of groping in the dark, ever getting a little nearer to the light. Three different times he thought he had reached the goal—first, when he mixed his crude rubber with magnesia; second, when he boiled this compound in quicklime and water; and third, when he washed the surface of this mixture with nitric acid; but each time apparent success soon turned into complete and disheartening failure. It was six years from the time he began his experiments before he discovered that the two things necessary to make rubber an article of practical utility under all conditions of heat and cold were sulphur and heat. This discovery was made by accident—but it was such an accident as befell Columbus when he discovered America; it was only such an accident as could befall a man who had given his whole thought, his whole time, his whole being, to one subject for many years.

How he was sitting by the kitchen stove expounding his theories to his incredulous neighbors, and in the enthusiasm of his gestures struck a handful of rubber and sulphur against the hot stove, thus accidentally discovering the secret of vulcanization, has been told and retold so often that it need not be repeated here; and yet this wonderful discovery that heat was the thing that rubber needed to make it insensible both to heat and to cold—a discovery which meant to Goodyear the triumphant solution of the problem which had remained for so many years unsolved—signified so little to his friends—indeed, the entire community was so weary of the whole rubber question, and men of means viewed the subject with so much suspicion—that it was not until two years later, in 1840, that he was able to interest any one in his new system of vulcanization. In that year he secured the assistance of two New York capitalists and built a factory in Springfield, Mass. Here, four years later, he took out a patent for preparing rubber by the process of vulcanization, and began to sell licenses for the manufacture of various articles under this patent. The license to manufacture rubber boots and shoes was sold to Leverette Candee, of New Haven, the founder of L. Candee & Co., a company which has continued to the present time an important factor in the American rubber footwear industry. The license to manufacture rubber gloves he granted to the Goodyear's India-Rubber Glove Manufacturing Company, of Naugatuck, Conn. The license to manufacture door-springs, which seemed a very trivial branch of the industry, but which later grew to considerable proportions, was granted to Daniel Hodgeman, of New York; and various other licenses for the manufacture of other goods were given out under his patent to different companies, which immediately began the manufacture of rubber goods under these licenses. All branches of the rubber

Charles L. Johnson.

business as we find it in this country to-day took their permanent rise from the date of Goodyear's patent. Several other companies, in addition to the Candee Company, bought licenses to manufacture boots and shoes; among them Ford & Company (now the Meyer Rubber Company), and the New Brunswick Company, both of New Brunswick, N. J., and the Hayward (which later grew into the Colchester Rubber Company), and the Goodyear's Metallic-Rubber Shoe Company, of Naugatuck, Conn.

Mechanical goods, and especially belting, began at this time to receive considerable attention. Some rubber garments were also made. An immediate demand for the poncho—a blanket for horsemen, with a hole in the center for the rider's head—came from the far Southwest and from Mexico; and various druggists' sundries also began to find their way into the market. With the discovery of hard rubber the field of rubber's usefulness was still further largely extended. The prosperity of the early rubber companies which took their rise from Goodyear's patent in 1844, was sufficient to warrant them in paying Daniel Webster, who defended the patent in a seven years' lawsuit—,finally adjudicated in 1852,—a fee of $25,000—the largest legal fee that had at that time been paid in this country.

Still it was the day of small beginnings, for we find that the importations of crude rubber at Salem, Mass., to which port the greater part of the rubber then imported was brought, amounted in 1851 only to 334,000 pounds, in 1852 to 1,961,000 pounds, and in 1854 to 2,055,000 pounds. In 1860 the boot and shoe industry had a yearly output of only 1,200,000 pairs, at a valuation of $795,000.

The Civil War gave a great impetus to the rubber industry. This was particularly true of the clothing branch; blankets were needed for the soldiers, and the government gave out large contracts. The attempt was made, and with some success, to construct rubber pontoons to be used in military operations. The boot and shoe industry increased rapidly with the other branches of rubber manufacture, so that, from an output in 1860 of the value of $795,000, the yearly output in 1870 had increased to $8,000,000.

The manufacture of mechanical goods took a rapid start shortly after the war. This was owing to a considerable extent to the great increase of railroad building at that time. The railroads called for large quantities of packing, and for hose to be used in conveying steam and gas. The impetus given to manufacturing in general made an increased demand for rubber belting. The first rubber belt was patented in this country in 1836, but this particular branch of the rubber industry reached no considerable size until after the war, when rubber belting was in demand for mills, factories, and elevators, and especially for all outdoor machinery. It possessed several advantages over leather belting: its lower price, the greater friction between the belt and the wheel, and the fact that it was not affected by exposure or by moisture. The rubber mechanical goods industry has increased constantly from the time of the war to the present day, until now it covers a vast variety of articles.

The making of rubber tires for bicycles, and to a growing extent for other vehicles, took its rise about fifteen years ago with the solid tire. That gave way to the cushion tire, which some five years ago was displaced by the now universal pneumatic tire. It is estimated that at least 6,000,000 pounds of rubber are now annually used in the making of bicycle tires. Next in importance to rubber tiring—which stands next to hose, belting, and packing—comes the making of rubber mats. This industry has enjoyed a constant and rapid growth, until we have mats for floors and for stairs, pitcher-mats for tables, and coin-mats for counters—and all in an infinite variety of design. They have lately come into vogue in the form of tiles, which can be laid in ornamental mosaics, and are particularly adapted to ship use.

The introduction and rapid growth of the typewriter industry has consumed a constantly increasing quantity of rubber in various details of typewriter construction. The humble carpet-sweeper consumes, it is said, over $100,000 worth of rubber yearly in the bands that encircle it to keep it from injuring furniture. Several hundred thousand pounds of rubber are used each year by one company alone in the manufacture of jar rings. The making of pencil erasers consumes a large quantity, and there is a large annual output of goring, in which rubber thread is used. A quarter of a million dollars' worth of rubber is used in this country each year in the making of cushions for billiard-tables.

Probably the most widely extended branch of rubber manufacturing—existing to some extent in almost every civilized country—is the making of rubber stamps. This is a large industry in this country. Then the item of rubber balls is a very considerable one. One firm alone makes over $100,000 worth a year of tennis-balls, and it has several competitors. The making of base-balls and foot-balls, and the various foot-ball accoutrements in which the player arrays himself, consumes considerably over $1,000,000 worth of rubber each year.

There are, in short, to-day, some thirty companies making rubber mechanical goods, with an aggregate capital of about $20,000,000, employing 4000 men, and having an annual output valued at from $18,000,000 to $20,000,000. Our export trade in mechanical goods amounts to something over $1,000,000 a year.

The attempt to utilize the waterproof properties of the caoutchouc gum in the manufacture of clothing was one of the earliest directions which rubber invention took. In England this branch of the industry has received more attention than any other; but in this country very little was done in this department of rubber manufacture until the Civil War, and the great demand to which it gave rise for rubber coats and blankets. After the war rubber coats continued to be made, but they were chiefly of a heavy sort and almost solely for men; women continued their vain attempt to protect themselves against the rain by the use of heavy woolen garments, most inaccurately called "waterproof." These gave way about twenty years ago to the light gossamer garment, which was at first very popular. But excessive competition resulted in such deterioration of quality as seriously to affect its popularity. About twelve years ago the manufacture of mackintoshes for both men and women was started in this country. Some garments had been imported from England, but they were not found perfectly suited to our drier climate. The American mackintosh has grown constantly in excellence and in general esteem, until now there are some twenty factories engaged in this branch of manufacture, with an investment of $6,000,000, and an annual output amounting to about the same sum. Of the several companies making rubber garments, the American Rubber Company, Cambridgeport, Mass., leads with a daily capacity of 1500 garments.

Another important branch of the rubber industry in the United States is the making of druggists' sundries. The pioneer in this industry was the Union Rubber Company, located in Harlem. It derived its license direct from Goodyear, and began to manufacture druggists' sundries early in the fifties, making syringes, water-bottles, bandages, air-pillows, air-cushions, and a variety of other druggists' articles. The atomizer, now so generally in use, was a later development, and came into vogue perhaps a dozen years ago. We do a fair export business in certain varieties of druggists' sundries. There are some ten companies engaged in this branch of the business in this country at the present time, with a capital of between $4,000,000 and $5,000,000, and with an annual output of about $4,000,000.

The hard-rubber industry, while somewhat distinct from the soft-rubber industry, may properly be included in the scope of this article. After Goodyear had brought his vulcanization process to a fair degree of perfection he turned his attention to the making of hard rubber, in which he was greatly assisted by his brother Nelson, who in the year 1851 obtained a patent for the production of hard rubber. Hard rubber differs from soft rubber in its composition—containing a much larger proportion of sulphur—and in the degree of heat used in vulcanization, which is considerably higher than that at which soft rubber is vulcanized. The first article made in hard rubber to any considerable extent was the comb. It is said that Goodyear's first experiments in this line made his combs cost twenty times as much as the ivory combs then in use; but the rubber comb has now practically displaced all other kinds. Probably five hundred varieties of rubber combs have been made since the beginning of this industry.

For twenty years after the invention of hard rubber two companies practically enjoyed its monopoly—the India-Rubber Comb Company and the American Hard-Rubber Company; but other companies entered the field after the expiration of the Goodyear patent, and now there are four large companies, employing 2500 operatives, having an aggregate capital of $4,000,000, and a yearly output of over $3,000,000 in value. The principal articles of manufacture are combs, syringes and syringe fittings, fittings for pipes, buttons, harness trimmings, and various desk articles, such as ink-wells, penholders, and rulers. We do a small export trade in this branch.

It is the boot and shoe industry, however, that has led in rubber manufacture in this country from the very first. In fact, for many years the boot and shoe industry used the great bulk of the rubber imported into this country; but the later development of other branches of the rubber business has been so large that now the boot and shoe industry comprises probably not over forty per cent. of the rubber manufactured in the United States.

From an annual output in 1860 of the value of $795,000, the value of the rubber boot and shoe product grew in 1870 to $8,000,000, in 1880 to $16,000,000, and in 1890 to $24,000,000. There are now a dozen or more large factories engaged in the manufacture of rubber boots and shoes. They are the American Rubber Company, Cambridge, Mass.;

the Boston Rubber Company, Boston; the Boston Rubber Shoe Company, Malden, Mass.; L. Candee & Co., New Haven, Conn.; the Goodyear's Metallic-Rubber Shoe Company and the Goodyear's India-Rubber Glove Manufacturing Company, Naugatuck, Conn.; the Jersey, Meyer, and New Brunswick Rubber Companies, located at New Brunswick, N. J.; the Lycoming Rubber Company, Williamsport, Pa.; the National India-Rubber Company, located at Providence, R. I.; and the Woonsocket Rubber Company, with three factories in Rhode Island—two at Woonsocket and one at Millville. The combined daily capacity of these companies is 180,000 pairs of boots and shoes, they employ 15,000 workmen, and their aggregate capital is $45,000,000. Their aggregate annual output in 1895 will equal 40,000,000 pairs of boots and shoes, valued at $29,000,000.

In Europe there are some eight factories manufacturing rubber boots and shoes—two in England, one at Paris (owned and managed by Americans), two in Germany, and three in Russia. The aggregate daily capacity of these eight companies does not exceed 30,000 pairs, as against the 180,000 pairs which the American factories can daily produce. The boots and shoes made by the European factories are uniformly heavy, and present few varieties in widths, sizes, or shapes; while the industry has been carried to such an extent in this country that several of the larger companies make—taking into consideration all the different shapes and sizes—fully a thousand varieties of rubber footwear.

There are several reasons why this country has so greatly outstripped Europe in the making of rubber boots and shoes. In the first place, labor being much higher here, we have had a greater incentive for making inventions and improving our machinery. Secondly, the great body of the working-people in this country are better able to afford the luxury of rubber footwear than they are in Europe, so that the demand is vastly greater here. In Europe rubbers are worn only by the well-to-do; here they are worn by every one, the yearly average consumption being a pair of rubbers to every other person. Then possibly our climate, with its more intense winter severity, has had something to do with our greater consumption.

We have as yet done comparatively little in the way of exporting rubber boots and shoes, our annual exports in this line rarely exceeding $300,000. The reason has been chiefly that the American demand has been so large and has so constantly increased that our manufacturers have not yet felt the necessity of looking for a broader field. They have consequently made no effort to appeal to foreign buyers by making rubbers particularly suited to their local conditions. The rubbers which we export go chiefly to England, the Continent, Japan, and China.

A very important event in the history of the rubber boot and shoe industry in the United States occurred in the fall of 1892, when the United States Rubber Company purchased nearly all of the large rubber footwear interests in the United States. This centralization of the rubber industry has already resulted in conspicuous economies; for while the different factories have remained under their former individual management, they have shared their individual advantages in common, the patents and secret processes of one factory becoming the property of all. In this way all the improved methods, a part of which each factory enjoyed before, are now shared equally and fully by all the different factories. There has been also a great saving in the matter of purchasing crude rubber, a large single purchase being made at a great advantage over a number of smaller scattered purchases. In reducing the necessity of carrying large stocks, in diminishing the duplication of a vast number of expensive lasts, and in various other ways, marked economies have been effected, while at the same time the quality of the goods has been more uniformly excellent than heretofore. The combination of all that was best in the methods of the different companies has proved a potent agency in advancing the rubber footwear industry in this country toward the universal goal of all industrial enterprises—better product at a lower cost.

The entire rubber industry in the United States, in its five important branches,—footwear, mechanical goods, clothing, druggists' sundries, and hard rubber,—consumes considerably more than one half of the rubber manufactured in the world. The consumption of rubber in this country increased from 9,830,000 pounds in 1875 to 17,835,000 pounds in 1880, and 31,949,000 pounds in 1890; while the consumption of crude rubber in 1895 will aggregate fully 36,000,000 pounds. To this large amount must be added the rubber which is obtained by the reclaiming process, which has now been brought to such a state of perfection that very little rubber goes to waste, old rubber articles being collected and subjected to a process which eliminates from the compound everything but the rubber. This reclaimed rubber is serviceable in several branches of manufacture, and is largely used in certain mechanical goods, in which the product is benefited rather than impaired by its use. It is probable that the amount of this reclaimed rubber used annually in this country equals 25,000,000 pounds, making the total yearly consumption of rubber 60,000,000 pounds. The rubber industry in the United States in 1895 is ten times what it was in 1860, three times what it was in 1870, and has doubled since 1880. There are $85,000,000 of capital invested in the various branches of rubber manufacture in this country, and the value of the yearly product is fully $75,000,000, while 150,000 people depend upon it for their support.

Almost the entire rubber output of this country is used at home, our exports amounting, all told, to less than $2,000,000 a year; but with our improved machinery and superior methods of manufacture, it is only a question of time—even though we pay nearly seventy per cent. more for our labor than is paid in Europe—when our export trade should assume large proportions. As soon as American manufacturers feel the need of a larger market, and will sufficiently direct their attention to foreign fields to make the boots and shoes best adapted to climatic conditions and local preferences, there is no reason why our export trade should not reach an importance more nearly commensurate with the large dimensions of our home consumption.

Chas. L. Johnson

CHAPTER LXXVII

AMERICAN WALL-PAPERS

JUDGED from the value of its product in dollars and cents, the wall-paper industry ranks very low in the list of American manufactures. Considered apart from its monetary value, however, it assumes an importance that can hardly be over-estimated, due to the refining influence it exerts in decoration and home adornment. Wall-paper has become the key-note in the decoration of a room; it gives the tone. Carpets and furniture are subsidiary. Criticism is chiefly directed to the wall-paper. The design must be perfect, and its coloring harmonious. In fact, wall-paper has become practically indispensable in furnishing a room. It is now the custom to paper the walls of new houses as soon as completed, instead of submitting to bare white walls as formerly; and builders find that they can more readily dispose of houses whose walls are papered, and can, furthermore, obtain a better price for them, especially if there has been a reasonable exercise of taste in the selection of the paper. Another point in its favor is the fact that it can be quickly applied, the annoyance incidental to the decoration of a house being reduced to a minimum through its use; and time is always an important factor with the American people. It is, furthermore, a not unhealthful agent, the ingredients entering into its manufacture being mainly wood-pulp and pure clay; and, being comparatively inexpensive, it can be replaced easily and as often as desired.

Unquestionably the industry had its origin in China centuries ago. Europe commenced making wall-paper about the beginning of the last century, the goods produced being mainly imitations of tapestries and various fabrics which had, previously to that, been employed in covering walls. In fact, the best goods produced in Europe at this day are imitations of tapestries, velvets, silks, cretonnes, and leather hangings. In these classes of goods European manufacturers have reached a high state of perfection, imitating any particular fabric so closely that in many cases it is impossible to detect the difference. In this work they are most conscientious, not permitting the smallest detail to be slighted. This attention to artistic accuracy necessarily renders the work very laborious and expensive. The rates of wages paid in Europe are low, however, when compared with those paid in this country; otherwise the prices of such goods would be almost prohibitory. The high measure of skill acquired in the manufacture of these goods is due in great degree to the fact that several generations of one family follow the same occupation, the son receiving instruction in the art at an early age, and succeeding the father in identically the same line of work. This state of proficiency is seldom met with in this country, where the opportunities of advancement are so great that the young man is not willing to follow in the footsteps of his parents, but strives to improve his condition and, if possible, establish a business of his own. This brings about a scarcity of skilled labor which is seriously felt by every manufacturer having advanced ideas, and which retards the progress of the business to a large extent. A more liberal provision on the part of labor organizations for apprentices is absolutely essential to secure the best results. Low wages have, to a certain extent, acted against the progress of the wall-paper industry in Europe. They have caused manufacturers to retain primitive methods that are in strong contrast with those used in this country, where labor is better compensated, and where, in consequence, inventive minds have been at work to overcome, by improved methods and increased production, the higher rate of wages paid here.

According to the best authorities wall-paper was first manufactured in this country about the year 1790, so that a retrospect of the business for the last hundred years practically embraces the entire life of this industry here. Those who introduced the industry were two Frenchmen, Boulu and Charden, in association with John Carnes, who had been the American consul at Lyons, France, followed shortly after by William Poyntell, and by John Howell and John B. Howell, father and son respectively, who had formerly conducted a similar business in England. The Howells established themselves at Albany, N. Y., but in a very modest way, their factory being a few rooms in the rear part of their dwelling. However, the amount of space required was not great, as the method of manufacturing was very crude, and the volume of business correspondingly small. Paper was at that time made only in sheets, and had to be joined before being printed. Color was then applied by means of a brush to form the background of the design, and the latter was subsequently printed upon the paper from wooden blocks, as many blocks being used as there were colors in the pattern, each block having a part of the pattern upon it in one color. One block was printed the whole length of the paper before the next color was applied. It should be stated that this method of printing by means of blocks still prevails, but only in connection with designs which, on account of their dimensions, or through some other peculiarity, cannot be printed on the cylinder-machines that have practically supplanted block or hand work, as it is termed. The method of applying color to the background by means of a hand-brush has, however, been done away with altogether.

It does not appear that any other factories were established until about the year 1810, at which time a man named Boriken was engaged in the business. The Howell firm had meanwhile sold out their Albany business to Lemuel Steel, and, after a short experience in New York City and Baltimore, had finally, in the year 1820, located at Philadelphia, Pa., where they have been established ever since, the present owners comprising the third and fourth generations engaged in the business.

It was not, however, until 1844 that any decided advance was made in the growth of the industry. About that time paper in continuous lengths came into more general use, and the necessity of joining sheets together was obviated. In that year, also, the first machine for printing wall-paper was imported from England and introduced into the Howell factory. While very crude, as it printed only a single color, it had a stimulating effect on the business, inasmuch as it enabled goods to be produced at a largely reduced price, and increased the volume of the business considerably. As near as can be ascertained, the entire production of wall-paper in the United States at that time did not exceed $250,000. The second printing apparatus was imported from England in 1846, this one printing six colors. Machines were subsequently built in this country, at first by the machinists connected with wall-paper factories, but after a time a specialty of this class of work was made by William Waldron, of New Brunswick, N. J. He was succeeded by his son, the present John Waldron, whose conscientious attention to the machinery requirements of the wall-paper trade has, during all this period, secured to him the bulk of the business in this line. Being of a highly practical mind and very observant, he has been quick to perceive possible improvements, and has, furthermore, been able to render practical the ideas of others.

The printing-machine of to-day is unquestionably a great improvement on that originally imported into this country, although the principle of its operation is practically the same. It is cylindrical in shape. The paper passes over the cylinder, the pattern being printed on it by means of rollers on which the design has been placed, each roller representing one of the colors used in the design. These rollers are registered so accurately that as the paper, in passing over the revolving cylinder, reaches one of them, it leaves the impression on the paper, and the succeeding rollers follow in regular order. The paper is hung up by an automatic process as it leaves the machine, and passes into drying-racks which are usually several hundred feet in length, after which it is rolled up in lengths of eight to sixteen yards, and is ready for market.

While the printing-machine is necessarily the most prominent feature of the business, yet other factors have contributed largely to the progress made by this industry. Among them are the grounding-machines, which furnish the background color to the paper; the bronzing-machines, which apply bronze powders to certain of the goods; the embossing-machines, which give various textures to the goods after they have been printed; the pressing-machines, which are used to make goods showing the design in relief; the machine or contrivance that is used to hang up the paper after it leaves the printing-machine; and a host of similar devices that enable the manufacturer to produce novel effects and manufacture the goods more rapidly than before, and at a lessened expense. It is these contrivances that have led to the tremendous progress achieved by this industry in the last fifty years, and more particularly within the last twenty years (the pace having been accelerated each year), which have enabled us to become independent of foreign

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manufacturers, and, notwithstanding a reduction in duties on wall-paper, have caused a continued falling off in imports, so that at the present time importations of wall-paper are simply nominal.

The improvements referred to have, however, not been so radical at any time as to enable us correctly to apportion to each individual the credit to which he is entitled. They were such as were called for by the exigencies of the moment, slight at the time, but cumulative, and enabling the industry eventually to attain its present state of perfection. The most notable are as follows: (1) Soon after the introduction of the printing-machine one McKernan invented a contrivance for festooning the paper automatically as it leaves the printing-machine and passes on to the drying-racks. This was undoubtedly a long stride in the process of making wall-paper, inasmuch as the speed of the printing-machine could be increased to the full capacity of the drying-racks connected with it. (2) The single (or continuous) process of making wall-paper was introduced about the year 1870. Formerly the ground color had to be applied by one machine, after which the paper was dried and rolled up and next passed through the printing-machine to receive the impressions of the design thereon. In the continuous process the paper passes through the machine which applies a ground color for the design, and then passes through a drying apparatus that is termed a "hot box," or into drying-racks, and then automatically passes into the printing-machine which applies the colors of the design, saving a double handling of the goods and involving less waste. (3) The method of applying bronze powders to wall-paper automatically was introduced about the year 1872, although, as it was conducted in secret for some time by one or two firms, the discovery may have been made at an earlier date. This method reduced largely the cost of making bronze (otherwise termed gold) papers, and led to an increased demand and output of them. (4) The next and most recent discovery was the application to wall-paper of bronze powders in a liquid state; that is, mixed with an adhesive material (made from potato-starch) of sufficient density to keep the bronze powders in solution without impairing their luster. This was first placed upon the market about 1882, and as the new process enabled the use of as many different shades of bronze as there were colors in the design, the opportunity was afforded for producing many new and brilliant effects, and for superseding in a large measure bronze or gold goods made by the former method.

While, as before stated, it would be difficult to apportion to each individual the credit to which he is entitled for his share of the improvements to which attention has been directed, yet mention should be made of those who may properly be termed the pioneers of the business, and who by their energy and individuality have left their imprint on its history. The firm of Howell & Brothers has already been mentioned, and ranks as the oldest now in existence. Next among the firms that made a distinct impression on the business was that which was founded by Thomas Christie about the year 1835, and which had a most successful career until its dissolution in the year 1881. Mr. Thomas Christie, in connection with a Mr. Robinson, started his factory at Poughkeepsie, N. Y., and subsequently removed to a larger factory in Twenty-third Street, between Tenth and Eleventh avenues, New York City. Of the firms now existing that had their beginning about the time that wall-paper printing-machines were introduced are Janeway & Company, New Brunswick, and the Robert Graves Company, New York and Brooklyn. The firms of William H. Mairs & Company and Frederick Beck & Company, New York, began shortly thereafter, and all of these achieved decided success. They comprised men of ambition, perseverance, and the strictest integrity, and their success is but the result of these qualities. Among the firms who, for a greater or less period, claimed the attention of the trade were those of Josiah Bumstead, of Boston, Mass., and J. R. Bigelow & Company, of Boston, Mass.; and Whiting & Young, of New York City. Mention should also be made of those firms which, though established more recently, possess a distinct individuality, have been highly successful, and whose future career is assured. Prominent among these are Warren, Fuller & Company, William Campbell & Company, M. H. Birge & Sons, Henry Gledhill & Company, and Janeway & Carpender. This list might be extended indefinitely, for there are many others whose work and standing in the trade deserve commendation.

While the mechanical part of the business has made vast strides, there is yet another feature that outranks it in importance, and that is the artistic element. The American people have a constant craving for something new, and the manufacturer is taxed to the full extent of his powers to satisfy this demand. On no industry does this demand fall more heavily than on wall-paper manufacture, and by no occupation has the demand been more fully satisfied. To meet this call it has become necessary to produce an entirely new line of goods each year. Imagine, then, the labor and expense necessary to reach this ever-heightening standard, the number of designers necessary to produce annually several thousands of designs, each entirely distinct from the other. But American enterprise is equal to every exigency. Formerly it was the custom to reproduce foreign styles of wall-papers, but we have outgrown that, and have distinct styles and methods of our own. We produce elaborate schemes of decoration, combining proper treatment of wall and ceiling so that perfect harmony of color will prevail. We offer these schemes of color and treatment not only in expensive grades, but in the cheapest grades as well. This makes it easy for the dealer or for the consumer to insure a well-decorated room, and one that cannot justly be subject to criticism. Talent of a high order is necessary to secure such results, and the staffs of the various manufacturers contain men of exceptional capacity, whose training and experience entitle them in the highest sense to the title of artist. The exhibit of the National Wall-Paper Company at the World's Fair at Chicago bears testimony to this fact, and the award of a gold medal is a recognition of the merit there displayed.

Statistics as to the growth of the industry are necessarily defective, but, according to the most trustworthy information obtainable, the following table gives some idea as to the progress made in the wall-paper business:

Year.	Number of Factories.	Capital Employed.	Number of Employees.	Value of Product.
1793......	1	Nominal	Nominal	Nominal
1810.......	3	$30,000	75	$25,000
1844.......	5	150,000	500	250,000
1880.......	25	3,500,000	2,500	6,500,000
1890......	30	9,000,000	5,500	9,000,000
1895.......	35	12,000,000	7,000	12,000,000

Such is the record of the wall-paper industry at the present day. While its growth in the past has been remarkable, its growth in the future must be even greater, as the advantages of the use of the product become more apparent.

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CHAPTER LXXVIII

AMERICAN MUSICAL INSTRUMENTS

FOR the introduction of the pianoforte, to which such an ennobling, educating, and progressively fascinating mission was intrusted, America is indebted to Europe. This instrument was invented almost simultaneously by Christophale, of Italy, about 1710, and Gottlieb Schroedter, of Germany, within a few years of that date, and was greatly perfected by Silbermann, of Strassburg, shortly afterward. The pianoforte did not come into general use until the beginning of this century, in either America or Europe. In London it was for the first time publicly played in the Covent Garden Theater in the year 1767. John Jacob Astor, of New York, imported from London the first pianofortes as early as the year 1784. They were small four and one half to five octave square pianos, having eight legs. Their tones were feeble and tinkling. Each piano had his own name on the name-board.

The few pianos which were used in the United States at the close of the last and the beginning of the present century were imported. In a short time, however, the trying climate of North America, with its ever-recurring dry land winds, its severe winters, and the general heating of houses by stoves and subsequently by hot-air furnaces exerted its destructive influence upon these instruments, which had been constructed for the comparatively uniform and moist European climate. Again, the great distance between the American settlements, scattered over so vast an extent of territory, with wretched roads, made it next to impossible to effect necessary repairs, even if trained and skilful piano repairers had been accessible; therefore to keep the instruments in anything approaching a playable condition was only possible in the largest cities. As a natural consequence pianos were articles of luxury, accessible only to the wealthy.

It was quite natural, then, that as the demand for pianofortes gradually increased, the enterprise of American manufacturers should have been directed toward their production here. The first successful attempt at building pianofortes was made in Philadelphia about the year 1790, by an American named John Hawkins. In the year 1802 he sailed to London, taking with him two upright pianofortes which he had manufactured, and exhibited them in London. One of these original instruments, preserved for over eighty years, was exhibited at the International Inventions Exhibition, South Kensington, London, in 1885, and there was personally examined by Mr. William Steinway, who could not but admire the ingenuity of this pioneer of pianoforte making in America. Drum and fife and military music were imitated in this instrument, which, though of no practical utility, showed great inventive genius.

There were one or two more manufacturers in Philadelphia at the close of the last century and the beginning of the present one, but not until the close (1815) of the second war between England and the United States was the industry of pianoforte making taken up as a distinct American manufacturing feature. From the close of that war till about the year 1825, a great business depression prevailed in Great Britain. In consequence a number of young and skilled English piano makers and artisans emigrated to the United States and began manufacturing pianofortes. Among them were Robert and William Nunns, Geib, Stoddard, Morris, and others. Pianofortes were gradually extended in compass from four and one half and five octaves to six octaves; but up to about the year 1830, none were larger than six octaves, all being of square form.

About 1825 the first steps of improvement in American piano making may be traced. In that year the first successful attempts were made to give the body of the instrument more durability and an increased power of resistance against the "pull" of the strings, by the application of a full frame of cast-iron in place of one of wood, which had before been used.

The object of this brief synopsis is to describe the enormous dimensions to which the manufacture of pianos has grown in the United States, and the excellence which has been attained, making the American piano a standard which has been recognized by all Europe for a number of years. Consequently, only those inventions can be mentioned which, by their practical and lasting value, have aided materially in the development of this branch of art industry. It must be mentioned, however, that a careful search of the records of the United States Patent Office from its beginning has revealed the fact that a large number of most interesting inventions have there been filed, which, though impracticable in themselves, prove that for nearly one hundred years there has existed a constant and earnest endeavor to improve the manufacture of pianofortes in North America.

In the year 1825, Alpheus Babcock, of Philadelphia, obtained a patent for the construction in a square piano of a cast-iron ring, somewhat resembling the shape of a harp, for the purpose of increasing its power of resistance to the "pull" of the strings. By this invention the principle was first practically introduced of casting the iron hitch-pin plate in *one piece* with that portion which supported the wrest-plank.

In the year 1833, Conrad Meyer, of Philadelphia, exhibited at the fair of the Franklin Institute in that city, a six-octave square piano which was constructed with a full cast-iron frame, substantially the same as that used at the present time. This original instrument, still in perfect condition, was exhibited by him, together with his new pianos, at the Centennial Exhibition of 1876. The successful introduction of this full iron frame was aided to a great extent by the excellence of the quality of American iron and the perfection to which the art of casting had already attained in the United States at that period. It may be mentioned here that as far back as the War of 1812, cannon using thirty-two-pound and even forty-eight-pound balls had been successfully cast in the United States and effectively employed in that war, while in Europe nothing heavier than eighteen-pounders were known.

By the year 1837, Jonas Chickering, of Boston, who was born in 1800 and died in 1853, had greatly perfected the application of the full iron frame in square pianos. It was indisputable that the iron-frame pianos thus made stood better in tune than those previously constructed; but one great defect was that they had a thin and disagreeably nasal character of tone. For this salient reason the new invention soon had quite as many opponents as admirers, so that until the year 1855 all the New York, Philadelphia, and Baltimore pianoforte manufacturers made no attempt to utilize it. In fact, before 1855 not one of the prominent manufacturers outside of Boston employed the full iron frame in the construction of his instruments; but all the pianofortes manufactured in Boston at that time had a full cast-iron frame, of which the wrest-plank bridge was a portion. Across the acute edge of this iron bridge were laid the strings, which were generally exceedingly thin. The action used in these pianos was, without exception, what is styled the "English action," having a somewhat "dragging" touch.

In New York, on the contrary, the instruments made were provided only with a small cast-iron hitch-pin plate, and the "French action" had a more direct and prompter touch. They differed from the Boston pianos in possessing a much fuller and more powerful tone, though at the same time with a quality which was less singing. The New York piano makers succeeded in giving their instruments the capacity of standing in tune more permanently than had been previously accomplished, by a greater solidity of construction and a heavy wooden bracing of the case, and more particularly by the use of a solid bottom or bed of wood fully five inches in thickness, which, however, to some extent marred the elegant appearance of the instruments. By degrees a new difficulty manifested itself in the instruments thus made, for, as their compass gradually extended and finally reached seven or seven and one-third octaves, it was found impossible to obtain the necessary power of resistance against the "pull" of the strings, even by the most solid construction of the case, if wood alone was the material used.

At that time (1850–55) the principal pianoforte manufacturers were the Chickerings, Lemuel Gilbert, Hallet & Davis, Woodward & Brown, of Boston; Nunns & Clark, Stoddard & Morris, Bacon & Raven, Horatio Worcester, John B. Dunham, J. C. Fischer, Light, Newton & Bradbury, Albert Weber, Adam Gale, Hazelton Brothers, Steinway & Sons, and Haines Brothers, of New York; Conrad Meyer and Schomacker, of Philadelphia; Knabe & Gaehle, of Baltimore; and Boardman & Gray, of Albany. There were a number of minor manufacturers in New York and Boston and their vicinity, but with few exceptions their firms became extinct many years ago, and other successful manufacturers—Decker Brothers, George Steck & Company, Ernest Gabler, Kranich & Bach, Sohmer & Company, and others—took their places. In the year 1849 a German named Mathushek, who was a highly skilled piano maker, was engaged in John B. Dunham's piano factory. Mr. Dunham was one of the successful piano manufacturers then established in New York. Mathushek had invented the so-called "sweep-scale" (increasing at the same time the compass from seven to seven and one-third octaves in square pianos), which greatly improved the power of tone, but also increased the size of the instrument and weakened its durability by narrowing the soprano part of the wrest-plank.

The Steinway family had arrived in New York on June 9, 1850, and the father and three sons (among them William Steinway, then a lad fourteen years of age) worked for nearly three years in different New York piano factories, familiarizing themselves with the requirements and tastes of the American musical community. Though possessing a reasonable amount of capital, they did not start in business for themselves until the fifth day of March, 1853, when, with cautious modesty, they placed their first shop in a rear building at 85 Varick Street, removing in 1854 to 88 Walker Street, New York. In 1855 they succeeded in constructing an overstrung square piano with a solid front bar and full iron frame, the latter covering the wrest-plank, the wrest-plank bridge, however, being made of wood. Without describing in particular the novelty of the instrument, it may be said that for the first time the overstrung plan—that of placing the bass strings obliquely across all other strings in the shape of a fan — was successfully introduced. The results achieved by this novel construction were in every way most successful. The instrument, by the unanimous verdict of the jury, received the first prize, a gold medal, at the exhibition, in 1855, of the American Institute at the Crystal Palace in New York. This was located at what is now known as Bryant Park, and was destroyed by fire in 1858. The new method of construction immediately became the standard for all American manufacturers and soon after for all other countries, and has remained so ever since.

As stated before, nearly all the pianos made in the United States up to the year 1856 were square pianos. Jonas Chickering, one of the leading pioneers of American piano manufacturing, in 1840 constructed the first American grand piano, successfully introducing the iron frame. A small piano manufacturer named Buttikoffer, a former workman of Erard, of Paris, France, also made Erard fine pianos entirely of wood; but the demand for grand pianos was so limited that the great pianist Thalberg, who arrived in the United States in the year 1856, brought with him two Erard concert grand pianos for his concert tour throughout the country. In 1859 Steinway & Sons made a great improvement by successfully introducing into grand pianos the overstrung system, which was secured to them by United States patent dated December 20, 1859. At the same time several other standard piano makers of New York, Philadelphia, Baltimore, and Boston commenced the manufacture of this kind of instrument, all of them with the overstrung system. Overstrung grand and square pianos were exhibited by Steinway & Sons at the World's Fair of 1862, in the Crystal Palace, London, taking a first-prize medal; and again overstrung grand, square, and upright pianos were shown by them at the great International Exposition of Paris in 1867, these being crowned by a first grand gold medal and the unanimous indorsement of the international jury. Messrs. Chickering, of Boston, also exhibited parallel-stringed grand and upright pianos and overstrung square pianos, and were also awarded a gold medal, so that America's triumph in the piano department was literally overwhelming.

The overstrung system was at once imitated by nearly all of the prominent manufacturers of Europe, and has ever since been known as the "Steinway" or "American system"; and the supremacy of the product of all first-class American piano makers has been conceded by the musical public of both continents. The importation of pianofortes from Europe into the United States not only practically ceased, but since that time the export of the American product to all parts of the civilized world has steadily increased, notwithstanding the somewhat higher prices. It must also be added that, practically speaking, almost all important novelties and inventions by which the tone and durability of all three styles, grand, square, and upright, have been enhanced and increased within the last half-century, have been made by American pianoforte manufacturers, all being imitated in Europe as soon as the details became known.

It may be interesting to state here that, up to the year 1850, England and France produced more pianofortes than all other countries, and supplied the European continent as well as the outlying colonies. Since that date there has been a marked change in that direction. Germany, which undoubtedly has, with America, the most skilled piano manufacturers and workmen, has nearly kept pace with the United States in the quantity of pianos manufactured, and

German piano makers were invariably the first to see the importance of American inventions and improvements. Only one old house in Paris and one old house in London still adhere to the antiquated system of parallel strings. All others have adopted the American overstrung system and full cast-iron frame. As far as can be judged, Germany, producing 70,000 pianos annually, has the largest export of pianofortes of any country in the Old World, especially in the cheapest class of instruments; and there is no doubt that Germany, although making at the present time more pianofortes than all other European countries combined, is surpassed by the United States of America, which, on a careful and conservative estimate, produce annually from 80,000 to 90,000 pianofortes.

The manufacture of pianos in the United States was formerly confined to the following four cities: first, New York; second, Boston; third, Baltimore; fourth, Philadelphia. Within a dozen years Chicago has stepped in, and now has become third in the number of pianos annually produced. The list is now: first, New York; second, Boston; third, Chicago; fourth, Baltimore; fifth, Philadelphia; and successful pianoforte manufacturers have also located in other large cities of the United States, such as Buffalo and Rochester, N. Y., Cincinnati and Norwalk, O., and Erie, Pa.

In Europe the manufacture of square pianos practically ceased about the year 1855, and only grand and upright pianos were thereafter made. In the United States, as mentioned before, the square pianoforte was, up to the same time, almost exclusively manufactured, and sales of grand pianos were about as scarce as angels' visits.

During the years 1844 and 1845 a French manufacturer named Henri Herz, who at the same time was a first-class pianist, traveled through the United States, giving concerts in the larger cities. He had brought with him a number of French upright pianos, and during his stay in this country imported many others. These were readily sold, but within a few years all succumbed to the influence of the climate and became total wrecks, from the fact of having been made from wood alone. This caused such a deep-rooted prejudice throughout the country against upright pianos that they became absolutely unsalable, and up to the year 1866 fully ninety-seven per cent. of all the pianos which were annually made in the United States were square pianos. In that year Steinway & Sons succeeded in completing a system of manufacture for upright pianos which produced instruments that were fully as beautiful in tone and as durable for use as the square and grand pianos. This was speedily followed by other standard American piano makers, some of whom made improvements of their own; and within a few years thereafter a complete revolution in the piano industry took place, so that the situation of to-day is exactly the reverse of what it was less than thirty years ago. The manufacture of square pianos has now almost entirely ceased. The annual production of American pianofortes consists of about ninety-five per cent. uprights, less than two per cent. squares, and a little more than three per cent. grand pianos. There is no question that by the year 1900 not a single square piano will be manufactured in the United States or any other part of the world.

Setting aside, then, the effects of the business depression of the year 1893, and, to some extent, of 1894, which fell with very much greater severity upon other branches of manufacture than it did even on pianofortes, American piano manufacturers have every reason to feel proud of the results achieved by them. There has not only been steady progress in the number of the pianofortes produced by them, but the art of piano making in the United States has been elevated to the highest perfection—a fact which is recognized all over the world.

Quite a number of good European pianos were exhibited at the Centennial Exhibition in Philadelphia in 1876, and at the Columbian World's Fair in Chicago in 1893; but none of them were sold, and all of them had to be reëxported. No grand piano of foreign make has ever been publicly heard in the United States since the advent of Thalberg, now nearly forty years ago; but many first-class American concert grand pianos have been, and are at present publicly used in the art centers of Europe by the greatest artists. Besides, the five largest piano manufacturing concerns in the world are located in the United States. They are: two at New York, one at Chicago, one at Boston, and the fifth at Baltimore. This is indeed a proud and unique position, and American piano manufacturers have no reason to complain of anything in their industry, with one exception, as follows:

In 1850 the overwhelming majority of piano artisans were of American nativity, while since that time, and now for many years, almost all of them are either foreign-born (mostly German) or the direct offspring of foreign-born parents, who, by permission of the employer, are taught a certain single branch of the business by their fathers. This is much to be deplored, for American boys, many of them extraordinarily intelligent and ingenious, are

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practically kept out of this important industry through what might be called the force of circumstances. As far as can be learned there is now no effective apprentice law in force in any of the States. This is very different from the conditions existing in Europe. Take, for instance, Germany. After having been released from school, say at the age of fourteen or fifteen years, a boy is apprenticed to a master mechanic for six or seven years. It is true he receives his board and lodging, but he has to pay, say, $100 *lehrgeld* (learning money), in order to indemnify the "boss" for the time lost in instructing him, or for the defective workmanship and spoiled material which may result from his unskilfulness.

No American boy would be willing to be placed in the position of an apprentice for six or seven years, although that is the only way in which a business can be acquired thoroughly in all its branches and details. Thus there is no guaranty to any employer that a boy, after one or two years spent in learning a branch or subdivision of a business, will not leave him and shift for himself. To enact laws compelling a lad who is growing up to remain with an employer and make up in the later years of his apprenticeship the losses he has caused in the first years does not suit American ideas, and probably never will. Still this matter should engage the attention of all those interested in social problems, for our American boys are second to none in intelligence and practical ideas. And this, too, is one of the chief causes of the sad fact that in no civilized country are there so many young men who are unskilled as in the United States.

In 1850, when William Steinway, then aged fourteen years, arrived in New York, a very lamentable state of affairs prevailed in the pianoforte and other manufacturing industries. The city was still suffering from the effects of the cholera epidemic of 1849; there was but little ready money in the country, much being of the "wildcat" order; there were no sawing, planing, or other labor-saving machines to do the hard work required in piano manufacture, nor were there any elevators; all heavy loads having to be carried up and down stairs on the shoulders of the artisans.

The despicable "truck" system prevailed throughout the country. The skilled workman was not paid his hard-earned wages, which were from $6 to $10 a week; but he would receive, say, from $2 to $3 of his weekly earnings in cash, and some of the rest in orders on grocers, tailors, and shoemakers. The remainder would be retained by the employer, who acted as a self-constituted savings-bank for his employees, without paying interest, and sometimes not even paying the principal. William Steinway, at the age of seventeen years, lost all his savings of $300 by the bankruptcy of his employer, William Nunns, in 1853. There were piano factories and other manufacturers who each were thus constantly owing over $100,000 in wages to their workmen. By the year 1860 this reprehensible "truck" system had, however, entirely ceased throughout the country.

The Civil War, between 1861 and 1865, also caused the piano manufacturers great hardships and struggles. They lost nearly all their claims against piano dealers in the South; there was no immigration to speak of; skilled artisans were scarce, many of them having gone to the war; and in February, 1862, the workmen in New York instituted a strike for higher wages, in which they were perfectly justified. The currency had then depreciated, and all the necessaries of life and rents had risen enormously in value. The workingmen's demand for ten per cent. was readily granted. In May following they again demanded ten per cent. more on the increased wages, which was also acceded to. But in October, 1863, they had formed a large society, the Piano-Makers' Union, and suddenly demanded an augmentation of twenty-five per cent. on the twice-increased prices, being in all a raise of fully fifty per cent. on the original rates. This was simply impossible for the employers to grant, the more so as no increase whatever had as yet been made in wages in the same occupation in Boston, Baltimore, and Philadelphia.

For the first time in the history of piano manufacture the twenty-three piano employers were driven together by necessity, and met at Ittner's Hotel, where it was resolved to resist the demands of the employees. A committee of seven manufacturers (of which William Steinway was a member) was elected to receive the committee of fifteen who represented about 3000 workingmen then on strike. The spokesman of the employees first demanded the increase of twenty-five per cent., with payment for all the time lost by the strikers, and then announced the program mapped out by the leaders of the strike as follows:

"Gentlemen bosses, we, the piano makers of New York, will now assume control of the piano business. You shall no longer be permitted either to engage or dismiss any workman without our consent. You must pay us full wages irrespective of bad or good times. You must all pay the same wages, must not undersell one another, and must every Saturday afternoon submit your books to our inspection, so that we may satisfy ourselves that you have strictly carried out our instructions. Now, gentlemen bosses, what can we report to our union as your response?"

The employers' committee were simply stupefied, when one of the manufacturers, Albert Weber (who died in 1879), a very quick-witted man, observed: "Gentlemen employees, your demands are exceedingly moderate; but in your very modesty you have omitted your most important point."

The spokesman of the employees inquired, "Well, and what might that be?"

"Simply this," returned Mr. Weber; "that every Saturday afternoon, when you have looked over the manufacturers' books, the employees shall go a-bowling, and that the bosses should be made to set up the tenpins for their workmen."

A deafening and unanimous roar of laughter followed this sally. It was the right word at the right time. The ice had been broken, and both parties were conciliated. Half an hour later a compromise was effected, that fifteen per cent. (instead of twenty-five per cent.) increase was to take place in wages, all other demands by the employees being withdrawn.

The truce, needless to say, did not last long; the strike broke out anew in February, 1864, and was completely put down, after a struggle of nine weeks, by the unflinching resistance of the United Piano Manufacturers. Another strike in 1872, to reduce the daily hours of work from ten to eight, was also defeated, and since then but few and brief strikes have occurred. One partially successful occurred in 1880. Those in 1886 and 1890 both brought defeat to the strikers. As a general thing a much kindlier feeling between employers and employees gradually arose, and has existed for a number of years past.

PRINCIPAL INVENTIONS OF AMERICAN PIANOFORTE MANUFACTURERS, WHICH HAVE BEEN MORE OR LESS ADOPTED BY AMERICAN AND EUROPEAN PIANO FIRMS.

1825. Alpheus Babcock, of Philadelphia, Pa., patented invention of a full iron frame in the form of a harp for square pianos.

1833. Conrad Meyer, of Philadelphia, construction of an iron frame in square pianos, except wrest-plank bridge, which remained of wood.

1837. Jonas Chickering, of Boston, Mass., construction of a full iron frame, with wrest-plank bridge (in square pianos) of iron, all in one piece—an important invention, although his application for a patent was unjustly rejected for alleged want of novelty.

1840. Jonas Chickering, successful patented construction of the full iron frame with agraffe bar in grand pianos.

1849. Mathushek (with John B. Dunham), invention of so-called "sweep-scale" in square pianos, the compass of which he at the same time successfully extended to seven and one third octaves.

1855. Invention by Steinway & Sons, of New York, of the overstrung system and its iron frame, placing the strings in form of a fan, in square pianos.

1859. Invention by Steinway & Sons (United States patent, December 20, 1859) of the overstrung system, with its strings in fanlike shape, and novel construction of the iron frame, in grand pianos; also the square grand piano and novel agraffe bar (United States patent, November 29, 1859).

1862. Invention (United States patent) by Decker Brothers, of New York, of novel wrest-plank construction, increasing capacity to stand in tune, in square pianos; also novel apparatus to veneer round corners in square-piano cases.

1866. Invention (United States patent, June 5, 1866) by Steinway & Sons of double iron frame and patent resonator (controlling tension of sounding-boards) in upright pianos.

1868. Invention (United States patent, August 16, 1868) by Steinway & Sons of tubular metallic action-frame in grand and upright pianos.

1870. Invention (United States patents, March 15, 1870, and August 15, 1870) by George Steck & Company, of New York, of the self-supporting, independent iron frame.

1872. Invention by Steinway & Sons (United States patent, May 28, 1872) of the iron cupola and pier frame; also the grand duplex scale (United States patent, May 14, 1872).

1874. Invention by Steinway & Sons (United States patents, October 27, 1874) of the tone-sustaining pedal. The same year Mr. Hanchett, of Syracuse, N. Y., brought out (United States patent) a novel apparatus for prolonging the tone.

1875. Invention by Steinway & Sons (United States patents, October 20, 1875) of concert grand with *capo d'astro* bar all cast in one piece, and design thereof.

1878. Invention by Steinway & Sons (United States patents, May 21, 1878), bending into form the entire case of grand pianos, composed of a series of continuous veneers; also tone-pulsator in grand pianos; also *capo d'astro* bar in upright pianos.

1879. Invention by George Steck & Company (United States patent, January 7, 1879) of further improvements in self-supporting, independent iron frame.

1881. Invention by George Steck & Company (United States patent, October 18, 1881) of further improvements in self-supporting, independent iron frame.

1885. Invention by Steinway & Sons (United States patent, March 31, 1885) of double cupola iron frame in grand pianos.

1893. Invention by Henry Ziegler (nephew of William Steinway), of Steinway & Sons (two United States patents of November 21, 1893), of the grand piano with *capo d'astro* bar in upright form.

1894. Improvement by George Steck & Company in self-supporting, independent iron frame in upright pianos.

1895. Invention by Henry Ziegler, of Steinway & Sons (United States patent, January 8, 1895), of iron frame with *capo d'astro* bar and suspended wrest-plank in grand pianos in upright form.

After a careful and conservative estimate, it appears that there are now engaged in the production of pianofortes and their component parts upward of 200 manufacturing concerns established in the United States, representing a capital of over $40,000,000, and giving employment to about 40,000 skilled artisans; to say nothing of the many millions of capital invested in, and the many thousands of people employed by, houses engaged in the sale of these and other musical instruments.

Next to pianofortes no class of American musical instruments has attained the prominence of the American reed-organs, the manufacture of which took distinct shape about the year 1850, commencing with melodeons in small square-piano shape, produced in great excellence by the late George L. Prince, of Buffalo, N. Y., Carhart & Needham, of New York City, and many other makers. These readily gave way to the superb reed-organs of Mason & Hamlin, of Boston, Mass.; the Estey Organ Company, of Brattleboro, Vt.; Burdett, of Erie, Pa.; the Fort Wayne Organ Company, of Fort Wayne, Ind.; and others too numerous to mention. Besides the interior capacity and the quality and quantity of tone, a variety of musical effects and the imitation of wind-instruments, as well as exquisite external workmanship, were introduced by these and other manufacturers. In good season, even before American pianofortes were exported, shiploads of these fine American reed-organs were sent to Europe, especially to Great Britain, Sweden, Norway, and other Protestant countries. Of late years, however, the importance of this branch of industry has diminished almost in the same ratio as the general interest in pianofortes has increased, the latter instrument becoming more and more popular. As the manufacture of the piano from year to year increased, the pianoforte, with its larger compass and its greater variety of expression, allowing full scope for the individual touch and for novel musical effects, has gradually taken the place of the organ. It has become the most welcome instrument in the American home and family circle, being especially fitted for accompanying the voice. Of late many of the standard manufacturers of American reed-organs have also gone into the manufacture of pianofortes, and several have been very successful.

Formerly, with the exception of banjos and mandolins, all small string and wind instruments had to be imported. All this, by the constantly growing perfection of the American manufacture of these articles, has been so greatly modified that the importation of these instruments does not now cut very much of a figure. At the present time fine harps, violins, guitars, flutes, and all kinds of wind-instruments are successfully produced in the greatest perfection by American manufacturers in all the larger cities of the country. They have greater durability, especially against climatic effects, than the imported articles, in which wood plays a part, can ever possess. Many millions of capital and thousands of skilled artisans are engaged in the manufacture of small musical instruments, and of late Chicago seems to make the greatest progress in this direction. Lyon & Healy, of that city, produce excellent small musical wind-instruments in large quantities, and their harps, which are of superb quality, are unexcelled by the best ones made in Europe. The latter are unable to withstand the effects of our severe North American climate for any reasonable length of time.

C. G. Conn, of Elkhart, Ind., and of Worcester, Mass., also produces most excellent brass wind-instruments in very large quantity. Vocalions, an English invention by Sir Bailey Hamilton, were first produced, and have been brought to high perfection, by Messrs. Mason & Risch, Worcester, Mass. Æolians are also extensively manufactured and sold. Within a few years autoharps, manufactured by Alfred Dolge & Sons, of Dolgeville, N. Y., have come into great favor, and are extensively produced.

The construction of church organs during the past fifty years has also reached large proportions in the United States. Everything is now manufactured, from the largest cathedral church organ down to the small portable pipe church organ. They are of the finest quality.

In all classes and kinds of musical instruments American ingenuity has achieved great triumphs and introduced many improvements, adding to the quality, and especially to the durability of the article, so that the importation of them has almost ceased.

William Steinway

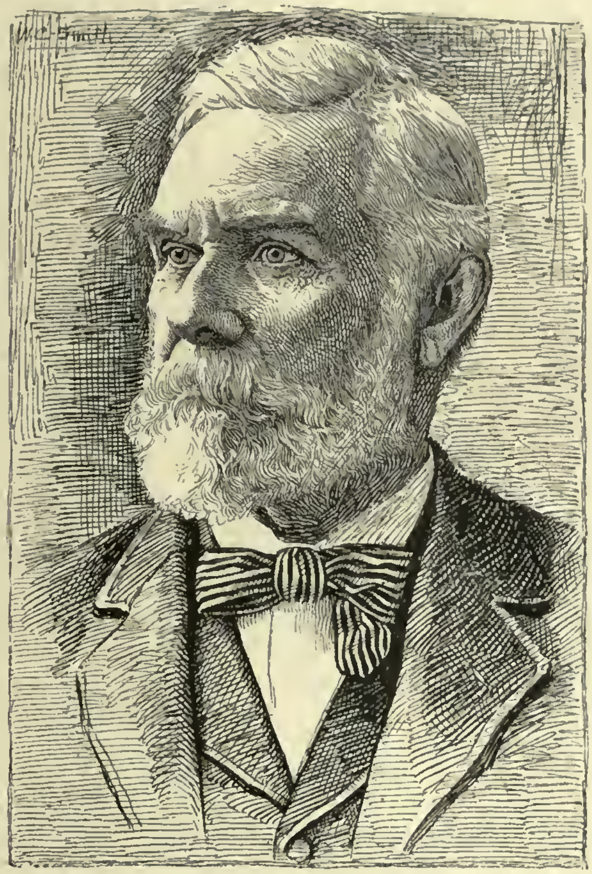
CHAPTER LXXIX

AMERICAN CARRIAGE AND WAGON WORKS

FROM the earliest times of which there has been any historical record, mankind has utilized wheels as a means of transportation. On the great sculptured stones now in the British Museum, taken from the ruined city of Nimrod near Nineveh, can be seen, besides the innumerable war chariots, carts drawn by oxen, and carts drawn by men. The writer made a drawing of one of the latter kind, which shows very good construction. The wheels have six spokes and are well proportioned; probably they were about forty-two inches high. The body is framed up with posts and a top rail, and the spaces are filled with handsome wicker work. There is an arched guard over the wheel to protect the latter from contact with the overhanging load. The cart is loaded with logs of wood. On another slab is shown the king's chariot, with an elegant canopy over the royal head. This chariot carries, besides the king, the charioteer and an arms-bearer. In Biblical history the chariot is very frequently referred to, those of the great army of Pharaoh being engulfed in the Red Sea. It is worth noting that the word "carriage" was at one time used in the sense of goods or baggage, and we find in the New Testament, "After those days we took up our carriages and went up to Jerusalem." The Greeks and Romans were, of course, familiar with the horse-drawn vehicle, and in the story of the Trojan war we find Achilles dragging the body of Hector around the walls of Troy lashed to his chariot. Carriages without wheels were used as late as the seventeenth century, when they were known as litters, having shafts behind and before which were supported upon the backs of the horses. The litter was but a form of the sedan chair, itself a species of carriage. If we look for a carriage with wheels but without horses, we find it in the jinrikisha of Japan, a unique vehicle drawn by man-power. The ancient chariot, with all its splendor of decoration, was but a two-wheeled cart without springs, and this, the starting-point in the evolution of the carriage, we find among many barbaric peoples, the wheels being formed of solid wood rendered circular when nature formed the trees from which they were made. Even the triumphal and funeral cars of early history were but springless carts; and ages of progress lie between a gorgeous chariot of the Cæsars and a modern buggy. Queen Elizabeth's wonderful state coach, with its highly ornamented and canopied body, was without springs. It was a sort of triumphal car, for State parades. Her usual mode of locomotion was by water or on horse-back.

The various forms which the modern carriage has assumed appear to be almost limitless. The old-time stage-coach has developed into the fashionable drag or tally-ho; the post-chaise and the curricle are no more; but there are still left to us innumerable forms of vehicles, of which the American buggy is perhaps the most useful and represents the highest development of the carriage-builder's art. Many of the forms came to us from England, notably the brougham, named for Lord Brougham. The landau takes its title from the town of the same name in Germany, where it was first made. A few specimens of the Irish jaunting-car have found their way to America, where they serve to remind us of the active nation with which they are popular. The hack as a name is solely American, but is of course a lineal descendant of the English hackney coach.

Carriage building, as an art, began to be developed in all parts of Europe about the middle of the seventeenth century. Steady but slow progress was made in all the great cities, and some almost elegant forms are shown in the old prints, profusely decorated. The running parts, however, were very imperfect. The first relief from the jolting of the dead-



Chauncey Thomas.

axle carriage was accomplished by suspending the body of the carriages on long leather thorough-braces stretched from upright iron jacks which stood up from each end of the running part. The next improvement was made by transforming these stiff iron jacks into spring jacks, and by making them of steel plates. Finally, in the early part of our own century, the spring jack was given a bold, sweeping curve, and the beautiful C spring evolved. The Collinge axle now in common use all over the world was perfected almost 100 years ago, and the elliptic spring, the best of all springs, was invented at about the same time. It was early in the eighteenth century that the post-chaise came into use for journeying, and the hackney coach and hackney cab came to take the place of the sedan chair in the great cities. This created quite a war in London between the watermen and the chairmen on the one side, and the coaches on the other.

In very old times the post-chaise had a small body hung very high on its leather straps; the wheels were very high and far apart, and the driver rode the wheel horse. In later times this uncouth post-chaise developed into the elegant chariot, perhaps the most perfectly formed carriage ever built. This carriage, with its gorgeously draped coachman's seat, as well as the full coach similarly mounted, is now only seen at royal receptions and other state occasions in the capitals of monarchical countries. As with other inventions, the evolution of the carriage has taken place by fits and starts, the greatest progress having been made during the present century, and the field in which that progress occurred having been the United States of America.

The volume of business done by American carriage-manufacturers in 1795 was exceedingly small. Technical knowledge was not wanting, however, for there were many shops which had been established in colonial days, where fine carriages were occasionally built, and many imported French and English vehicles repaired. But business languished for lack of customers. Before the War of the Revolution the rich shipping merchants of Salem, Boston, Newport, New York, Philadelphia, Baltimore, and Charleston lived in good style, as was common in those monarchical times, and imported in their own ships coaches, chariots, and phaetons, from England and France. Repair shops sprang up in all the large towns and cities, and skilled workmen came from England, Ireland, and Scotland, finding ready employment on their arrival.

A curious bit of history, clearly showing the use of carriages in New York City in 1770, came to the writer's knowledge some years ago from the late George W. W. Houghton, who embodied the facts in a lecture delivered before the New York Historical Society. The old record, which he somewhere discovered, gives a list of fifty-nine owners of carriages; and the vehicles mentioned were twenty-six coaches, thirty-three chariots or post-chaises, and twenty-six phaetons — in all, there were eighty-five vehicles. The names of the owners were Cadwallader Colden, Daniel Horsmanden, John Watts, Oliver De Lancey, Joseph Reade, Charles W. Apthorp, Colonel Roger Morris, Henry Cruger, John Cruger, James De Lancey, the widow of Governor James De Lancey, the widow of William Walton, the widow of Judge John Chambers, the widow of James McEvers, the widow Lawrence, Mrs. Waddell, Andrew Elliott, William Bayard, Nicholas Bayard, Philip Livingston, John Livingston, Robert G. Livingston, Walter Rutherford, Gerardus Beekman, Colonel Beekman, Nathaniel Marston, John Marston, Rev. Dr. Ogilvie of Trinity Church, Anthony Rutgers, Jacob Le Roy, David Johnson, William Axtell, Miss Lodge, Leonard Lispenard, Samuel Verplanck, Lawrence Kortright, David Clarkson, John Van Cortlandt, Robert Murray, James Jauncey, Dr. William Brownjohn, Dr. Jonathan Mallet, Thomas Tiebout, Jacob Walton, John Watkins, Nicholas Gouverneur, John Aspinwall, Hugh Wallace, Isaac Low, A. Van Cortlandt, Gerardus Duyckinck, General Gage, John Read, Archibald Kennedy, Thomas Sowers, Captain John Montressor, John Leake, Abraham Montier, and Ralph Izard. Many of these names are familiar to the New Yorker of to-day, the prestige of the old families having kept pace with the march of events.

It will be observed that there were but three styles of carriages known among the old aristocracy, and they were all for town use. No similar records are to be found in other cities, but there are many ancient relics of grand chariots now to be found in Boston and vicinity, still preserved in the stables of the old families as curiosities. One fine old chariot-body is now at the writer's factory, sound and serviceable. It was used by the owner's grandfather in London in 1793. The wheels and running-gear long ago disappeared, but the body is now being fitted with an elegant set of runners, and, when the first snow comes, will enter upon a new career of usefulness, completely rejuvenated as a stylish winter carriage.

The effects of the struggle for independence, and the hard times which followed, so impoverished the people that there was but little use for carriages of luxury in the early days of the present century.

The tendency of all classes was essentially democratic, and rigid economy was esteemed a great virtue. This state of things was not favorable for the makers of fine carriages; but, fortunately for them, all well-to-do people required something to ride in, and that took the form of the two-wheeled chaise, immortalized by Dr. Holmes. These were in great demand as the country grew prosperous, and were built in large numbers in Boston, Salem, Worcester, Pittsfield, West Amesbury, Mass., New London and New Haven, Conn., as well as in Wilmington, Del., and Philadelphia. They had enormously high wheels, and the tops were stationary, being supported on iron posts. Curtains of painted canvas or leather covered the sides and back. These chaises were often built without dashers or aprons in the earlier times, but in later years they had falling tops and were gay with silver plate. So universally was this style of carriage in use that most carriage-makers were known as "chaise-makers," as the old sign-boards of fifty years ago plainly indicated. Chaise-making throve mightily, and up to about 1840 it seemed that nothing could ever fully supplant the favorite old two-wheeler. But the buggy, which had been struggling for existence for several years, began to come to the front.

The chaise had been for generations of nearly the same form, no radical changes having been tolerated; but the buggy came in a multitude of forms, as it was new and without any recognized standard of shape to hamper the fancy of the builder. At last the door was open for novelties, and has since been still wider open, with no signs of being closed again.

The buggy is purely American in its origin, and is without doubt the greatest achievement of American carriage-makers. The body may be of any form, but the running part is always of the same, or nearly the same, type. Its common-sense construction is wholly unlike the work of any other country. It is simpler, lighter, stronger, and cheaper than any other style of vehicle, and is so admirable in all respects that it is not likely to go out of use for at least another century.

In the early days of this century of progress a great stimulus was given to the carriage and wagon trade by the advent of the grand old stage-coach. It was elegant in form, gay with paint and gilded scrollwork, and when starting out on its journey, rocking on its tough thorough-braces under its load of passengers and baggage, with its team of four or six Morgan horses, it was an inspiriting sight. It has been said that the stage-coach was unknown in America prior to 1810, but this is a mistake. In 1776 John Hancock stole away from his duties in the Continental Congress to Tamfield, Conn., where he married the beautiful Dorothy Quincy, and took her on a wedding journey to Philadelphia by stage-coach. The incidents of the journey, including the upsetting of the coach, are duly set forth in the record of William Bant, attorney to Governor Hancock. It is also related that Mrs. Hancock took a similar journey with her son, who was but two weeks old, to join her husband in Philadelphia. This was in 1778. The roads, however, at this early date, were little better than bridle-paths, and the chief resource for journeying was the saddle. In 1791 there were but 1905 miles of post-roads in the States, and in these roads were many bottomless sloughs, and corduroy bridges consisting of round logs laid crosswise over swamps, sometimes for long distances. As the government and local authorities improved and extended the roads, some sort of public conveyance followed.

In New York, New Jersey, and Pennsylvania the great Conestoga wagon, broad-wheeled, and with huge canvas-covered body, was drawn over the rough roads by six or eight horses or oxen for the transportation of freight and passengers. This wagon was the prototype of the famous "prairie schooner," or emigrant wagon, of later times.

Government roads, called military roads, were built across the mountains of Virginia, connecting the East with the valley of the Ohio; also through the great forests of Maine to the town of Houlton on the New Brunswick frontier, and in many other parts of the country. They were for postal and military purposes. On all these were quickly established thriving stage lines, and the business grew very rapidly. Capital was freely invested in the varied interests directly and remotely connected with the innumerable lines which radiated from all the chief towns and cities in the country; and the investments paid good dividends.

The carriage-maker, the harness-maker, the horse-breeder, and the jolly old country tavern-keeper, with his good dinners, his well-stocked and well-patronized bar, all seem to have been prosperous and happy in the good old slow-going time.

Stage-coaches and wagons were built in many places at the time I write of. Salem, Mass., was early in the field. Osgood Bradley, of Worcester, was a large builder; the Troy coach, of Troy, N .Y., was very famous in its day; but a little later, and still more famous, came the Concord coach, of Concord, N. H. The founder of the house of Abbott, Downing & Company, now the largest wagon-builders in New England, whose work is known throughout America as well as in South Africa and Australia, was Louis Downing, who moved to Concord from Salem, Mass., in 1815. There he began the manufacture of coaches and wagons; and after eighty years, this old house is still in the full tide of active business.

So great was the coaching business from 1810 to about 1845, that in addition to the builders hundreds of smaller shops derived their chief income from repairing and painting these fine old road coaches.

After the War of 1812, trade and commerce entered upon a new career of prosperity. The shipping merchants were piling up wealth; manufacturing, which had grown strong by the fact that the war had thrown us wholly on our own resources, was opening up new sources of wealth, and again stylish carriages for city use were in demand. Fine coaches and chariots, hung on C springs, and made grand with the hammer-cloth coachman's seat, were built in all the large cities. Boston had two well-equipped shops for this kind of work; New Haven and Bridgeport were active and growing; Newark, N. J., became celebrated for its fine productions, and New York, Philadelphia, Baltimore, and Wilmington, Del., were supplying their own wants, and sowing the seeds of greater development in later times.

About this time a considerable export trade grew up with the West Indies. The carriages shipped there were known as volantes, and were large two-wheeled vehicles with immensely long shafts. The wheels were placed so far in the rear of the vehicle, in order to give greater freedom of access, that the shaft horse had a very large share of the weight upon his back. In addition to this, the overloaded beast carried the postilion, while the leader did most of the hauling. These carriages were shipped by the sugar and molasses merchants of the northern cities to the planters of the West Indies, in commercial exchange for their product, which was speedily converted into rum, then in great demand at home and abroad. Thus the carriage-maker played his part in the interchange of commodities, and trade flourished.

Farmers' wagons and carts had been made in every village in the country since the earliest time, but wagon-making as a great business began with the development of the Western States. First came the large emigrant wagon, and after that the lighter farm wagon, and, later still, wagons for the great overland current of emigration, which flowed like a mighty river from the East to the gold-fields of California. Happily for the emigrants, the wagon-makers of the West were equal to the occasion. Great factories quickly grew up, stimulated by this additional demand, and among the rest the great house of Studebaker Brothers, which had its origin as far back as 1813, now came to the front, reorganized and ready for business. This firm, now the largest wagon and carriage manufacturers in the world, was just in time to take a leading part in supplying the government with army wagons for the western regiments in the Civil War. It was due to the thorough equipment of the wagon-makers of the country that the armies of the North were better and more properly supplied with the means of transportation than any army in military history. Wagon-building is so vast in its proportions that when one visits such an establishment as that at South Bend, Indiana, he wonders where purchasers can be found for so many vehicles, a wagon being produced every ten minutes in this one factory.

The older men of the present generation of carriage-makers have witnessed a great change in the extent as well as in the method of manufacturing. In the early years of the century, business in the old carriage towns was done on what is called the "dicker" system. Woodworkers, blacksmiths, trimmers, and painters, each did business on his own account, and swapped parts, as they termed it, the final settlements being made in finished carriages. The dealer in materials also took carriages in payment. The workmen were paid with orders for goods, and money was almost unknown in all the various transactions. The old operators, who did business in this way, used to say that the plan was much safer than the cash system, there being fewer failures, and less danger of getting involved in debt.

By and by the small operators with their little shops went the way of all old-time things, and well-organized factories succeeded them. Then a multitude of inventions in machinery were eagerly taken up and utilized. Larger and larger grew the factories, more and more perfect the machinery, until the present time, when the limit of quick methods and cheap production seems to be well-nigh reached. But the end is not yet.

Much the larger number of carriages built in the great factories where machinery is employed are built in duplicate by the million, and are sold to the million at exceedingly low prices. Of course, there are many qualities among the vast variety of vehicles built by the new processes, and many grades of stock enter into their composition. As in all other manufactures, the price is a very fair indication of quality. One might think that in the rush for low prices of both builders and buyers all really good work would be superseded by low grades, and that the tendency would be steadily downward in quality; but such is not the fact. Fine work — I may say superb work, that which taxes the highest skill and care of the best designers and mechanics — is still in great demand, and will probably continue to be for all time.

There are many builders of high-grade work widely known by the public, of whom I should be glad to speak, and who are distinguished for their excellent productions; but I will name only one, easily the first in this or any other country — Brewster & Company of New York. A visit to this great establishment — of which all American carriage-builders are justly proud — will show the appreciative observer to how high a degree of perfection, beauty, and completeness modern carriage-building has attained.

In 1872 the leading carriage-makers of the country formed an association called the "Carriage Builders' National Association." The good that this organization has accomplished by means of its annual conventions can scarcely be estimated. All trades which have similar associations know the value of good fellowship and good feeling among competitors instead of the old-time jealous antagonism. Very early in the history of the association the decay of the useful old apprenticeship system was recognized; and as a substitute for this past method of training workmen a fund was raised by subscription for a technical school, to be established in New York City, to teach the science of carriage drafting and construction. This school has been a great success. Under able teachers a large number of talented young men have graduated, well equipped to take charge of the constructive department in our factories. Thus scientifically trained foremen and whirling machinery now very largely take the place of the skilled workmen who formerly occupied our benches, each working by his own methods, carefully guarded, in which there was more of the rule of thumb than of science.

It is fortunate for the graduate of the technical school when, in addition to the knowledge gained in the course of his studies, he has the inborn faculty of producing new and beautiful forms; that keen sense of fair proportions and graceful lines which is the necessary qualification of a designer. Few things fashioned by human skill are more beautiful than a fine carriage; none but a true artist in his line is fit to determine its form, and none but an expert mechanic, painstaking and honest, is fit to supervise its construction. The light-weight carriages now required, the tremendous strain and rough usage which they must undergo without a sign of weakness, require the most carefully selected stock and the most watchful care in all the details of mechanical arrangement.

The volume of business done by all the carriage-makers in the country is clearly shown by the last census report, from which the following figures are taken:

AMERICAN CARRIAGE AND WAGON TRADE.

Number of establishments	4,571
Number of workmen employed	62,594
Number of all other employees	56,525
Officers, firm-members, and clerks	6,069
Capital employed	$93,455,257
Miscellaneous expenses	5,495,271
Wages of workmen	34,687,827
Wages of other employees	28,972,401
Wages of officers, firm-members, and clerks	5,715,426
Value of all products	102,680,341
Cost of materials	46,022,769
Value of road carts	6,074,173
Value of buggies	27,345,546
Other light carriages	13,109,982
Broughams, coaches, Victorias, etc.	4,279,738
Other heavy carriages	2,973,898
Light and heavy spring wagons, etc.	12,640,339
Farm wagons and carts	14,146,700
Repairing	18,610,366

It will be seen from the above figures that the value of buggies manufactured was double that of any other style of carriage or wagon, and more than one fourth of the total product.

That the volume of business done in the carriage trade at the present time is fully equal to the wants of the community is evident from the exceedingly sharp competition among builders and dealers. The business, however, will certainly continue to grow as fast as the increased capacity of the purchasing class can be made to absorb the increased product.

Given that prosperity which our country and her beneficent institutions insure us, if wisdom rules, a continued advance will be made, a wider and wider market will be open to us, greater novelties will be forthcoming to tempt the lovers of new things, greater perfection will be attained, and a greater number of our hard-working fraternity will find good employment with satisfactory returns.

Chauncey Thomas

CHAPTER LXXX

AMERICAN SAFE-WORKS

FROM the earliest period in history, the inventive genius of man has been applied to the work of providing safe receptacles for the storage of treasure, jewels, and other valuables. The development has not been so rapid as in some other industrial interests, but it has kept pace with the demands of the commercial world, and the evolution from the strong-box to the mammoth chilled-iron and steel vaults, absolutely fire-proof and burglar-proof, seems to have reached the highest stage that science and art can impart to the wonderful mechanism of American safe-building.

In the early days of Egypt the organization of government had attained a point of perfection which made its treasury an important interest, and the moneys obtained by the tax-gatherers upon the industries of the country were carefully guarded in securely-built treasure-houses fastened with locks of elaborate design and construction. From the keys which have been found in the ruins of Thebes it would appear that the ancient Egyptians were acquainted, even at this early period, with some of the principles which have been supposed to be distinctive in modern improvements in locks—for example, that of tumblers which hold the bolt fast until it has been moved by the key. Locks rudely constructed upon this principle were also to be found in many European communities during the middle ages, although its use by our modern safe-makers has been comparatively recent.

The discoveries in Pompeii and elsewhere have shown that among the Romans locks of intricate workmanship were known; and in Great Britain keys have been found which date back to the Roman occupation of that country. Among the Chinese the art of lock-making has for a long time been well understood, and the locks there constructed upon the principle of the famous Bramah lock, invented in England in 1784, were made of wood from early times. In these the tumblers were made of different lengths to fit the sizes of the wards in the keys.

During the middle ages chests for the safe-keeping of valuables were ordinary articles of furniture in houses. Some were very elaborately made, strengthened with ironwork of various kinds, and furnished with locks which were frequently decorated in very artistic ways. These chests, which were really the safes of that period, were protected by bands of iron. The burglar's skill and cunning had not then attained to its present perfection, and a modern "cracksman" would laugh at the provisions then made for the security of valuables. The oaken chest, or strong-box of that time, seems to have been considered the acme of security. In 1707 such a chest was made and used for the safe-keeping of the crown jewels of Scotland, and when the Royal Commissioners desired to examine them they were obliged to force open the chest, because no keys could be found that would open the locks, and no "expert" could pick them; yet they can be picked to-day by an ordinary expert locksmith in three or four minutes with a simple piece of bent wire. These safes or chests were often reinforced with iron bands and knees, and made to look more formidable with sharp-headed spikes or similar devices. No attempt seems to have been made to construct these articles to resist fire or heat, or to render them to any degree fire-proof, until between 1825 and 1835.

About that date the Yankee inventive genius produced an oaken chest that was a great improvement on the old style, and many of the old-time business houses in New York and Boston still have in their offices specimens of these first efforts of the inventive genius of America in the "fire-proof" safe line. A body of solid oak plank three or four inches thick, saturated with an alkali, was covered with sheets of thin iron. Bands of iron were crossed and recrossed over these plates and secured to the body with large round-headed iron nails. This made a very formidable-looking affair, and with its immense key, weighing sometimes over a pound, was considered thoroughly fire and burglar-proof. As a fire-proof safe when new it would probably stand a severe test of two or three hours. In the great fire of 1835, which destroyed a large portion of the lower part of New York City, hundreds of these safes were shown to be worthless in a severe conflagration.

With the advent of paper money and the commencement of our modern commercial activity, wealth began to assume a more portable form; large values began to be possible in conveniently small packages, and the necessity was soon made apparent for improved methods in safe-making. The oaken box defended by iron bars, which had done duty as a burglar-proof safe during the last century, began in the early years of the present century to be replaced by boxes covered entirely with iron. The Hall Safe and Lock Company, of Cincinnati, have in their possession a safe formerly used by the Marietta Bank, and made in New York City in 1807, which is constructed of oak plank two inches thick, bound together by iron straps, and thickly studded with small nails. It is fastened by an ordinary hasp and padlock.

About the year 1820 the attention of safe-manufacturers, mechanical engineers, and inventors was directed toward making safes absolutely fire-proof, for the preservation of money and valuables. The first attempts appear to have been made in France. The safes were made with double walls, the space between them being filled with a non-conducting substance, a composition. This idea was quickly taken up in the United States, and in 1843 the first patent was issued to Daniel Fitzgerald, who had conducted experiments on his own account in the same direction. Fitzgerald had been a workman engaged in grinding plaster of Paris. A simple incident had suggested to his mind an improvement in the construction of fire-proof safes. Being in the habit of washing his hands daily in a tin basin, he one day desired to warm the water, and, placing the basin over the fire, discovered that it did not heat rapidly; and, after stirring the fire, he threw out the water, and discovered that a thin scale of plaster of Paris had gradually formed in the bottom of the basin. This he scraped out, and found that the water heated rapidly. He concluded that if a safe were filled with plaster of Paris it would be a good protection from fire, and he immediately secured a patent and began the manufacture of the first so-called Salamander Safes.

In a short time, as the business grew, he needed much more capital, and Mr. Azor S. Marvin was induced to engage in the business with him. A few years later Mr. Silas C. Herring also secured a right to manufacture safes under this patent. Mr. Fitzgerald's patent was subsequently assigned to B. J. Wilder, and the safes manufactured under it were known as the "Wilder Patent." In these the space between the walls of the safe was left vacant, reliance being placed upon the non-conducting properties of the air thus enclosed to preserve the contents from heat. Other substances, which had also a high non-conducting power, were proposed for filling the space left between the walls, and numerous patents were granted for various compounds.

But other inventors were also at work upon the problem of fire-proof safes, and asbestos, mixed with plaster of Paris, clay, alum, fire-clay, mica, and chalk were each used with effect, and were proclaimed in turn absolutely fire-proof. The intense heat, however, to which safes have been subjected has demonstrated that none of these fillings was absolutely safe. Another plan, invented by Prof. A. K. Eaton, of New York, consisted in using pure alumina, and he also introduced the idea of using steam as a non-conductor. Experiments showed that as long as any steam was produced no excessive heat reached the articles in the safe; but the objection to this is found in the dampness to which the contents of the safe are subjected.

Protection against burglars is in modern days regarded as of very great importance in the building of safes. The modern burglar has the thorough experience of a practical mechanic, together with a full comprehension of the details and theory of safe-making. During the present century great attention has been given both to lock-making and lock-picking. The invention of the Bramah lock was regarded as a step of great importance. The lock abandoned the use of wards, and other improvements introduced into its mechanism enabled it for a long time to retain its reputation as a lock that could not be picked. It was finally picked, however, in 1851, by a Mr. Hobbs, by what is known as the "tentative process." Subsequently the work of picking the lock became comparatively easy.

The next important lock invented was Chubb's, which was introduced in England in 1818. This was also picked with ease by Mr. Hobbs. A lock made by Mr. Pyes was placed in the London exhi-

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bition in 1851, but it was picked by Linus Yale, Jr., of Philadelphia, by what he called the "impression process." The father of Mr. Yale then patented a lock which was regarded as absolutely safe, but it was finally picked by his son. The inventors persevered, however, and the modern lock-combinations are such as to defy the skill of the most accomplished or ingenious burglar, while the construction otherwise renders them absolutely fire-proof. The testimony of E. B. Denison, the celebrated lock-maker of London, demonstrates the superiority of American-made safes over those produced anywhere in the world. He says: "The American safes are vastly superior to any we have ever seen made in England; and on the whole the United States are evidently far ahead of us in the manufacture of both good and cheap locks."

The method of construction used in the modern safes makes them impregnable to any appliance in use by the most expert burglars. The doors, which are generally the weak point of a safe, are constructed of plates so dovetailed, and fitting correspondingly into the jambs, that the wedge, the most effective implement used by the burglar, is powerless against them, while the accuracy with which they fit offers no opportunity for any crevice into which nitro-glycerine or any other explosive fluid or substance can be introduced. The body of the safe being also constructed of alternate plates of iron, welded iron, and steel, carbonized and decarbonized steel, and crystal steel, fastened together by bolts from the inside, effectively prevents them from being forced by sledge-hammers, jimmies, jackscrews, or other mechanical devices. Their fire-proof qualities are also secured by fillings of concrete which make them absolutely proof against fire and damp.

But in addition to the building of safes much attention has been paid in recent years to the manufacture of burglar-proof bank vaults and chests. Among the specialties employed in their construction is a material made from Franklinite ore found in Sussex County, N. J., which possesses a hardness exceeding that of the finest tempered steel. This metal, often presenting the appearance of crystallized silver, is so interwoven with wrought-iron rods that it can be battered until bent without being broken, and at the same time the combination of wrought and crystallized iron is such that, in any attempt to drill, the tool will pierce the soft metal faster than the hard, and, consequently, working sideways, will soon have its point fractured and broken off.

A first-class banker's chest consists of three casings of one-fourth-inch wrought iron with angle corners, a casing of one-fourth-inch steel bars, a casing of one-fourth-inch wrought bars, with angle of solid corners, a casing of patent crystallized iron two inches thick, with wrought-iron rods cast through it, and projecting rivets on each side, so that the entire thickness is three and one fourth inches. Such a safe will not only overcome any drill or cutting-tool, but is also a restraint against sledging or battering, which has always been the weak point in safes in which hardened metal has formed an integral part. Many of the vaults in use in this city are receptacles for enormous sums of money and other valuables, the safety of which is rendered absolutely secure by the modern methods employed in their construction. The safety of hundreds of millions of treasure against the depredations of the most expert burglars, and also from loss by fire, is thus assured. One of the most important factors in securing absolute safety for valuables in bank safes and vaults has been the introduction of the combination-locks, the evolution of the "tumbler" principle already alluded to. The mechanism in these locks exhibits the highest skill. Each one is practically unlimited in the number of combinations upon which it may be set, thus rendering it absolutely impossible for any person, other than the one who knows the combination, to open it. In recent years a valuable addition has been introduced in the shape of chronometer or time locks. The mechanism and adjustment of these are as fine as the work of the most expertly constructed watch. Three movements are usually inclosed in a single case, so that, should one or even two of them get out of order, the remaining one would still unlock the ponderous doors at the hour appointed for them to be opened. Bank officers have in the past been compelled in some instances to unlock the door of a safe at the point of a burglar's revolver, under threat of death, but the chronometer combination has effectually prevented robbery in that way, as no human agency can open the doors of the safe or vault until the time on which it is set has expired.

The construction of the modern office building of fifteen or twenty stories has induced safe-manufacturers to build the framework of safes much thicker than was formerly the case, and to make use of greater quantities of fire-proof filling, so that the safes may withstand a fall from an upper floor to the cellar, and also the crushing weight of heavy walls and machinery.

There are at present about ten leading firms and corporations in the United States engaged in the manufacture of safes, vaults, etc. They give employment not only to mechanics, who are mostly of a very high class in the factories, but, in addition, large numbers of salesmen, draughtsmen, and others are connected with the work, aggregating upward of 5000 people, and producing annually in the neighborhood of $10,000,000 worth of work. The capital invested in machinery, plants, etc., for the production of this work approximates $6,000,000. Some of the principal manufacturing companies are located in the West, principally in Cincinnati: those include the Hall Safe and Lock Works, the Mosler Safe Company, the Diebold Safe Company; and in the East the Herring Safe Company and the Marvin Safe Company of New York, and the Farrel Safe Works and Remington Safe Works of Philadelphia. These companies all manufacture first-class work, and it is due to their energy and business activity that the American safe is the standard for the entire world. No foreign safes are imported to this country.

The immense superiority of the American over the European safes was shown in the great safe test at the Paris Exposition in 1867. An American safe was pitted against an English safe of one of the leading manufacturers of that country; the Yankee workman opened the English safe in less than three hours, while it took the Europeans more than double that time to open the American safe.

At the Centennial Exposition in 1876, the difference in the qualities and improvements shown in the American safes over the European exhibits was very marked, while the European safes were found to be but slightly in advance of those produced soon after the World's Fair in London, in 1850, and were about on a par with the safes produced in the United States twenty-five years previous. The American safes, in both fire-proof qualities and burglar-resisting devices and construction, were so far superior to all others that the foreign safes did not receive a single medal, or even honorable mention.

Naturally the recognized security offered by American safes opens the market of the world to the products of this important branch of industry. Not only throughout Great Britain and her colonial dependencies, but throughout Europe, Asia, Africa, and Mexico, the American safe-manufacturer finds customers; and great as is the volume of the trade to-day, the possibilities of the future cannot be foreshadowed with anything approaching accuracy, although its steady growth is assured.

W. B. Marvin.

CHAPTER LXXXI

AMERICAN SEWING-MACHINES

THE American sewing-machine is the sewing-machine of the world. Not only is this true as to the machines used for domestic purposes, but of machines used in manufacturing for stitching all kinds of textile fabrics and leather, including special machines for working buttonholes, eyelets, overseaming, embroidery, etc. It is, however, proper, in writing a brief history of the inception and invention of the sewing-machine from its beginning down to the advent of the first American sewing-machines which were of practical value as an article of commerce and trade, that we refer to what had been done in other countries in the way of inventing and producing sewing-machines.

The first sewing-machine of official record is that of Thomas Saint, on which a patent was granted in England, July 17, 1790. It is not known whether more than an experimental machine was made; only the drawings on file in the English Patent Office, together with a full description of the machine in the specifications of the patent, are in evidence to show to what extent success was attained. Enough is shown in the drawings and description to demonstrate that it corresponded more nearly to the form and mechanical arrangement of the first successful American productions of 1850 than did any of the several machines made during the intervening time. Knight says in his "Mechanical Dictionary": "The overhanging arm, vertically reciprocating needle, continuous thread, and automatic feed, were patented in England fifty years before Greenough's [machine] and sixty years before the Singer attained its excellence." This indicates that subsequent inventors from 1790 to 1850 either did not have knowledge of Saint's invention or did not choose to profit by it.

The first sewing-machine of official record that was put into operation is that of Barthlémy Thimonnier, patented in France in 1830. This machine was so far a success that in 1841, it is said, eighty of them were made, and used in making clothing for the French army, and were destroyed by a mob, as had been the Jacquard loom and other labor-saving machines years before. Thimonnier made another attempt in 1848 to introduce his machines in France, and a mob again defeated his efforts. He took out a patent in the United States, September 3, 1850, but his machine had no important features that were of value as compared with the sewing-machines of that date.

Several patents on sewing-machines were taken out in England and the United States up to the year 1846, but none of them contained the essential features necessary for success. September 10, 1846, Elias Howe, Jr., took out a patent in the United States on a machine that had new and important features, and that placed his name among the great inventors of this age of inventions. Prior to Howe all the sewing-machines patented made the chain or tambour stitch, or attempted to imitate sewing by hand, making what might be called the backstitch. They used a short thread with a common needle that was passed through the material and pulled out with pincers, or else a needle with an eye in the center, passing it through the material and making the same stitch as is common to workers in leather.

The chain-stitch was produced by Saint, Thimonnier, and others, and might properly be called a knitted stitch, as they used a continuous thread direct from the ordinary spool, and the stitch was formed the same as in knitting. Howe used an eye-pointed needle and a shuttle, passing the shuttle through a loop of the needle-thread and producing a lock-stitch alike on both sides of the material, with the lock or intertwining loops of the two threads pulled to the center; this might very appropriately be called a woven stitch in contradistinction to the chain or knitted stitch.

There is a general impression that Howe invented the eye-pointed needle, but this is not true. The eye-pointed needle was invented many years before, and was extensively used in France for the purpose of working by hand, in a chain-stitch, the name of the manufacturer on the ends of broadcloths. It was also used in chain-stitch sewing-machines.

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.

It is not claimed that any machines made after the model of the original Howe machine were ever put into practical use. Mr. Howe, in his application for an extension of his patent, only claims to have made three machines, one being the model deposited in the United States Patent Office, and the other two he retained and claims to have used in sewing the seams for two suits of clothes, one for himself and the other for Mr. Fisher, the assignee of one half of the patent. Mr. Howe also relates that, not meeting with any success in obtaining adequate capital in this country, he sold the other half of his patent to his father for $1000, and went to England, where his right for a patent had been sold to William Thomas for £250. He engaged to work for Mr. Thomas at £3 per week in perfecting and adapting the machine for work in the corset factory of Mr. Thomas, in London. He was not successful in this, and was arrested for debt and took the "poor debtor's oath." Through the kindness of the captain of an American packet he was enabled to send his wife and children back to the United States. Later he took for himself steerage passage for Boston, where he found that sewing-machines had been made during his absence that infringed his patent. He then obtained a reconveyance of the half-interest previously conveyed to his father, and commenced suits to enforce his rights in Boston and New York. In the latter city he found I. M. Singer & Company making and selling machines, they setting up in the courts, in justification of their right to make machines, the claims of Walter Hunt, who established the fact that he made a sewing-machine with an eye-pointed needle and a shuttle that made the lock-stitch previous to the year 1834, but failed to apply for a patent on it or to produce a machine made at that time.

Mr. Howe further says that the suits brought by him in New York were fought with the utmost vigor and pertinacity by I. M. Singer & Company; but the courts decided that Hunt's invention was never completed in the sense of the patent law and did not in any way anticipate the patent granted to Howe. I. M. Singer & Company submitted to the decree of the court, and July 1, 1854, took out a license under the Howe patent, and paid him $15,000 in settlement of license on machines made and sold prior to that time. Howe then purchased the other half-interest of his patent, and his success in the Singer suit made it comparatively easy for the enforcement of his legal rights with others. He obtained an extension of his patent in 1860 for seven years, and again applied for another extension in 1867, setting up that he had received only $1,185,000, that his invention was of incalculable value to the public, and that he should receive at least $150,000,000 for it. His second application was very properly denied.

In 1853 Amasa B. Howe, an elder brother of Elias Howe, Jr., commenced the manufacture of sewing-machines under a license from his brother Elias, in which he infringed the Bachelder, Wilson, and Singer patents. Under subsequent arrangements he obtained the right to use those patents, and the machines were called the "Howe sewing-machine." This gave an erroneous impression to the general public as to what was really the original Howe sewing-machine. The facts in regard to it came out in after years, when Elias Howe, Jr., made an attempt to manufacture sewing-machines that were very like those made by Amasa B. Howe, and endeavored to appropriate the name of Howe as a trade name for the machines he manufactured. A suit brought by Amasa to establish his right to the word "Howe" as a trade name proved successful, the decision of the court being that Amasa B. Howe was the original inventor and proprietor of the trade-mark of "Howe" as applied to sewing-machines.

The next invention patented that covers a fundamental and important feature was that of John Bachelder, patented May 8, 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 to be sewed, carrying it along intermittently at a proper time to meet the action of the needle.

To Allen B. Wilson must be awarded the highest meed of praise as an inventor, and for the ingenuity displayed in constructing and improving the sewing-machine. His patent of November 12, 1850, covered the invention of the moving feed-bar, with teeth projecting up through the horizontal table or plate of the machine, in conjunction with a presser-foot coming down on the material to be sewed, and holding it in position for the action of the feed-bar. His patents of August 12, 1851, and June 15, 1852, for improvement in a feeding device, and for a revolving hook for passing the upper thread around the bobbin containing the under thread, gave to the world a feed that would admit the sewing of a curved seam, which has become almost universal in the sewing-machine, while the revolving hook is a marvelous piece of ingenuity and mechanical skill.

It is to be regretted that Wilson did not receive an adequate reward for his great inventions. In his petition to Congress in 1874 for a second extension of the three above-named patents he stated that he did not receive anything above his expenses during the fourteen-year term of his original patent; that owing to his impecunious condition he was obliged to sell a half-interest for $200; that for the seven-year term of the extension he had only received $137,000; and that he had no stock or interest in any company manufacturing sewing-machines at that date; which statements were verified by his original partner.

The sewing-machine constructed by Allen B. Wilson was small and light, and only adapted for domestic purposes in the ordinary sewing for a family, or on very light fabrics in manufacturing. It used a vibratory arm for carrying the eye-pointed needle, which was curved to meet the arc of the circle described by the motion of the arm.

In 1873 the Wheeler & Wilson Manufacturing Company produced its first machine, with horizontal bed and overhanging arm attached thereto, using a needle-bar with perpendicular action and carrying a straight needle. Its vibratory arm was actuated by a cylinder-cam on the shaft under the table of the machine. This defective and cumbersome mechanism was not a success and was superseded by a rock-shaft in the overhanging arm. This was again displaced by substituting the revolving shaft, as used in the original Singer machine, and giving motion to the needle-bar and the upper thread "take-up" in the same manner as applied on the Singer machines at the present day.

In 1850 Mr. Isaac M. Singer visited Boston for the purpose of promoting the manufacture of a machine that he had invented for carving wood. His attention was there called to a sewing-machine made by Blodgett & Lerow, after the model of the Howe machine. That night he worked out in his mind a machine differing materially in shape, form, and mechanical construction, and made a rough draft of his conception, showing its advantages over the plan of construction of the first and only sewing-machine he had ever seen or heard of.

The feasibility of his plans being apparent to Mr. Orson C. Phelps, the owner of the machine-shop, and to Mr. George B. Zieber, who had previously been interested in the machine for carving, an agreement was entered into by which Singer was to furnish the plans, Phelps to do the work in his shop, and Zieber to put in $40 in money to pay for materials and expenses. It is a matter of well-authenticated history that the first machine was made in eleven days, and that "it went to work at once," and was the most perfectly organized sewing-machine for practical use that had been made up to that time.

Thus was created a sewing-machine that in its size and the mechanical construction of its arm and table serves as model for ninety-five per cent. of all the sewing-machines that are being made throughout the world to-day. It had the horizontal table, with a continuous feeding device coming up through an aperture in the table; an overhanging arm attached to the table; a horizontal shaft in the arm giving motion to a needle-bar acting perpendicularly and carrying a straight eye-pointed needle; a horizontal shaft under the table of the machine, and directly connected with and driven by the upper shaft, giving proper motion for moving the shuttle back and forward, and an intermittent motion to the feed-wheel, which was an improvement over the Bachelder feed, as it was constructed of iron, with a corrugated surface that did not penetrate the fabric or injure its surface. It also had a presser-foot to hold the fabric down to the feed-wheel, which had a yielding spring that would permit of passage over seams, or would sew different thicknesses without requiring any change in its adjustment. This important feature had not been shown in any other machine up to that time. The yielding spring presser-foot was claimed by Mr. Singer in his original application for a patent on a sewing-machine; but this claim was disallowed because there was a question as to who was the first to invent this important feature, although the idea was undoubtedly original with Singer.

The construction of the original Singer machine, with its straight horizontal shaft in the overhanging arm, easily admitted enlargement and extension, thus gaining increased space for handling the work.

As an indication of its capabilities in this respect it may be stated that at this time there are over forty distinct classes of machines made by The Singer Manufacturing Company, that vary in size and capacity from the smallest for domestic purposes to a machine having a bed eighteen feet in length and capable of stitching canvas belting of any practicable width and up to one and one half inches in thickness. Mr. Singer did not confine his efforts to his original machine and the lock-stitch, but in 1854 he invented a "latch underneedle," and constructed a machine making the single-thread chain-stitch; and the same year he produced a machine for embroidering, using two threads and making a double-thread chain-stitch, with a very ingenious mechanism for throwing another thread back and forth in front of the needle and producing an ornamental fringe.

In 1856 he brought out a machine making the lock-stitch, but discarded the wheel-feed and used the "Wilson four-motion feed"; so that the name of Singer, as applied to sewing-machines, did not designate any particular type of machine, or a machine making any one kind of stitch, or using either of the well-known feeding devices. He also turned his attention to making attachments for the sewing-machine, in the way of binders, rufflers, etc.

The machines of prior date to Singer, and many of them for a long time after, used either a vibratory arm and a curved needle or a vibratory arm and a needle-bar carrying a straight needle. It is obvious that a machine constructed on either of these principles could not be enlarged without destroying its effectiveness. The shorter the arm, the greater the curve of the needle, and the more contracted the space for turning and handling the work; the longer the arm, the more liability to spring and affect the proper action of the needle, and the more power required to propel the machine and drive the needle through the material to be sewed.

We have now reached a period where the inventors had discovered the essential features of a sewing-machine and made them mechanically practicable. The time had arrived for active and practical business men to take hold of it and make the discovery of value to the world at large. A new industry had sprung into existence, the product of which was not only to be of great importance in itself, but was also to work a revolution in many branches of manufacturing industry.

The men who came to the front and duly appreciated the magnitude of the prospective business were Mr. Nathaniel Wheeler of the Wheeler & Wilson Company, Mr. Orlando B. Potter of the Grover & Baker Company, and Mr. Edward Clark of I. M. Singer & Company. Mr. Nathaniel Wheeler became a partner of Allen B. Wilson in 1851. Mr. Wheeler brought with him energy and ambition that soon developed into superior business ability. This, with fine presence and engaging manners, enabled him to obtain financial aid from some of the leading capitalists of Connecticut, his native State. His great tact in the way of bringing before the public, by advertisements and otherwise, the fact that sewing by machinery could be practically accomplished in the household gave the invention of Wilson an enormous sale, and its manufacture at Bridgeport, Conn., soon became one of the most important manufacturing industries in that city.

Mr. Wheeler became prominent in banking and other business interests, and received political honors from both city and State. He was president and general manager of the Wheeler & Wilson Manufacturing Company from its organization down to the date of his decease, in January, 1894.

Mr. Orlando B. Potter was president of the Grover & Baker Sewing-Machine Company, a corporation organized under the laws of Massachusetts, with its factory located at Boston. Mr. Potter, however, recognized the fact that New York was the metropolis, and the proper place for him to establish himself and the headquarters of his company.

The inventions of William O. Grover and William E. Baker were of prime importance in some of the sewing-machines of early date, but the great feature was the "Grover & Baker stitch." It was formed by interlocking the upper and lower threads on the under side of the material, and producing on the knitting principle a double chain-stitch. This company also made a few machines using a shuttle and making the regular lock-stitch; but Mr. Potter became imbued with the belief that the Grover & Baker stitch would be the stitch universally used in family sewing and nearly every branch of manufacture, and he apparently directed his efforts to that end. That he had committed an error became evident, as the sales of the Grover & Baker machines decreased, while those making the lock-stitch were increasing in much greater proportion.

In 1875 Mr. Potter sold out the business and all the effects of the Grover & Baker Sewing-Machine Company to a company making lock-stitch sewing-machines. The demand for the Grover & Baker machines became so small that their manufacture soon ceased, and the name of the Grover & Baker machine and stitch soon passed out of existence.

Frederick G. Bourne.

The merits of a double chain-stitch are in its elasticity, and in using the under thread direct from the commercial spool without rewinding. Machines making a similar stitch have been made since that time for use in the manufacture of knit goods, bags, etc., where an elastic seam is required, and the stitch is also used in machines made by the Singer Company for sewing the seams in carpets.

After Mr. Potter's graceful retirement from the sewing-machine business he showed his faith in the progress and growth of his adopted city, New York, by large investments in real estate. He became interested in politics, being twice elected to Congress, where he was very prominent and an important member of some of its leading committees.

The complex and important litigation of the early days of the sewing-machine required the employment of the very best legal talent of that period; and soon after the establishment of the business of I. M. Singer & Company in New York, in the early part of 1851, they employed Messrs. Jordan & Clark as their attorneys and counselors. The senior member of that firm, Ambrose L. Jordan, was at that time attorney-general of the State of New York, and the affairs of that office so engrossed his attention that the junior partner, Edward Clark, took in charge the new clients. They were unable to pay the fees and costs of the extensive litigation in which they were involved, and Mr. Clark accepted an interest in the firm to secure payment for his services and the advances he had made. Mr. Singer recognized the legal ability and business sagacity of Mr. Clark, and proposed that they should buy out the interest of the other partners, Mr. Clark taking charge of the legal and financial branch of the business, while Mr. Singer gave his attention to the manufacturing and improving of the sewing-machine. In March, 1852, they consummated this arrangement; and from that time up to the incorporation of The Singer Manufacturing Company, in April, 1863, Mr. Clark had charge of the financial and commercial branch of the business, and directed the affairs in litigation. That he conducted both of these important parts of the business with success is well attested by the remarkable growth of the first and the well-protected interest of the latter.

Mr. Clark at an early day appears to have fully comprehended the value of the sewing-machine as an article of trade and commerce. His policy always contemplated the diffusion of the business in every direction, following the most direct method of placing its products in the hands of the consumer. He not only established agencies throughout the United States, which were conducted by agents employed under salaries, but he gradually extended a system of agencies throughout Europe and all other parts of the civilized world. In 1856 he originated and inaugurated the system of selling sewing-machines on the renting or instalment plan, and this method has been adopted and extended throughout the offices of the company all over the world. This system has been extended by others to the sale of nearly every article of merchandise, from a family Bible to a railway-car, and has proved of inestimable benefit to mankind.

Mr. Clark continued to take an active interest in the business of The Singer Manufacturing Company, holding the office of president of the company from 1876 down to the day of his decease, in 1882. He was a large owner of real estate in the city of New York, being one of the first to construct a building for residences on the French system. Among the notable buildings of this class erected by him are the "Dakota" and the "Van Corlear."

Mr. Clark was of a very modest and retiring disposition, and never permitted himself to be brought prominently before the public; and although he was at the head of one of the largest mercantile enterprises in the world, his natural tendency for association was with the members of his profession. If occasion called he had an easy flow of rhetoric, and with a pen his diction was pure, terse, and to the point. These qualities, with clear logical reasoning on legal questions, and an inherent love of equity, would have insured him high standing had he continued in active practice at the bar, or he would have graced with ornate dignity the bench of a court of last resort.

After the validity of the patent of Elias Howe, Jr., had been fully established, he commenced a system of licenses to manufacturers of sewing-machines, demanding the exorbitant price of $25 on each machine, without any regard to its merits. In his application for a second extension of his patent he states that his first license was granted May 18, 1853, and that up to July, 1854, he had granted fifteen licenses "for the general manufacture and sale of sewing-machines." As Howe's imperfect and impractical models did not contain the features essential to practical sewing-machines, the result of operation under his licenses was suits and countersuits by the owners of the more important patents, and great distrust and unrest on the part of all purchasers of sewing-machines.

In 1856 the owners and controllers of the Bachelder, Wilson, and other fundamental patents brought about a coalition, in which they included

Elias Howe, the Wheeler & Wilson Manufacturing Company, the Grover & Baker Sewing-Machine Company, and I. M. Singer & Company; thus forming the famous "sewing-machine combination" in which were pooled all the patents of the essential features of the sewing-machine in such a way as to protect the interest of each of its members in an equitable manner, and enable other manufacturers to continue in the business by the payment of only one license-fee to the combination. Under this arrangement any manufacturer who had a meritorious machine that was not an offensive imitation of the machine of some other licensed manufacturer was granted a license, the rate being uniform to all, and much less than the excessive and exorbitant license previously demanded by Elias Howe, Jr.

There was no pooling of any other interest in the combination excepting that of the patents; no restrictions were placed on the price at which the machines were to be sold, either at wholesale or retail, but the market was open to fair competition on the merits of the several machines, and the result was to be the "survival of the fittest." The combination continued in existence with Mr. Howe as a member until the expiration of the extended term of his patent in 1867, and was then continued by the other members in interest until the expiration of the Bachelder patent in 1877.

No record or estimate was made as to the number of sewing-machines manufactured prior to the date when Howe began to grant licenses, but from that time to the termination of the combination a report was made at stated periods by all licensed manufacturers. Unfortunately some of the records of the combination were destroyed by fire, and only a partial list, showing the number of machines made from 1853 to 1877 by each of the several manufacturers, can be furnished. Enough, however, is shown in the tabular statement appended to indicate the volume of business from year to year during that period.

A PARTIAL STATEMENT FROM RECORDS OF "THE SEWING-MACHINE COMBINATION," SHOWING NUMBER OF SEWING-MACHINES LICENSED ANNUALLY UNDER THE *ELIAS HOWE* PATENT.

Name of Manufacturer.	1853.	1854.	1855.	1856.	1857.	1858.	1859.	1860.	1861.	1862.	1863.	1864.	1865.	1866.
Wheeler & Wilson Mfg. Co ..	799	756	1,171	2,210	4,591	7,978	21,306	25,102	18,556	28,202	29,778	40,062	39,157	50,132
I. M. Singer & Co.	810	879	883	2,564	3,630	3,594	10,953	13,000 (a)	16,000 (a)	18,396	....	.....	.....	.....
The Singer Manufacturing Co.	...	....	....	....		....	.....	....	....	....	20,030	23,632	26,340	30,960
Grover & Baker S. M. Co. ..	657	2,034	1,144	1,952	3,680	5,070	10,280	(b)	(b)	(b)	(b)	(b)	(b)	(b)
A. B. Howe " " ..	...	60	53	47	133	179	921	(b)	(b)	(b)	(b)	(b)	(b)	(b)
Leavitt " " ..	28	217	152	235	195	75	213	(b)	(b)	(b)	(b)	(b)	(b)	(b)
Ladd & Webster " " ..	100	268	73	180	453	490	1,788	(b)	(b)	(b)	(b)	(b)	(b)	(b)
Bartholf " " ..	135	55	31	35	31	203	747	(b)	(b)	(b)	(b)	(b)	(b)	(b)

A PARTIAL STATEMENT SHOWING NUMBER OF SEWING-MACHINES LICENSED ANNUALLY FROM 1867 TO 1876 INCLUSIVE.

Name of Manufacturer.	1867.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.
The Singer Manufacturing Company...	43,053	59,629	86,781	127,833	181,260	219,758	232,444	241,679	249,852	262,316
Wheeler & Wilson Mfg. Company......	38,055	(b)	78,866	83,208	128,526	174,088	119,190	92,827	103,740	108,997
Grover & Baker Sewing-Machine Co...	32,999	35,000 (a)	35,188	57,402	50,838	52,010	36,179	20,000 (a)	15,000 (a)	....
Weed Sewing-Machine Co.	3,638	12,000	19,687	35,002	39,655	42,444	21,769	20,495	21,993	14,425
Howe Sewing-Machine Co.	11,053	35,000 (a)	45,000 (a)	75,156	134,010	145,000 (a)	90,000 (a)	35,000 (a)	25,000 (a)	109,294
A. B. Howe " "	......	....	....	......	20,051	....	....	....	....	....
B. P. Howe " "	......	....	....	......	......	14,907	13,919	....	....	....
Willcox & Gibbs Sewing-Macbine Co...	14,152	15,000	17,201	28,890	30,127	33,639	15,881	13,710	14,522	12,758
Wilson (W. G.) " "	......	....	....	......	21,153	22,666	21,247	17,525	9,508	....
American B. H. & S. M. Co.	.... .	....	7,792	14,573	20,121	18,930	14,182	13,529	14,406	17,937
Florence S. M. Co.	10,534	12,000	13,661	17,660	15,947	15,793	8,960	5,517	4,892	2,978
Shaw & Clark Sewing-Machine Co.....	2,692	3,000	....	......	......	....	....	....	....	....
Gold Medal " " "	......	....	....	8,912	13,562	18,897	16,431	15,214	14,262	7,185
Davis " " "	......	....	....	......	11,568	11,376	8,861	....	....	....
Domestic " " "	......	....	....	......	10,397	49,554	40,114	22,700	21,452	23,587
Finkle & Lyon Mfg. Co. and Victor	2,488	2,000	1,339	2,420	7,639	11,901	7,446	6,292	6,103	5,750
Ætna Sewing-Machine Co.	2,958	3,500	4,548	5,806	4,720	4,262	3,081	1,866	1,447	707
Blees " " "	......	....	....	......	4,557	6,053	3,458	....	....	....
Elliptic " " "	3,185	....	....	......	4,555	....	....	....	....	....
Empire " " "	2,121	5,000	8,700	......	......	....	....	....	....	....
Remington Sewing-Machine Co.	......	....	....	3,560	2,965	4,982	9,183	17,608	25,110	12,716
Parham " " "	......	....	1,141	1,766	2,056	....	....	....	....	....
Bartram & Fanton Mfg. Co.	2,958	....	....	......	1,004	1,000	1,000	250	....	....
Bartlett Sewing-Machine Co.	......	....	....	......	614	1,000	....	....	....	....
J. G. Folsom	......	....	....	......	280	....	....	....	....	....
McKay Sewing-Machine Asso.	......	....	....	129	218	....	....	128	161	102
C. F. Thompson	......	....	....	......	147	....	....	....	....	....
Union Buttonhole Machine Co.	......	....	....	......	124	....	....	....	....	....
Leavitt Sewing-Machine Co.	1,051	1,000	771	......	......	....	....	....	....	....
Goodspeed & Wyman S. M. Co.	2,126	....	....	......	......	....	....	....	....	....
Keystone Sewing-Machine Co.	......	....	....	......	......	2,665	217	37	....	....
Secor " " "	......	....	....	......	......	311	3,430	4,541	1,307	....
Centennial " " "	......	....	....	......	......	....	514	....	....	....

(a) Number estimated. (b) No data.

From the beginning to the end of the combination there was an army of would-be infringers and imitators who kept up a constant howl on any and all occasions, claiming that the existence of the combination tended to retard the improvement of the sewing-machine, and that the public were the sufferers thereby. It is now nearly twenty years since the expiration of the last important patent on a fundamental principle of the sewing-machine, and it is a notable fact that two of the companies that were members of and formed the combination in 1856 are the only manufacturers, with one or two exceptions, that have shown any marked improvement in the sewing-machine proper over those of twenty-five years ago, or who now produce machines that are capable of being run by steam or other power at the high rate of speed, and doing the grade of work, that is required in the factory use of sewing-machines at the present day.

It may be said that the patents issued to Howe, Bachelder, and Wilson cover all the fundamental principles of the sewing-machine. If we divide the various machines into two classes, the "dry thread" and the "wax thread," it appears that the number of patents covering all the essential elements in the first-named class do not exceed ten, and an equal number those in the other. Reference will be made later to important inventions in machines using wax thread, and only employed on leather in the manufacture of boots and shoes, harness, etc.

The inventive genius of the age is actively engaged in the production of new developments of the sewing-machine, and patents covering devices of more or less utility are constantly being granted. The annexed list shows the number of patents issued by the United States for sewing-machines and accessories, from the first to J. J. Greenough, dated February 21, 1842, down to September 10, 1895, the total being 7439. Of this number there were:

Sewing-machines making the chain-stitch	433
Sewing-machines making the lock-stitch	661
Sewing-machines for stitching leather	431
Feeding devices for sewing-machines	316
Machines for working buttonholes	448
Machines for sewing on buttons	33
Miscellaneous parts of sewing-machines	2,950
Attachments, rufflers, hemmers, corders, etc	1,524
Cabinet cases and tables	473
Motors: foot, hand, steam, air, and electric	170

This classification is a continuation in part of the system adopted and used in Knight's "Mechanical Dictionary," comprising patents on sewing-machines issued up to March 10, 1875. It is not a complete or accurate classification, as it enumerates each patent only once, classifying it according to its most important feature, although it may cover several other minor features of the sewing-machine which may have been embodied in the same patent. For instance, the original Howe patent covers the combination of the eye-pointed needle and the shuttle for forming the stitch, and also the very important device for feeding the material to meet the proper action of the needle and shuttle; yet it is entered in the list but once, and then simply as a sewing-machine making the lock-stitch.

DESCRIPTIVE LIST OF EARLY U. S. PATENTS ON SEWING-MACHINES FROM 1842 TO 1855.

Serial Number.	Date.	Name.	Invention.
			1842.
2,466	Feb. 21	J. J. Greenough	Using short thread. Needle with eye in center, pointed at both ends, pulled through the material with pincers, and making shoemaker's stitch.
			1843.
2,982	March 4	B. W. Bean	Short thread, rnnning stitch, ordinary hand-needle, cloth crimped into ridges for passage over the needle.
3,389		G. H. Corliss	"Sewing Engine." Short thread. Similar to Greenough's.
			1844.
3,672	July 22	J. Rodgers	Rnnning stitch. Similar to Bean's.
			1846.
4,750	Sept. 10	Elias Howe, Jr.	*Eye-pointed needle in combination with shuttle for under thread, continuous thread from spools, lock-stitch, automatic feed the length of baster-plate.*
			1848.
5,942	Nov. 28	J. A. Bradshaw	Lock-stitch, reciprocating shuttle.
			1849.
6,099	Feb. 6	C. Morey & J. B. Johnson	Chain-stitch, *barbed needle.*
6,437	May 8	J. S. Conant	Chain-stitch.
6,439	May 8	J. Bachelder	*Two or more threads, chain-stitch, continuous feeding device, horizontal table, and overhanging arm.*
6,766	Oct. 2	S. C. Blodgett & J. A. Lerow	Lock-stitch, shuttle rotating in a lateral annnlar race. Continuous feed by endless rotating baster-plate.

DESCRIPTIVE LIST OF EARLY U. S. PATENTS ON SEWING-MACHINES.—*Continued.*

Serial Number.	Date.	Name.	Invention.
			1850.
7,296	April 16	D. M. Smith	Rnnning stitch, short thread.
7,369	May 14	O. L. Reynolds	Chain-stitch.
7,622	Sept. 3	B. Thimonnier, Sr.	Chain-stitch.
7,659	Sept. 24	J. Bachelder	Chain-stitch.
7,776	Nov. 12	A. B. Wilson	*Lock-stitch, vibratory shuttle pointed at both ends, reciprocating feed-bar.*
7,824	Dec. 10	F. R. Robinson	Short thread.
			1851.
7,931	Feb. 11	W. O. Grover & W. E. Baker	*Chain-stitch, two or more threads.*
8,282	Aug. 5	W. H. Akins & J. D. Felthousen	Lock-stitch.
8,294	Aug. 12	I. M. Singer	Lock-stitch, *feed-wheel, thread controller.*
8,296	Aug. 12	A. B. Wilson	Lock-stitch, *rotary hook, for carrying upper thread around bobbin containing under thread.*
			1852.
8,876	April 13	I. M. Singer	Lock-stitch, thread controller, and tension device.
9,041	June 15	A. B. Wilson	Lock-stitch, rotary hook. *Four-motion feeding bar.*
9,053	June 22	W. O. Grover & W. E. Baker	Chain-stitch, two threads.
9,139	July 20	C. Miller	Back-stitch, vibratory shnttle.
9,338	Oct. 19	O. Avery	Chain-stitch, two needles, two threads.
9,365	Nov. 2	C. Hodgkins	Chain-stitch, two needles, two threads.
9,380	Nov. 2	J. G. Bradeen	Short thread, running stitch.
			1853.
9,556	Jan. 25	F. Palmer	Feeding device.
9,592	Feb. 22	W. H. Johnson	Chain-stitch, two needles, two threads.
9,641	March 29	T. C. Thompson	Lock-stitch, magnetic shuttle and race for keeping shnttle in contact with race.
9,665	April 12	W. H. Johnson	Cloth holder and feeding device.
9,679	April 19	W. Wickersham	Sewing leather, barbed needle, two threads.
10,344	Dec. 20	H. L. Sweet	*Binder,* for binding hats, etc.
10,354	Dec. 20	S. C. Blodgett	Chain-stitch, two needles, two threads.
			1854.
10,386	Jan. 3	S. C. Blodgett	*Hemmer,* for sewing umbrellas.
10,597	March 7	W. H. Johnson	Chain-stitch, one thread, *needle feed.*
10,609	March 7	C. Miller	*Buttonhole,* two threads.
10,615	March 7	W. Wickersham	Sewing leather, chain-stitch, *two needles, two parallel rows of stitching.*
10,622	March 7	C. Hodgkins	Chain-stitch, two threads.
10,728	April 4	W. H. Akins	*Cop for shuttle.*
10,757	April 11	S. J. Parker	Lock-stitch, *transverse reciprocating shuttle.*
10,763	April 11	J. Harrison, Jr.	Lock-stitch, reciprocating shnttle. Upper and under thread controller.
10,842	May 2	I. M. Singer	Chain-stitch, two threads; *embroidery attachment carrying third thread.*
10,875	May 9	S. Coon	Lock-stitch; reciprocating shuttle, thread controller.
10,878	May 9	H. Crosby, Jr.	Lock-stitch; revolving hook, thread controller.
10,879	May 9	C. Hodgkins	Feed-wheel movement.
10,880	May 9	O. Avery	Chain-stitch, two needles, and two threads.
10,974	May 30	I. M. Singer	Chain-stitch, one thread; latch nnderneedle, *lifting presser foot.*
10,975	May 31	I. M. Singer	Lock-stitch, shuttle-thread controller and tension.
10,994	May 31	M. W. Stevens & E. G. Kinsley	Lock-stitch, *reciprocating shuttle in cylinder bed, with feed-wheel.*
11,161	June 27	Walter Hunt	Lock-stitch, reciprocating shuttle. Needle feed.
11,240	July 4	W. Butterfield	Chain-stitch, waxed thread for leather. Barbed needle, wheel feed.
11,284	July 11	G. A. Leighton	Chain-stitch, two threads.
11,507	Aug. 8	A. Swinglc	Sewing leather, chain-stitch, one thread.
11,531	Aug. 15	S. H. Roper	Short thread, backstitch.
11,571	Aug. 22	E. Shaw	Sewing leather.
11,581	Aug. 22	M. Shaw	Sewing leather. Clamp-guides.
11,588	Aug. 22	S. S. Turner	Sewing leather. Single thread, chain-stitch.
11,615	Aug. 29	J. B. Nichols	Binder and folder.
11,631	Aug. 29	S. S. Turner	Sewing leather, wheel-feeding device.
11,680	Sept. 12	P. Shaw	Wheel-feeding device.
11,884	Nov. 7	D. C. Ambler	Lock-stitch, two needles, *overseaming for felling lap-seams.*
11,934	Nov. 14	D. Harris	Lock-stitch, upper-thread controller.
11,971	Nov. 21	C. Parham	Lock-stitch, *shuttle carrier.*
12,011	Nov. 28	T. E. Weed	Thread controller.
12,014	Nov. 28	O. G. Boynton	Binder.
12,015	Nov. 28	T. J. W. Robertson	Lock-stitch, stationary shuttle.
12,066	Dec. 12	W. Lyon	Feeding device.
12,074	Dec. 12	G. W. Stedman	Chain-stitch.
12,116	Dec. 19	A. B. Wilson	Feeding device.

CONDENSED CHRONOLOGICAL LIST OF U. S. PATENTS ISSUED FROM 1842 TO SEPTEMBER 10, 1895, ON SEWING-MACHINES AND ACCESSORIES THERETO.

1842 to 1855	As per preceding list	70
1855 to 1867	Expiration of Howe's patent	843
1867 to 1877	End of sewing-machine combination and expiration of Bachelder patent	2,144
1877 to 1887		2,496
1887 to Sept. 10, 1895		1,886
Total		7,439

The large number of patents indicates that inventors have not been idle or neglected the sewing-machine. But there is something required aside from the mere invention. The inception of the original idea is only the first essential; it is equally necessary to have the place and opportunity to experiment, and to get the machine into practical operation and test it on the class of work it is required to do.

In the larger factories of the present time the experimental department is one of the most important and expensive. Here the inventor's idea is carefully wrought into form and receives preliminary tests of its efficiency. After carrying it to what seems to be a perfect condition, involving months, and sometimes years, of patient toil and disappointment, the machine or attachment is then sent to various factories engaged in the class of work for which it is intended, and there it is put to the severest tests of practical use. If its operation appears to be satisfactory, then a special plant of machinery is installed to make this new machine, attachment, or part, so that it can be perfectly duplicated in any number required. After all this expensive preparation and experiment, the invention may soon be replaced by something better and be abandoned. Notable instances of this are shown in the development of the Goodyear machine for stitching soles to shoes. It was a matter of several years of devoted labor before the inventors succeeded in getting this machine to perform satisfactory work, and within the past year improvements have been made that render a change from the old to the new machines desirable.

The same can be said of the latest production of the Singer Company for sewing breadths of carpet together. The older machine is propelled by hand-power, and the operator walks along by the side of the distended breadths, working the machine, and using some skill and labor in getting the carpet properly matched and stretched. The new machine is operated by mechanical power, and is constructed so as to hold the carpet in position by means of clamps, that also assist in matching the figures properly, and then stretch it so that it will lay perfectly flat on the floor after it is sewed. The little sewing-machine, which passes along on a track in proper position to do the sewing, is propelled by electric or other power. It starts and stops by means of automatic devices that work in conjunction with the clamps that match and hold the carpet in position. When it arrives at the end of the seam it unlocks itself from the forward motor-power and grasps another, that takes it quickly back to place of beginning. The production of the hand-machine is equal to that of eight or ten hand-sewers; but the new power-machine has a capacity eight or ten times greater than the hand-machine, and one operator can handle the increased quantity of carpet with greater ease and less labor. There is no royalty on the product of this machine, but it is sold outright, as are all machines made by the Singer Company.

Under the title of "motor" are classed devices for driving a sewing-machine by hand and foot power, and engines to be attached to the machine and propelled by water, steam, air, and electricity. The sewing-machines prior to Singer had no arrangement for applying power for driving them except the common hand-crank. This required the use of the right hand, and only the left hand could be used for arranging and guiding the material to be sewed. The machines were put on a bench or table of home construction. Singer, in traveling about exhibiting his original machine, utilized the box in which it was packed for shipment as a table, and conceived the idea of using a treadle similar to that employed on the old spinning-wheel, and having a pitman attached to the handle on the driving-gear to assist him in working the machine. He used an ordinary door-hinge as a fulcrum for the treadle, which was longer than the depth of the box, and projected therefrom. He therefore placed the hinge about where the instep of the foot would be, and attached the other half of the hinge to the box, and thus found that he had a rocking motion on the treadle that aided in securing uniform motion to the machine. He soon discovered that, with the addition of a balance-wheel on the upper shaft for increasing the momentum when the machine was once in motion, he could run it by foot-power with his rocking treadle, operated by heel-and-toe motion, and so have the use of both hands for guiding and arranging the material. This was a great gain in utilizing the machine, and he soon after produced an iron stand having a rocking treadle constructed for the use of both feet. Mr. Singer did not realize that he had made a great and important discovery, and failed to apply for a patent. He was very much chagrined after having used the invention for two years and thus debarring himself from a patent, to be informed of his oversight by a rival manufacturer.

Many devices have been made for driving the sewing-machine by foot-power since that time, the latest being the revolving treadle with the bicycle movement; but none of them have been as good as the rocking treadle. Backus, in 1874, made a water-motor that had some sale; Ericsson made an air-engine in the same year; and a number of small steam-engines and a great many devices using springs, weights, etc., have been tried, but no efficient motor has been successfully put on the market until the development of the use of electricity for power. The "Diehl electric sewing-machine motor" can be directly connected to the main shaft of a sewing-machine, and is a great success on account of its convenience, compactness, and effectiveness. In its smallest form, for driving individual machines, the field-magnet is secured to the arm of the machine, the armature being carried inside a brass wheel which acts as a balance-wheel. The rheostat is attached to the ordinary foot-power table or cabinet case, and is connected by a pitman with the treadle, so that the machine may be started and stopped and the speed regulated as desired by pressing the foot on the treadle. The versatile inventor of this motor has made a notable demonstration of the uses of electricity by applying it to the operation of a sewing-machine drop-cabinet and its contents for the purpose of public exhibition. The cabinet stood in a show-window on Broadway, and, apparently of its own volition, the cover of the case opened, the sewing-machine was elevated from its receptacle under the table, the doors to this receptacle were folded back, and the machine began operation at a high rate of speed. After a few minutes this operation ceased, the machine descended to its former position, the cabinet was fully closed, and became an elegant and useful table, appropriate to the most ornate furnishings.

For the factory operation of sewing-machines there are ingenious devices for their stable support on tables which are made in sections, carrying the shafting, and so arranged as to be readily connected in longer lengths as desired, and adjustable to any unevenness of floor. These tables are made for the operation of one or of two rows of machines from one line of shafting, which is so carried beneath the tables that it is easily adjusted. The tables have a thick wooden top that may be entirely flat, or it can be provided with convenient work-holding troughs. In point of convenience, cleanliness, safety, and economy these tables leave nothing to be desired, for they seem to satisfy all requirements in these respects. In the matter of power transmission from the shaft to the machine there are several devices to enable the instant stopping and starting of the machines. The use of electricity has demonstrated the feasibility of attaching the electric motor directly to a shaft for transmitting power at the point where it is needed. Much economy is gained by this method over the old system of successive countershafting and belting, with its dangers, its expense, and the loss of efficiency. The ideal system will have been reached when the motor is attached to the head of each sewing-machine, so that all objects intervening between the source and the subject of power, other than the wire for the electric current, can be dispensed with.

The reports to "the sewing-machine combination" of the sales of sewing-machines during the four years 1873–76 show a total of 2,303,941, the average for each year being about 576,000. As these reports terminated with the year 1876, we have no other information as to the extent of sewing-machine manufacture since that time than what is indicated by the United States census reports of 1880 and 1890. The total value of production reported at the census of 1880 for one year was $13,863,188, the census of 1890 showing a value of $12,823,147. These figures indicate that the average number of machines made annually during the last twenty years has been from 500,000 to 600,000.

A comparison of the census reports of 1880 and 1890 shows a decrease of fifty per cent. in the number of establishments engaged in the manufacture of sewing-machines, but also shows that the number of persons employed was about the same, and that their average wages increased about ten per cent. during the decade. In 1880 the average wages were $485, and in 1890 they were $567 per annum, thus showing the class of labor employed to be of a very high order. The reports, at the census of 1890, from fifty-six establishments showed the employment of 9121 operatives, whose wages amounted to $5,170,555. The market value of their product was $12,823,147, so that the cost of their labor constituted forty per cent. of this value.

The table on pp. 536 and 537, relating to exports of sewing-machines, shows the value of such exports to have exceeded $67,000,000 during thirty years, 1865–95, the annual average during the last ten years exceeding $2,500,000. This sum does not, however, adequately represent the foreign use of the American sewing-machine, because American establishments are extensively engaged in the manufacture of these machines in other countries. An active foreign demand for the American sewing-machine was developed during the Civil War, 1861–65, and the value of machines exported during the year ending June 30, 1865, was nearly $2,000,000. The foreign selling-price per machine was less than the domestic price, but the high premium on foreign exchange and the depreciated United States currency made the business fairly remunerative at that time. As previously stated, the cost of labor in the manufacture of a sewing-machine is forty per cent. of its total cost at the present time; but during the period from 1861 to 1865 wages did not increase as fast as the value of the currency decreased, and thus the machine could be sold at a price in specie very much below its value in United States currency.

Upon the gradual restoration of that currency to its normal specie value, however, the rates of wages were not reduced to correspond to their increased purchasing power; on the contrary, these rates have steadily increased, as has been shown. Thus the cost of the domestic manufacture became too high to enable competition in the world's markets with the numerous imitators who were manufacturing in Great Britain and on the continent of Europe. Therefore some of the American manufacturers established factories in foreign countries, and supplied them with American machinery and tools for producing facsimiles of the machines made by these manufacturers in the United States.

The "American system" of making all parts of the finished product completely interchangeable has been carried to its highest development in the manufacture of sewing-machines, every piece being made to gauge and tested before assembling. In no branch of manufacture has the use of automatic machines and tools of fine precision become more essential than in this. The special tools required to make the various parts of some of the many varieties of sewing-machines often require greater inventive talent and ingenuity than that displayed in the machine produced.

The Singer Company have continued the manufacture in foreign countries of duplicates of the machines made in this country; and the factories erected by this company at Kilbowie, near Glasgow, Scotland, are equal in capacity to the factories at Elizabethport, N. J., and have produced about 400,000 machines annually during the past four years. The total number of all the machines made by I. M. Singer & Company and their successors, The Singer Manufacturing Company, from 1853 to October 1, 1895, is 13,250,000, and of this number 5,877,000 have been made in factories located in foreign countries, but under the direct control and management of the American company.

The average value of the exports of sewing-machines, including cabinet-work and parts of sewing-machines, from the United States, indicates that about 150,000 machines are exported annually; and it is a fair estimate that the total number of American sewing-machines sold annually in foreign countries, including those made abroad, is equal to the sales in the United States by all the American companies.

The export of sewing-machine cabinet-work is a matter of considerable importance, because the United States easily surpasses all other countries in the wealth of its woods for this purpose, in the ingenuity of its cabinet-makers, and in the efficiency of its woodworking machinery. The different climatic conditions of other countries and continents do not admit of finishing the woodwork in this country; but it is cut "in shape" and exported "in the white," so that it can readily be put together and finished where it is to be used.

The number of tables and cabinet-cases for foot-power stands, and of cases for hand-machines, exported by the Singer Company aggregate about 694,000 annually; of this number the cases for hand-machines constitute about seventeen per cent. The proportion of hand to foot-power machines used in Europe and in Asiatic countries is far greater than in the United States, where the operation of a sewing-machine by hand is very exceptional, and usually confined to those crippled and physically unable to apply foot-power. The great difference in social conditions is largely accountable for this peculiarity, and the increased use of the hand-machine in Europe is also largely due to the itinerant character of the urban population, who find the tables and stands an impediment in their constant moving from house to house.

The most remarkable industrial development in connection with the sewing-machine has been its diversification and adaptation for use in a great variety of manufactures, which have thus been enabled to

VALUE OF AMERICAN SEWING-MACHINES EXPORTED.

COMPILED FROM STATISTICS OF THE UNITED STATES TREASURY.

NO DATA FOR THE YEAR 1866.

EXPORTED TO	1865.	1867.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.
	$	$	$	$	$	$	$	$	$	$	$	$	$	$
CONTINENTAL EUROPE:														
Austria Hungary	....	80	....	100	11,610	....	....	....	40	....	....	....	....	....
Belgium	5,754	9,102	..... .	8,107	8,228	6,400	100	....	....	19,800	8,723	8,951	10,416	17,670
France	55,961	138,437	107,781	185,234	148,059	10,623	133,915	72,886	53,086	92,111	57,230	38,281	41,135	59,987
Germany	465,425	362,244	377,710	706,709	516,303	277,013	456,640	330,199	214,965	462,264	367,369	587,684	539,187	563,910
Holland	628	133	....	....	330	359	100	6,588	134	330	854	1,131	605	2,810
Italy	20	604	150	150	159	....	....	52	400	50	280	1,284	1,881	835
Portugal	661	100	120	....	823	400	330	....	84	....	....	....	289	363
Russia	28,433	3,407	2,912	6,700	14,190	9,762	....	....	3,228	103	....	....	....	7,650
Spain	5,728	358	3,539	1,900	5,734	14,019	1,677	202	200	....	....	722	115	208
Sweden and Norway	135	....	....	....	....	....	....	....	....	....	....	....	....	50
Switzerland	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Turkey	....	....	....	50	139	1,509	....	....	180	287	....	....	....	90
GREAT BRITAIN	753,792	618,965	723,003	662,070	926,896	986,553	898,405	768,903	512,328	567,764	699,016	486,842	482,574	363,431
BRITISH NORTH AMERICA	25,724	12,665	16,285	22,169	23,621	35,030	53,490	49,953	60,752	72,518	70,987	124,341	19,785	23,811
BRITISH AUSTRALASIA	135,626	91,758	57,763	120,776	149,144	59,869	97,406	176,295	140,524	82,480	103,154	77,632	110,221	118,671
WEST INDIES:														
British West Indies	7,295	1,743	1,094	2,182	2,906	3,845	5,620	7,500	8,617	7,414	9,507	5,393	3,084	4,231
Haiti	1,233	436	770	204	2,245	6,870	3,175	3,443	410	1,137	3,556	4,616	5,007	1,256
Santo Domingo	1,805	90	72	....	....	....	3,884	4,715	2,040	3,294	4,238	1,283	2,901	2,897
Cuba	94,213	80,659	49,042	22,049	37,633	66,969	71,224	128,046	68,610	58,979	87,074	63,471	66,631	48,289
Dutch West Indies	474	300	103	363	442	1,436	1,985	3,367	8,552	4,534	1,403	757	1,298	2,962
Danish West Indies and Denmark	3,059	1,462	859	809	549	683	12,004	1,632	54	112	65	805	1,103	....
French West Indies	....	....	214	....	....	....	....	....	1,010	457	625	588	1,293	1,218
Puerto Rico	12,282	2,249	3,702	2,178	6,447	10,683	21,881	17,668	9,268	24,237	14,327	10,257	9,351	6,863
MEXICO	102,424	20,316	36,945	26,657	43,928	38,950	60,339	110,786	121,530	114,436	75,577	115,970	153,574	158,124
CENTRAL AMERICA	3,276	805	1,199	1,215	987	988	2,780	6,051	3,271	4,217	3,872	5,632	13,222	11,125
SOUTH AMERICA:														
British Guiana	....	140	65	....	....	....	....	58	504	....	610	1,049	136	26
French Guiana	......	....	....	....	....	....	....	....	....	....	....	....	....	....
Dutch Guiana	....	....	76	....	....	....	....	....	....	....	....	....	....	161
Colombia	54,037	91,548	22,959	20,180	16,567	55,623	137,135	209,201	174,289	115,734	90,227	80,734	93,800	103,879
Bolivia	....	....	....	....	....	....	....	....	....	....	....	......	....	....
Ecuador	....	....	....	....	....	....	....	..... .	....	....	....	....	. .....	....
Brazil	74,550	102,785	125,149	123,284	152,841	159,534	272,513	61,958	72,071	72,446	29,483	21,158	21,814	39,997
Argentina	59,539	64,142	46,439	66,037	59,496	37,530	28,718	66,486	33,244	11,937	14,771	10,081	18,341	28,700
Uruguay	46,336	19,041	26,615	17,093	16,521	4,775	34,659	6,752	705	3,444	469	60	517	1,883
Venezuela	10,442	3,297	6,669	4,086	5,993	7,194	11,820	22,528	29,614	30,958	58,208	38,668	30,174	21,493
Peru	10,449	3,985	4,348	11,063	18,942	37,393	45,967	17,685	15,641	19,466	5,210	8,803	15,356	15,811
Chile	12,359	10,993	22,099	28,842	38,392	46,924	39,072	43,321	35,522	7,694	17,444	36,112	1,159	2,356
AFRICA	2,851	2,020	3,514	2,042	4,136	5,344	2,161	1,398	7,713	11,638	3,005	1,143	552	5,346
CHINA	70	246	1,858	617	4,004	849	10,673	9,654	1,654	296	1,144	1,353	1,066	1,305
JAPAN	....	360	716	867	774	1,669	22,644	19,524	9,195	1,272	1,244	921	2,786	871
HAWAII	1,205	....	....	2,649	1,674	1,950	1,660	1,976	2,536	3,138	3,425	5,609	8,681	20,966
EAST INDIES	6,418	1,591	841	940	....	....	....	..... .	....	195	....	40	....	586
ALL OTHER	17,070	4,279	33,431	4,259	13,613	8,118	4,108	1,893	2,325	3,187	9,667	1,922	3,661	9,083
Totals by years	1,999,274	1,650,340	1,657,942	2,051,581	2,233,326	1,898,864	2,436,085	2,150,720	1,594,296	1,797,929	1,742,764	1,743,293	1,661,715	1,648,914

VALUE OF AMERICAN SEWING-MACHINES EXPORTED.—*Continued.*

COMPILED FROM STATISTICS OF THE UNITED STATES TREASURY.

NO DATA FOR THE YEAR 1866.

1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894	1895.	Totals by Countries for 30 Years.
$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$
......	......	......	......	16,381	5,565	1,945	1,889	2,736	1,111	1,417	14,492	3,850	2,920	5,413	12,160	81,709
24,135	16,683	23,630	31,411	56,956	63,944	56,671	55,862	41,515	40,337	34,022	50,626	43,302	53,938	48,363	36,200	780,846
50,269	41,160	59,921	72,074	49,059	67,027	99,461	102,026	72,457	92,885	115,978	116,046	269,387	52,757	91,246	98,566	2,645,045
542,407	522,564	708,950	814,176	1,136,037	814,114	680,604	384,610	398,114	213,904	456,884	609,750	616,936	563,401	255,407	472,203	15,417,683
2,204	5,656	6,178	31,574	41,437	49,533	53,377	41,152	5,829	......	12,471	34,417	32,869	47,365	4,673	22,613	403,800
20,449	3,628	5,120	12,054	9,866	10,093	13,443	21,527	38,350	3,956	4,059	10,832	15,820	12,307	8,696	8,756	204,821
35	511	993	......	......	2,044	1,763	1,069	20	1,630	370	1,666	950	......	741	77	15,039
49	94	50	265	31,696	6,910	682	......	......	......	3,956	......	......	7,223	3,270	......	130,580
667	131	863	3,028	5,525	6,953	3,945	5,950	2,309	247	8,578	3,122	166	437	1,340	1,314	78,977
......	......	......	169	215	11,379	7,830	16,573	......	......	2,512	13,240	21,558	17,981	1,097	8,919	101,658
......	......	......	......	411	......	736	3,546	1,154	2,430	......	352	......	......	......	100	8,729
......	......	115	......	......	210	746	18,822	1,607	337	262	359	......	......	835	137	25,685
387,668	559,177	820,813	1,043,711	1,280,135	1,040,235	994,052	813,225	847,211	822,730	1,028,442	848,493	809,391	848,540	712,411	645,847	22,952,623
32,007	57,340	117,583	158,542	138,025	133,321	109,415	87,790	102,891	71,434	63,370	64,059	60,108	90,320	114,299	111,388	2,123,023
85,957	169,472	191,179	152,212	125,375	129,524	117,255	124,626	103,162	243,787	217,555	268,578	366,058	73,174	310,948	224,875	4,425,056
6,688	9,064	6,922	8,301	9,126	7,366	7,575	7,375	13,929	12,105	12,940	15,101	16,983	10,249	13,853	13,628	241,436
2,913	2,729	2,264	2,778	4,889	3,013	2,164	2,242	8,282	3,392	14,381	7,314	6,619	9,217	11,967	4,906	123,428
3,894	3,000	2,084	4,282	3,312	1,501	2,095	1,313	1,020	3,227	4,406	2,921	1,377	3,723	1,962	1,817	70,908
70,434	73,257	72,014	55,216	60,443	29,275	68,261	53,965	29,222	42,571	60,741	112,319	246,218	95,630	212,696	16,114	2,241,264
4,292	4,476	3,737	2,025	2,810	3,422	784	1,150	2,341	2,220	1,903	3,961	2,574	2,910	1,191	1,069	68,841
782	318	162	170	2,669	1,337	43	100	10	66	1,166	128	876	776	404	1,958	34,161
2,117	1,130	992	1,514	2,841	1,032	1,687	997	1,029	2,208	2,495	2,728	2,533	750	932	1,849	32,239
8,701	3,014	2,965	11,848	2,753	1,219	1,485	1,246	1,647	4,227	3,913	2,760	5,215	4,618	3,534	2,230	212,768
135,823	179,555	305,595	312,854	207,018	198,634	68,570	125,699	146,398	160,723	231,245	174,546	165,122	142,764	151,239	132,841	4,018,182
13,971	21,922	21,199	15,040	57,022	44,292	47,704	49,445	71,319	73,393	92,468	104,492	76,841	59,177	32,066	64,976	903,967
1,107	395	193	1,648	980	35	405	225	1,112	509	850	1,093	1,116	1,965	2,862	3,189	21,182
170	492	256	220	103	97	168	241	222	424	509	234	473	361	627	1,314	5,911
......	150	......	......	......	......	......	103	70	190	150	......	230	25	165	324	1,644
115,152	158,105	128,415	130,857	83,841	41,453	55,619	41,503	47,101	82,598	95,136	120,248	99,790	65,204	49,674	39,924	2,620,533
......	......	......	......	......	......	......	......	253	280	178	......	1,294	199	295	830	3,329
......	......	......	......	......	......	......	19,018	29,522	19,168	12,009	16,171	9,015	16,738	14,116	11,492	147,249
40,645	39,100	35,662	46,363	55,555	24,396	28,232	41,831	46,599	78,751	60,558	78,393	72,976	89,832	101,719	140,054	2,310,249
23,611	29,216	42,654	50,921	43,081	73,763	63,276	83,832	109,625	109,862	66,243	24,420	22,892	67,886	71,513	53,504	1,481,760
7,804	6,721	3,742	7,025	6,520	15,802	7,298	13,029	10,454	16,199	25,358	5,685	2,035	2,569	7,256	13,317	329,784
26,928	27,330	25,185	37,533	30,014	36,786	23,814	26,821	49,681	59,949	62,828	76,631	70,744	52,673	45,306	46,248	979,615
2,411	......	33	1,019	15,995	15,774	19,865	25,238	17,077	22,551	33,907	36,105	31,763	19,503	13,743	8,609	493,712
1,507	4,291	16,473	8,712	20,135	21,770	8,189	9,980	9,228	18,654	13,288	17,079	22,665	19,842	18,126	21,894	569,122
11,141	6,762	8,977	1,950	3,468	1,550	2,739	2,230	8,130	13,069	13,764	10,623	6,262	6,428	4,958	7,823	162,681
2,042	2,011	2,038	332	1,018	3,292	1,688	3,790	1,992	4,042	3,020	6,021	6,956	8,933	5,352	3,001	90,317
1,015	1,730	203	5,042	2,221	707	1,487	736	2,362	2,030	1,522	1,453	1,052	2,499	1,265	3,465	91,632
14,075	17,274	23,894	23,145	16,804	8,847	9,240	13,634	10,606	10,367	16,876	16,289	7,026	7,318	8,818	9,968	269,649
......	......	......	645	510	2,029	831	1,386	2,162	3,483	4,685	3,942	4,573	6,815	3,993	1,363	48,028
6,297	13,866	6,461	8,751	24,336	16,222	15,352	7,057	6,352	6,289	7,365	6,888	8,387	7,479	8,983	9,277	276,378
1,649,367	1,982,324	2,647,515	3,061,639	3,552,814	2,898,698	2,584,717	2,212,853	2,245,110	2,247,875	2,793,780	2,883,577	3,133,992	2,476,446	2,347,354	2,260,139	$67,245,243

increase the quantity, quality, and value of their product, and to cheapen its cost to the consumer.

In the census reports relating to the principal manufacturing industries that use the sewing-machine largely, the figures show that the total value of their products in 1890 had increased about seventy-five per cent. from 1880. These census figures are given in a tabular statement which is appended, and which contains comparative data for seventeen classes of industry in the operation of which the sewing-machine is an important factor. These industries employed 661,000 hands in 1890; they had about $437,000,000 invested in machinery, tools, and implements of all kinds, and the value of their product approximated one thousand million dollars ($1,161,196,659).

introduced, and demonstrated that neater and more uniform work could be done on the machine. The result was the concentration of the scattered home industry into convenient factories, and the use of steam-power for driving the machines. The use of machines for stitching the uppers suggested the need of machines for sewing on the soles, and in 1861 the machine known as the McKay, under patents to L. R. Blake and others, was first put into successful operation. The time and money put into experiments on this machine, and the large amount of work which it performed, caused the owners of the patents to place a royalty on each pair of shoes sewed on it, as the only way to obtain a fair remuneration for their invention. The value of the invention to its owners may be estimated when it is stated

CENSUS STATISTICS FOR 1880 AND 1890 RELATING TO MANUFACTURES IN WHICH THE SEWING-MACHINE IS USED EXTENSIVELY.

Name.	Year.	Number of Establishments.	Capital.	Number of Hands Employed.	Value of Product.
Awnings, tents, and sails	1880	151	$522,700	1,268	$1,968,942
	1890	581	3,063,009	3,872	7,829,003
Bags, other than paper	1880	37	2,425,900	2,242	9,726,600
	1890	64	6,015,685	3,769	16,355,365
Bookbinding	1880	588	5,798,671	10,612	11,976,764
	1890	805	10,062,034	13,815	17,067,780
Boots and shoes (factory product)	1880	1,959	42,994,028	111,052	166,050,354
	1890	2,082	95,282,311	139,333	220,649,358
Clothing (men's)	1880	6,166	79,861,696	160,813	209,548,460
	1890	18,658	182,552,938	243,857	378,022,815
Clothing (women's) [1]	1880	562	8,207,273	25,192	32,004,794
	1890	20,811	34,142,607	109,606	125,235,751
Corsets	1880	113	1,611,695	8,802	6,494,705
	1890	205	6,640,056	11,370	12,401,575
Flags and banners	1880	11	54,300	68	119,600
	1890	29	376,130	364	455,849
Furnishing goods (men's)	1880	161	3,724,664	11,174	11,506,857
	1890	586	12,299,011	22,211	29,870,946
Gloves and mittens	1880	300	3,379,648	7,697	7,379,605
	1890	324	5,977,820	8,669	10,103,821
Hats and caps, not inclnding wool hats	1880	489	5,455,468	17,240	21,303,107
	1890	705	13,724,002	27,193	37,311,599
Hat and cap materials	1880	64	746,828	1,159	2,217,250
	1890	73	1,709,650	1,705	3,465,524
Pocketbooks	1880	53	598,350	1,413	1,769,036
	1890	62	1,121,834	1,348	2,165,462
Rubber and elastic goods	1880	90	6,057,987	6,268	13,751,724
	1890	139	13,703,787	9,802	18,708,917
Saddlery and harness	1880	7,999	16,508,019	21,446	38,081,643
	1890	7,931	35,346,620	30,326	52,970,801
Shirts	1880	549	6,841,778	25,687	20,130,031
	1890	869	14,273,611	32,750	33,638,593
Horse clothing	1880	3	410,000	565	695,000
	1890	31	1,028,523	952	1,572,265

[1] The figures for 1880 relating to the manufacture of women's clothing do not include custom dressmaking establishments. In the figures for 1890 all such establishments are included that had a product exceeding $500 in value.

In no branch of manufacture has a greater revolution occurred than in boots and shoes. The fitting of the uppers was formerly accomplished by sending them out in small quantities to be sewed and stitched by hand in the homes of the operators. The handworkers bought sewing-machines when they were

that as many as 900 pairs of shoes have been sewed on one machine in one day of ten hours; that the average license was at the rate of two cents per pair; and that over 350,000,000 pairs of shoes had been made on it up to the year 1877 in the United States, and probably an equal or greater number in Europe.

The McKay machine made the chain-stitch with a waxed thread. The outer sole was stitched to the inner sole by removing the last and placing the shoe on an arm similar in its general appearance to the human arm, with elbow bent to hold up the hand and swing around on the shoulder-joint, so as to bring the needle and awl in the overhanging arm into position above the shoe, to take up the thread from a very ingeniously worked underneedle in the arm inside of the shoe. The awl also had a lateral movement, and acted as a feed to move the shoe forward as each stitch was taken. This very useful and meritorious machine has been superseded to some extent by the Goodyear machine, which makes the lock-stitch with waxed threads and sews on the sole in the same manner that it is done by hand. In the Goodyear process the last is left in the shoe, and the welt is sewed to the inner sole and upper by a machine making the chain-stitch, that not only does the sewing, but also draws the upper tight on the last and greatly assists in "lasting" and giving proper shape to the shoe. The outer sole is then sewed to the welt in a manner that successfully imitates the very best of hand-work. The Goodyear machines are sold on a royalty plan based on their production.

The next sewing-machine of great importance was for working buttonholes, and was made under patents to Vogel, Humphrey, and others. After years of experimenting the Union Buttonhole Machine Company produced a machine that was a marvel in its line. It worked buttonholes that had the peculiar "purl" of the best hand-made buttonholes, to which they were superior in strength and finish. The manufacture and sale of this machine was not profitable to the Union Buttonhole Machine Company, and in 1867 it passed to the Singer Company, and by that company was still further improved and became a great success, having a large sale in the United States and Europe.

The Reece buttonhole machine was brought out in 1880; it is a wonderful organization of machinery, and has had a large sale on the royalty plan, making it very remunerative to the owners of the patents.

During the early years of the sewing-machine, its use by clothing manufacturers was confined to the production of the medium grades, the custom tailors showing a great prejudice against machine sewing.

This prejudice gradually disappeared as it became apparent that seams made on the machine were equal to the best handwork, and the sewing-machine is now in general use for making the finest garments.

The enormous increase during ten years in the factory production of clothing is remarkable, and it may fairly be claimed that the development of this industry has been coincident with the invention of special appliances and attachments adapting the sewing-machine for factory operation in the performance of all stitching processes, including buttonhole and eyelet making, attaching buttons, staying seams, etc.

The concentration of clothing manufacture into factory operation has effected greater economy in the marketing of the cloth, especially the cheaper fabrics, such as jeans, shirtings, denims, etc. These are now sent from the mills where they are woven directly to the manufacturers of clothing, shirts, overalls, etc., thus saving the cost of commissions and handling, formerly incurred through the wholesaler, the jobber, and the retailer to the local tailor or housewife. Several hundred sewing-machines are sometimes operated in a single power plant for the manufacture of clothing.

By the use of improved methods for cutting to standard sizes in great variety, well-fitting garments are now as easily obtained in "ready-made" as in "custom" clothing. By the use of the sewing-machine they are as well made, and are furnished to the wearer for what the material formerly cost him.

Economies of equal importance have been effected in many other industries in which the sewing-machine is the principal element of productive force.

While these industries have thus been enabled to more than double their output during the last decade, the population of the country has only increased about one quarter. It is evident, therefore, that the quantity of sewing done in the home has been greatly reduced, and that domestic burdens have been correspondingly lessened; also that the cost to the consumer of the products of the sewing-machine has been reduced, all of which may fairly be claimed as the results of inventive genius and executive ability in the field of sewing-machine manufacture, its development and improvement.

In the preparation of this article the writer has received invaluable information and assistance from Mr. John F. Elliott, who has been intimately connected with the sewing-machine industry in many capacities for nearly forty years; and much credit must be awarded him for the research and investigation which have given this brief history whatever of value it may possess.

F. G. Bourne

CHAPTER LXXXII

AMERICAN WATCHES AND CLOCKS

CLOCKS were among the first articles of a complicated construction which were made in America. In 1765 there was in Grafton, Mass., a remarkable family named Willard, all of whom were clock-makers. There were three brothers, named Benjamin, Simon, and Aaron. The two former removed to Roxbury, Mass., in 1771, and established themselves there as clock-makers, on Roxbury Street, at the "Sign of the Clock," where Simon remained over seventy years, dying at the age of ninety-six. He was the best workman and the most ingenious of all the Willards, as he not only made several kinds of clocks, but invented a number of machines for various other purposes. He was only thirteen when he made his first clock, all the work being executed by him, thus showing the character of the boy. There was no machinery in those days by which labor could be saved, and everything was filed out from the rough. Somewhere in the latter part of the last century or the early part of the present, he invented and patented the "timepiece," so called, which very soon superseded the tall eight-day clock, which before was the only method of recording time. He was also the inventor of perambulators for accurately measuring distances, cook-jacks, alarums, chimes, etc. He made many turret clocks for public use in Boston, New York, and Philadelphia, as well as one for the University of Virginia. In Virginia he became intimately acquainted with Thomas Jefferson, our third president, and James Madison, our fourth president, corresponding with them for years. Jefferson had a strong mechanical turn of mind, and liked to divert himself with curious problems. Willard made and set up the clocks in the United States Senate Chamber and in the House of Representatives, performing the latter labor after he was seventy-five years of age. He never considered profit, the quality of work being everything. His clocks, great and small, are just as good, after the lapse of a century, as when they left his hands.

Aaron, a younger brother of this family, settled in Boston, Mass., building what, for the times, was a large establishment, on Washington Street, Boston Neck, near the Roxbury line. His particular branch of business was the tall striking clocks for halls. These he manufactured almost exclusively; they were of excellent workmanship, and stood every test. His clocks were largely sold in Virginia in exchange for Haxall flour, a trade which proved very advantageous to him. He died at about the age of eighty-five. The fourth Willard, Aaron, Jr., was also a clock-maker, being the son of the one just mentioned. He was born in Boston, Mass., and was taught clock-making by his father, afterward setting up in business not far from where his father was located, and there making various forms of clocks for common and extra use. His business was not large, no more than four or five workmen being employed, the most of whom were apprentices. The shop he occupied was thirty by fifty feet, and one story high.

My connection with clock-making commenced at the age of sixteen, in 1829, under the instruction of Aaron Willard, Jr., with whom I served an apprenticeship of five years. The aggregate production of Mr. Willard in money value would not exceed $8000 per annum. During my five years of apprenticeship not a single tower or hall striking clock was made by us, although now there are hundreds, if not thousands, of these kinds of clocks made every year. In 1875 there was only a small amount of such work done, as compared with what has been accomplished during the last twenty years. Then there were only a few clock-makers scattered throughout New England, — mostly in Connecticut, — whose united production only amounted to a few thousands of clocks yearly, while

Edward Howard.

now there are numerous clock factories of immense size, filled with the most ingenious labor-saving machinery. The demand then was limited to the United States alone; now we have the whole world for a market, and the demand and supply run into millions every year. Then the forms, styles, and finish were few; now they are almost innumerable, it seeming impossible to conceive of anything novel. Clocks were then often set by the noon sun-dial, but now we make them to run so close to true time that we sometimes think the sun has gone wrong. The tower-clock business has had a wonderful growth in the past thirty years, and more have been made and put up in that time than during all the preceding period from the time of the landing of the Pilgrims at Plymouth. Some that I made fifty years ago are now running, being still in good working order.

I went in business for myself, as a clock-maker, in 1840, continuing up to 1882, when I retired from active industry. During that time I manufactured various kinds of clocks, many being specially designed for halls, churches, offices; also electric watch clocks, tower clocks, etc. I began in a shop not over thirty feet square, and ended with a number of buildings, one of which was one hundred and fifty feet long, seventy feet wide, and seven stories high. The clock-manufacturing companies are not very numerous in the United States, not exceeding twenty-five in all; but their size and facilities are so great that it does not take long to flood the market when they are all in operation. I commenced the clock business single-handed, but later employed from 100 to 200 hands. The amount of capital invested in clock-making in 1795 is very much a matter of conjecture, as well as the amount of yearly production at that time, but it is probable the former did not exceed $100,000, and the latter could not have been over $250,000.

The most extensive clock factories at the present time are located as follows: New Haven Clock Company, New Haven, Conn.; Waterbury Clock Company, Waterbury, Conn.; Seth Thomas Clock Company, Thomaston, Conn.; J. E. Ingraham Clock Company, Bristol, Conn.; Gilbert Clock Company, Winsted, Conn.; Phelps & Bartholomew Clock Company, Ansonia, Conn.; E. M. Welch Clock Company, Forestville, Conn.; E. Howard Clock Company, Boston, Mass.; F. Knoeber Clock Company, New York City; Ansonia Clock Company, Brooklyn, N. Y. Their combined capital in 1860 was about $885,000, and production about $2,300,000. The combined capital in 1892 was $5,550,000, and the production in that year, $10,475,000. No sufficient data exist before 1860 to make any satisfactory estimate of the capital invested or the amount of yearly production; but it can be seen that for the last thirty years there has been a large and continued increase of capital and production, and it is fair to believe that it will continue to grow.

Watchmaking did not exist in the United States as an industry in 1795. There were watchmakers, so-called, at that time, and there are great numbers of the same kind now, but they never made a watch; their business being only to clean and repair. Watchmaking, as a business, was not started in the United States until 1850. Its commencement on a comprehensive and systematic method was the result of many deliberations during the years 1848 and 1849, between Mr. Aaron L. Dennison and myself. Mr. Dennison was a first-class watch repairer, none being better, and he knew from experience that there was no proper system employed in the manufacture of watches. In watches purporting to be of the same size, of the same makers, there were no two alike, and there was no interchangeability of parts. Consequently it was "cut and try," by which a great deal of time was wasted, and many imperfections resulted. Mr. Dennison being a watch repairer, and myself a clock-maker, we made a good combination to systematize watchmaking, and to invent labor-saving machinery for producing perfect and interchangeable parts. With such views and intentions, we began the watch business in the spring of 1850, building a factory in Roxbury, Mass.

It is almost needless to say that we met with many obstacles. We were told by importers and dealers in watches that we would never be able to carry out our plans, and that our project would be an utter failure. Some of our friends even told us we were crazy to attempt such an undertaking, but we were Yankees, both of us, and had a sufficient quantity of the proverbial "grit," and at least believed in ourselves, even if others did not have so much faith. We could not import and use foreign help, unacquainted with our methods or tools, so we had to instruct our men from the beginning. There were many times when we felt that the predictions of the importers would prove true, but perseverance, money, and brains conquered. The financial problem was a hard matter to solve, as the unbelief in our success was universal. Frequently it was difficult to raise the necessary funds to carry on the work. This struggle was continued for six years before the tide turned. The company's best friends during that time were Samuel Curtis and

Charles Rice, both of Boston. Without the financial assistance of these gentlemen, watchmaking would probably not have existed at the present time as an organized industry in the United States. This may seem to be a sweeping statement, but no one can conceive the trials and tribulations that Mr. Dennison and myself endured. We hear and read about going through purgatory, but that must be a species of pleasure compared with what we experienced at that time.

We were trying to establish under one roof an industry embracing at least a dozen distinct trades. Such a thing had never been done before, and we were still further handicapped in our undertaking by having only inexperienced assistants. We had to teach ourselves first, and then teach others, making our progress slow and expensive; and there was much bad work that we were obliged to throw away. We did not know how to make a jewel, or a dial, or a tempered hair-spring, or to do proper watch-gilding or to produce a mirror polish on steel. Each one of these operations was a feat of which the ways and means had to be studied out and worked over until, after many attempts, one at last would be successful.

All the tools to make the different parts, after being designed or invented, had to be made in the factory by the machinists then employed, under our own supervision, in order to have them perfect and durable. Attempts were made to have them executed outside, but it was impossible to get them constructed carefully. When it is understood that if many of the parts of a watch are one five thousandth of an inch thicker or thinner, longer or shorter, larger or smaller, than the proper sizes, the watch will not run well, it will be seen at once that the tools must be as near perfection as possible, to produce the exact and uniform sizes needed. It was more than three years before the establishment had fairly and fully started in the business of making watches, and then it was found that it would require ten times as much room as had been provided, and we set about building a very much larger factory at Waltham, Mass., where the American Waltham Watch Company's works now stand. We removed there in 1854. The company remained at Waltham, making watches, until 1857, when it met with financial reverses, and the property was sold to Royal E. Robbins in settlement of its affairs. Up to that time the watch factory had been under the name and style of the Boston Watch Company. I then returned to the first factory at Roxbury, when a new company was formed as successor to the Boston Watch Company. It was entitled the Howard Watch and Clock Company, and had a nominal capital of $150,000. It was necessary to begin at the bottom and make all tools anew. Mr. Dennison left me in the early part of 1857, but after Mr. Robbins bought the factory at Waltham, Mr. Dennison was employed by the new company for two or three years.

During the War of the Rebellion the Waltham Watch Company became a great financial success as well as a mechanical one. At that time the premium on gold increased the price of watches so much that very large dividends were paid, which occasioned the establishment of several new watch factories in different parts of the country. Nearly all the companies were obliged to increase their capital from two to four times the amount originally believed to be necessary before they were successful, while several never did succeed.

Previous to 1853, many thousands of English and Swiss watches were imported into the United States yearly. At that time the American manufacturers had begun to control the market, and in a few years more the importation of English watches had generally declined. At present this trade is of little or no account. The importation of Swiss watches was also very much reduced at the same time, but the Swiss have in the last five years regained a part of their trade by adopting American methods and machinery.

In 1866 the American market was not only mostly supplied with American watches, but extensive offices were also opened by the American Waltham Watch Company in London, where their watches met with ready and extensive sales, the business continuing to this day. An attempt was made several years ago to introduce the American plan of watchmaking into England, a set of American machinery being set up there, but it did not prove a success. There was also a plant started in Switzerland by two Americans about the year 1869, to be carried on in the American manner. The machinery was all made here and sent over. A plant was started in the West a few years since, which had a lingering life, after a while being moved to San Francisco. It did not succeed there, so it continued its journey to Japan, where it is a fixed institution, and soon will be in competition with Americans in their home market. This will be hard to meet, as a workman can live there on four cents a day and get rich on eight cents a day. It would sometimes seem that Americans are altogether too good and accommodating, desiring to let the whole world know what they can do, and just how they do it. On the other hand, I do not believe they care to learn of the Japanese how to live on four cents a day.

A well and properly made watch has wonderful qualities as a machine, considering the labor it has to perform and the length of time, if treated with a very little care, it will continue to do its work. It is conceded that every person in the world has a distinct individuality, and it is just so with every watch that is made. Some of the parts are so minute that, although you suppose you have them all alike, the fact is that no two have been made without some little variation, having an appreciable effect on its action as a timekeeper. That is where the individuality comes in. The lowest or medium, grade watch may be found, occasionally, to be keeping better time than some of those which have had a great deal of time spent on them to make them as nearly perfect as possible, yet if you take the latter in pieces, and thoroughly examine them in all the parts, you cannot find any cause for the defect. Therefore I say that each watch has an individuality of its own, as all human beings have, and we must make the best of such a condition. Does any one ever consider the amount of labor that is performed by a watch during its lifetime, which is fifty years at least? In its daily duties the balance vibrates 18,000 times each and every hour, 432,000 times a day, or 157,680,000 times a year. The hair-spring makes the same number of vibrations and an equal number of ticks from the escapement. The first thought would be that the machine would be worn out in a year, but this does not prove true. If it is a good watch you can multiply 157,680,000 by 50, which would give 7,884,000,000 pulsations, and yet the watch will still be in good condition. This is a wonderful record, considering the small amount of food that has been consumed by its constant action. I say food, for whatever labors must be fed, and the watch lives on about sixteen inches of mainspring every twenty-four hours. It is cheap feeding, however, as the spring is not digested, but only the power which is stored in it, which costs nothing to renew daily. Thus it goes on, with very little care, year after year, having no palsied hands, no wrinkled or care-worn face, no failing heart-beats, but with the same vitality as ever.

The people of the United States are to be congratulated on the successful establishment of such an important industry as watchmaking within their borders, on such a magnificent scale as at present, and with so great a future before it. There have been wonderful strides in the last twenty years in the quantity and quality of the movements. There has been so much improved automatic machinery that the cost of production has been greatly reduced, at the same time that the quality has been improved. At the present time there are no key-winders made, but all are stem-winders and stem-setters. They are also nearly all made so that if the mainspring should break, while wound up, no damage would happen to the train, which is an advantage over all others.

The principal watch-manufacturing companies doing business on an extensive scale, at the present time, are located as follows:

Name.	Place.	Organized.
The E. Howard Watch Company	Boston, Mass.	1850
American Waltham Watch Company	Waltham, Mass.	1859
Elgin National Watch Company	Elgin, Ill.	1864
Illinois Watch Company	Springfield, Ill.	1870
Rockford Watch Company	Rockford, Ill	1874
United States Watch Company	Waltham, Mass.	1883
Trenton Watch Company	Trenton, N. J.	1883
Hamilton Watch Company	Lancaster, Pa.	1892

The combined capital of the above at the commencement of the business, as nearly as can be ascertained, was $1,502,110. Five years later the yearly sales were $3,379,344. The capital in 1892 was $10,550,000, and sales in that year, $15,838,817.

E. Howard.

CHAPTER LXXXIII

AMERICAN TYPE-WRITERS

THOSE who tell in these pages the story of the progress of a century in the many lines of life's activities, record a history of achievement which, for growth in volume, in character, and in method, is marvelous and unequaled in the history of any other nation or of any other time. But all who write will concede that the American type-writer has been a factor in the growth and progress of other lines of commerce, and it must be admitted that had the American type-writer come into being in the early part of the century, instead of toward its close, a greater advancement would have been recorded in every particular line of industry, because of the assistance which the type-writer would have rendered.

The type-writer, world-wide in its use, is essentially and almost entirely American. True, the idea of reducing the manual labor of writing, so far as the records show, first occurred to an Englishman. The earliest patent on mechanical writing was granted to an Englishman nearly two hundred years ago. He thought that there might be an easier method of writing than that practised by his forefathers; but the machine which he devised did not prove to be practicable. One hundred and fifty years elapsed between the first and the second English patents on writing-machines. The Englishmen are slowly awakening, for there have been issued up to the present time 375 English patents for improvements in type-writing machines. Many of these have, of course, been granted to American inventors, and those which have been granted to Englishmen have made no mark in writing-machine history; for no machine has yet been made in England, nor, for that matter, anywhere outside of the United States, which has found any extensive sale, or which has equaled, in any way, any one of the leading American type-writers.

While our English cousins slept, and while they have been rubbing their eyes and partially awakening, American genius and ingenuity have been at work. Beginning in 1836, when the first American patent on a type-writer was granted, patents were taken out at an average of about one a year for forty years. Our early American inventors were, however, not very successful in their attempts to produce a practical writing-machine. For thirty years nothing of especial value was evolved, or, if any practical machine was, during that period, invented and patented, the faith and the capital requisite for commercial success were not enlisted in its behalf. We can, therefore, not fairly date the beginning of the history of the type-writer as a factor in commercial life further back than the patent granted in 1868 to C. Latham Sholes (now deceased), who was then collector of the port of Milwaukee, and an editor, a scholar, and a man of genius. His inventions, patented in 1868 and later, formed the foundation of the first American type-writer, and covered a basic principle upon which all successful type-writers have since been made. Since the patent was issued to Mr. Sholes some 1200 American patents on type-writers have been issued, including, it would seem, every conceivable modification which can be made in such an instrument, and yet no one has devised any plan of constructing a machine on a better principle than that invented by Mr. Sholes.

In discussing the American type-writer and the type-writer business, therefore, we may be said to be considering the whole field of the type-writer industry, for our American type-writer manufacturers have no competition from abroad, either in home or in foreign markets. We are discussing, too, a business which has grown from nothing in twenty years. The first type-writer was offered for sale in 1875; but so few were made and put in use in that year that it may properly be said that the beginning of the business dates from the introduction of the machines at our Centennial Exhibition held in Phil-

Clarence W. Seamans.

adelphia in 1876. Shall we be able to show that within twenty years the type-writer has won its way into usefulness and popularity to an extent such as justifies the assignment to it of a place in these pages among the first one hundred American industries? Let us see.

When the type-writer made its bow and offered itself as a candidate for public favor, it was looked upon as a plaything rather than as an instrument of genuine utility, as a toy rather than as a practical labor-saving implement. It wrote in those days with capital letters only, and though the work which it produced was a great improvement over the illegible chirography of many lawyers and business men, objection was nevertheless raised to it on account of its monotonous appearance. Notwithstanding these objections, the early machine, cumbersome and unsatisfactory as it was, was accepted as a helper by men whose business required an amount of writing which was irksome; and 3000 or 4000 of them, writing capitals only, were made and sold within three years from the first introduction of the machine, and before the makers had worked out a plan for constructing a machine which should write with both capital and small letters. The sale of 3000 or 4000 machines by no means established the business upon a firm basis, nor did it even result in a general acceptance of the machine itself as a useful article. While a few men here and there used the type-writer with acknowledged advantage in their work, just as a few of the older boys of that time used and appreciated the bicycle (velocipede) of a quarter of a century ago, the great majority of business and professional men failed to see any real merit or advantage in it. Even after the machine writing both capital and small letters was, in 1878, presented to the public, the type-writer salesman was generally looked upon as offering an article of no real merit; and the men who have been from fifteen to twenty years in the business well remember the discouragements and rebuffs which they met in their endeavor to show business men that a writing-machine was a useful adjunct to a business office. Even the judges of some of our courts refused to accept type-written documents, strange as such a thing may seem in these days, when it is a rare exception to find any legal document not written with a type-writer.

But this condition of public sentiment could not, and did not, long prevail. The type-writer had merits which could not be permanently ignored. From its inception there were a few men connected with it who knew its usefulness and realized its possibilities, and they pinned their faith and their future to it, and never wavered nor lost faith in it during the half-dozen years of its early history, when the skepticism and the opposition of the people who might have used it with profit made the cost of selling the machines much greater than the profit realized upon them. So much was this the case that, when the first 10,000 machines had been sold, not only had no money been made in their manufacture and sale, but the business had been conducted at an actual loss of something like $250,000. It will, perhaps, serve no useful purpose to narrate in detail the history of the struggles of the invention during the first half-dozen years after its introduction upon the market, and the names of the men who, during that period, labored to make it a success. Some of them were men of marked ability who had achieved success in other lines of trade.

Men of equal faith and energy, with steadfastness of purpose and the benefit of the experience of those who had preceded them, came later, and to these new men fell the control of the sale of the machines. New plans for the education of the public were adopted. Advertising was done in a more systematic and a more extensive manner. The public was given to understand in an emphatic way that the day of doubt was passed, and that the type-writer was a mechanical and a commercial success. The wheels began to revolve more rapidly. The growth of the business became more marked. Americans believe in success. We like to buy of successful houses. Convince us that an article is useful and that it has passed the experimental stage, and we adopt it. The latest ideas, the most improved methods and machinery, are none too good for us. We revere the memory of our fathers, but we are willing to use better tools than they had, and not, like some of our foreign cousins, adhere to the calamus, the stylus, or the quill, because they were used by their ancestors; and so when the writers in business and in the professions once realized that the type-writer would lighten their labors, the machine found ready sale.

Then began the competition; for as soon as success attends the manufacture or sale of any article in this country, just so soon does some enterprising American devise a modification or a substitute for the original article, and he launches it upon the market in the hope of getting a share at least of the profits of the business. At first, competition came slowly. When the first machine, the Remington, had been on the market ten years, two competitors were in the field. Since that time several new machines have been launched each year, until now they aggregate, taking them all, about 100. Perhaps this statement ought to be modified. About 100 have been at one time or another on the market during the past ten years; but the law of the survival of the fittest has been in operation, and the manufacture of eighty or more of them has been discontinued. The mention of the names of the machines which have thus come and gone can hardly prove of interest. They have had their day. We shall see them no more. Let them rest in peace. Neither is it the purpose of this article to particularize the machines which have survived. Is it not better to group them together and to treat them as a whole, showing what they have unitedly accomplished in the two decades since the leader made its appearance upon the market?

Gradually, the usefulness of the type-writer began to be appreciated. First the professional stenographers—court reporters—took it up. Then the lawyers saw that the reports furnished them by the court reporters were more legible when written with the type-writer than with the pen, and they became purchasers. Commercial men still held aloof. They thought it might be all very well for legal documents, but not for business correspondence. The mercantile agencies realized the great usefulness of the machine, and they began to use it in their offices, scattered over the world. Presently the machine was found in the counting-room of the leading dry-goods house in America, and other houses in the same line of trade followed the example. One after another the principal houses in each branch of manufacture and of trade realized that a type-writer could be made useful, and adopted it. A list of the early users of the type-writer would show that those who were the first to appreciate its advantages were then, and are still, the leaders in the professions and in commerce. When once the leaders had committed themselves to it, the smaller concerns followed in that, as they usually follow in other things.

Until 1880 the sale of the machine suffered for lack of skilful operatives. Business colleges, schools of commerce, and similar institutions were then prevailed upon to engage in the work of qualifying young men and young women for employment in the use of the type-writer. The schools helped greatly the type-writer business, and the type-writer people helped the schools. The increased advertising and soliciting of salesmen, as one machine after another made its appearance upon the market, brought the machine more prominently to the notice of business and professional men. Curiosity was awakened, then interest aroused; investigation followed, then purchase. By 1885 the permanence of the machine as an institution, and its prosperity as a commercial enterprise, were assured in America. From that date until the present the business has had a steady growth, uninterrupted in its yearly increase, except by the temporary set-back due to the commercial depression of 1893 and 1894, from which it is now rapidly recovering. Starting with 1000 in 1880, increasing to 5000 in 1885, the sales had reached the respectable figures of 60,000 per year in the early part of 1893, exclusive of the many thousands of low-priced machines which were annually sold, and which are not considered in this article except to give them credit for the work they do as educators, used, as most of them are, as toys, but serving a useful purpose by convincing thousands of people of the value of a better machine in the actual business of life.

As this article is not intended to be a detailed history of the type-writer as an invention and as a business, but rather to show its origin and what it has accomplished, few names are mentioned and few figures given. Commercially it occupies no mean position among our business enterprises. Beginning within a very few years, it has grown from nothing until it now occupies ten acres of factory-floor space, and furnishes employment in its manufacture and sale to 15,000 people; but those who derive their income and their livelihood directly from their connection with the manufacture and sale of the machine are few compared with those who are furnished employment through its use. Let us consider the changed conditions regarding its popularity. For years rejected and its usefulness denied, it has worked its way by its own merit into every professional office and every counting-room of prominence in the land. It is found in every State and national capitol, and even in the Vatican. It figures in every political movement, and the first step in any political campaign is the opening of a headquarters and the installation of a corps of type-writer operatives and machines. One of the first articles in furnishing a new office or in starting a new business is a type-writer. Even if there be no work for it to do, it is put in to give an appearance of business. Considered a few years ago as fit for only the most unimportant documents, it is now used for the most important work of the American and foreign governments. Nearly 2000 machines are used in the offices of the government departments at Washington, and it has been formally adopted for governmental use in England and her colonies, France, Germany, Russia, and, indeed, in nearly every country on the globe. Many of our States have placed laws upon their statute-books legalizing its work. Judges who once objected to it now require that it be used in the production of all papers submitted to them. It is used for drawing deeds, for writing wills, for state and diplomatic correspondence. Even foreign noblemen and potentates have adopted it. The Queen of Madagascar has her type-writer; the khedive of Egypt has his. The czarina of Russia acts as secretary for her husband, the czar, and does her work on the type-writer. The little machine, once so unpopular, has invaded the realm of fashion. Our English cousins were more slow to admit the propriety of using the type-writer for personal correspondence, but merit and usefulness have won. Among the wedding gifts to Princess May of Teck was an American writing-machine. The acknowledgments of the wedding presents of another one of the royal family were written upon a type-writer, and the Prince of Wales himself has recently brought Marlborough House up to date by the introduction of an American writing-machine. A representative of one of the leading American manufacturers has been decorated by a foreign ruler with a distinguished order, in token of his appreciation of the ingenuity and value of the American writing-machine, which is used extensively by his Excellency's government, and even by his Excellency in person; and the leading firm of American manufacturers has received the appointment from her Majesty, and his Royal Highness the Prince of Wales, of contractors to her Majesty's government.

So much as to its present popularity at home and abroad. Now what has it accomplished? It has made itself a factor in the increase of business in all lines of trade. It has enabled a telegraph operator to supply at one writing every newspaper in New York with the news of the day. Its speed has resulted in an abbreviation of the original Morse system. By the use of the new code the capacity of a telegraph wire is doubled, resulting in great savings to the telegraph companies. It has shortened the number of hours during which a business man is confined to his correspondence, and has given him a greater portion of the day to devote to other things, to the advantage of his business. It has improved the correspondence itself, so that letters are more easily read and the contents more quickly grasped. The greater legibility of its work prevents many errors and consequent loss. The head of a Wall Street house, overloaded with a certain stock, and desiring to realize upon a little of it without affecting the value of the rest, sent a message to his broker on the floor of the Exchange: "Sell quietly 1000 shares." Illegible handwriting made the message read, "Sell *quickly* 1000 shares." The hasty sale demoralized the market, broke the price, and the house failed. Had the message been type-written the failure would not have occurred. It has increased the trade of those who have used it, and has driven the fogies out of business, or compelled them to adopt it. It has educated the public in spelling, in punctuation, in capitalization, and in paragraphing, to a great degree. Compare business letters of twenty years ago, all of them written by hand, with business letters of to-day, nine tenths of them written on a type-writer, and observe the improvement in these respects. It has lessened the laboring hours of thousands of men, giving them more time for recreation, and perhaps lengthening their lives. It has in a measure solved the problem of women's work. It has opened an avenue of genteel and profitable employment to an army of educated women.

To those who are permitted to look back over their connection with the business from its infancy, and recall the struggles and discouragements of the first few years, its present popularity is naturally a source of pride; but even more gratifying is the contemplation of the vast army of young people who, as the outcome of those struggles, have found congenial and profitable employment. To fully impress upon the reader what the type-writer has accomplished in this respect is no easy task. One writing-machine company, realizing the mutual advantage which would result, began in 1882 the work of finding employment for type-writer operatives. Employment bureaus were established in the principal cities of the country, and have been continued until now, at a cost of many thousands of dollars, serving without charge both employers and employees. If the young people—mostly women—who have found employment through the agency of this one house could march through one of our city streets, shoulder to shoulder, from curb to curb, it would require from daylight to dark for them to pass in review. Would the size of this army be more easily comprehended if the number is mentioned? Here, then, it is—70,000.

What, too, of the earnings of the legion of young people who, by means of the type-writer, not only support themselves, but in many instances contribute to the support of others? The entire amount paid as wages to operatives has been found to be

$150,000,000 yearly—a sum greater than the customs receipts of the United States; greater than the cost of maintaining the army and navy or the entire civil list of the government; a sum equal, in fact, to the entire cost of the public schools of the nation. This vast amount of money has been earned without corresponding loss of employment by any other class, and may certainly be said to have added an equal amount to the wealth of the nation.

Who deserves the greatest credit for these accomplishments? A measure of credit must be given to those who first conceived the idea of decreasing the labor and of increasing the speed and legibility of writing; but this credit must be divided among many persons. Credit is also due to the men of business acumen who, taking up the enterprise when the crust of opposition had been broken, used their ability, their money, and their energy in establishing the business firmly in public favor and confidence, and made it profitable. Space will not be taken to discuss those whose inventions have added to the value of writing-machines, but who were not pioneer inventors in the field; nor those who, having invested their money, devoted their time to getting a share of the profits of the business, after the leaders in its introduction had demonstrated that it was an enterprise which could probably be embarked in with profit.

Above all others, credit seems due to three men, all of whom have finished their work and entered into their reward: James Densmore, who, when the idea was unpopular, invested several thousands of dollars,—all that he had,—and who, when he had used all of his own means, had the faith and the courage to borrow from others many thousands more, all of which he spent in converting the public to his ideas; George W. N. Yost, Mr. Densmore's lifelong friend, who with no less faith worked with him from the beginning, and who possessed in a remarkable degree that enthusiasm and tenacity of purpose required to overcome public prejudice; and William O. Wyckoff, who believed in the machine from the time he saw the first crude model, and was among the very first to use and sell it, and who, with better business ability than either of the others, had not only the faith to invest his money in the enterprise at the dawn of its history, in spite of the protests and the ridicule of his friends, but had also that prescience which told him that sooner or later the whole civilized world would want type-writers. When the hour came it found him ready. Dropping all other tasks, he put into the work all that he had of means, of energy, and of enthusiasm, with results so magnificent as to command universal wonder and admiration.

To revolutionize commercial methods; to give employment even indirectly to hundreds of thousands of young people; to add annually to the nation's wealth hundreds of millions of dollars, are no mean accomplishments. These results have been attained through the instrumentality of the American type-writer.

Clarence W. Seamans

CHAPTER LXXXIV

THE BICYCLE INDUSTRY

THOUGH the idea of man-power locomotion is an old one, its practical development is a modern achievement. What appears to be a machine of the hobby-horse type is illustrated in a stained-glass window of the old English church at Stoke Pogis, whose graveyard is famous as the scene of Gray's "Elegy" and the final resting-place of the poet's remains. This window bears the date 1642, but as no records throw further light on the subject, it must be taken as an isolated point in the history of wheeling, or perhaps be considered merely the strange product of an artist's imagination.

Within the space allotted to this subject it would not be of advantage to describe, even in outline, the crude devices which appeared during the early experimental period; yet their number and variety are of interest as showing how persistent inventors were in their search for a vehicle with which the muscular force of the human body could be used to such advantage as to secure an easier and more rapid transit than was attainable on foot.

The first rudimentary bicycle of which we have a fairly satisfactory record was a machine used by Baron von Draise, of Mannheim-on-the-Rhine. It was of great service to him in the performance of his duties as Master of the Forests of the Grand Duke of Baden. From him it took the name "draisine," though the claim of priority in invention has been questioned, as a wheel of the same type—the célérifère—was exhibited in 1816, in the Garden of Tivoli, a favorite Parisian resort of the day. The construction of this machine was very simple, consisting of two wheels in line, connected by a perch on which the rider sat, and to the fore end of which the front-wheel fork, bearing a cross-bar for steering, was swiveled. The rider propelled this contrivance by quick thrusts of his feet upon the ground, but on down grades they were held up and the machine allowed to coast. Johnson's pedestrian curricle, brought out in England in 1818, was an improvement in detail over the draisine or célérifère, and at once came into favor under the names of "dandy-horse" and "hobby-horse." In 1819 machines of this kind were introduced into New York, where people took kindly to them, riding them on the Bowery, through the parks, and even speeding them on the decline to City Hall Park. It was during this year that W. K. Clarkson was granted a United States patent for an improvement in the velocipede. Little or no progress was made for a number of years after this, but a great problem was successfully solved by Lallemont, a Frenchman, who hung cranks to the front axle of the modified form of the hobby-horse, so that the machine could be propelled entirely by the feet and steered by the hands. Lallemont's machine, the original "bone-shaker," was exhibited by his employer, M. Michaux, at the Paris Exposition in 1865, but little attention was attracted by the improvement in driving-gear. The next year, however, Lallemont worked his passage to America, where he at once built a wheel, and aroused considerable interest by riding it through the streets of New Haven. In November, 1866, a joint patent was granted to Lallemont and Carrol, and this is the first one in the United States showing the two-wheeled velocipede with foot-cranks—in fact, the first complete patent actually obtained anywhere for such a machine.

This vehicle consisted of two wooden wheels, of nearly equal size, one before the other, shod with iron tires and surmounted by a wooden perch, from which projected downward, near its rear end, two arms on either side of the rear wheel, each pair of arms meeting at the end of the hub and forming a bearing for the axle. A similar device projected from the fore end of the perch on either side the forward wheel, furnishing bearings for its axle, and arranged with a pivot in the perch near the upper end, so that, by means of a handle-bar above, the front wheel could be turned to the right or left in steering the machine. The perch was curved downward in the middle part, and from a joint near the front forks, backward to a joint over the rear wheel, extended a straight steel spring bearing a saddle about midway between and above the two wheels. From this position the rider could place his feet upon the balanced pedals on the cranks connected with the front axle, the latter being fixed in the wheel. Thus seated, he started the machine in motion with his feet on the ground, and then put them on the pedals and propelled it. This was certainly a better contrivance than any other yet brought out, but, at best, it was clumsy and awkward, and lacked the important features which were essential for the success of a practical road vehicle. The application of power was disadvantageous, as the thrust, instead of being directly downward, was forward and down. It required several times as much propelling force as is used on the modern bicycle. Historically it is a rare curio, and as such is preserved in the collection owned by the Pope Manufacturing Company.

The popularity of the velocipede in America reached its height about 1869 or 1870, and the makers who had gone into this line of work had all they could do to supply the demands of the trade. The "Velocipedist," a journal devoted exclusively to the new interests, was issued, and a book written on the sport; and yet—so suddenly come the changes of public sentiment—two years later these machines had entirely disappeared, save here and there one in the hands of a boy. The reason for this short-lived popularity was the fact that the carriage builders who put out these wheels neglected to use proper bearings and such other devices as would have made riding more easy and enjoyable. Some steps looking to improvement in this direction were taken, however. C. K. Bradford, an American, had suggested the use of rubber tires, and experiments were tried with larger front wheels and antifriction bearings. In point of fact, one of our carriage manufacturers made velocipedes of a type similar to the high or ordinary bicycle, but the improvements came too late to save the trade, so that in 1870 he was caught with his store-rooms well stocked with these wheels, and no market for the goods.

The Franco-Prussian War retarded for a time the progress of cycling interests in France, though during that period there was a slow and steady growth in England, and the United States Patent Office reports show that our inventors were earnestly endeavoring to solve the problem. Meanwhile the use of wood gradually disappeared, giving place to wire spokes, steel hubs and felloes, and the tubular backbone, handle-bars, and forks. The round contractile rubber tire, too, came to be used in place of steel, and added materially to the comfort and ease of riding.

The first bicycles seen by me were some English machines shown at the Centennial Exhibition in Philadelphia in 1876. They attracted my attention to such an extent that I paid many visits to this exhibit, studying carefully both the general plan and the details of construction, and wondering if any but trained gymnasts could master so strange and apparently unsteady a mount. Some eight years had passed since the velocipede had excited interest in man-motor vehicles. This cumbersome machine, which had failed of success and gone out of use, because it was wrong in design and poorly constructed, had yet served a purpose in awakening the desire to possess a light and easy running mount suitable for every-day road service, and it naturally followed that many of the early devotees of the bicycle were men who had enjoyed a foretaste of its pleasures in riding the old bone-shakers.

The sport had by this time become more or less popular in England, and early in 1877 I had a bicycle constructed under the personal supervision of an English gentleman who was a guest at my house. This wheel, completed in August, was made entirely by hand, and cost the somewhat extravagant sum of $313. As soon as the machine was mastered I became so interested in it that I at once took active steps toward introducing wheels in America. The Pope Manufacturing Company had already been organized, and in September, 1877, an order was sent to England for a small quantity of bicycles, which were received late in that year. The initiative step in this great industry, however, was an order for the construction of the first fifty Columbias. It was given to the Weed Sewing-Machine Company, of Hartford, Conn., in the spring of 1878. During that season we marketed all told ninety-two wheels.

A trip to England and a careful review of the field abroad confirmed me in the opinion that this line of manufacture could be made profitable in the United States, and that Americans could be brought to look upon wheeling without unfavorable prejudice. The wheels seen at the Centennial Exhibition had been turned over to a Baltimore firm, who imported a few more, but soon went out of the business. Interest having been aroused, however, importers appeared in the market, and some years subsequent to our beginning to make wheels other companies were organized and took up the manufacture of bicycles; but from an historic point of view it is of interest to note that the Pope Manufacturing Company is the sole survivor of all the concerns started during the first few years.

As soon as the possibility of the industry being pushed to success was realized, owners of patents became aggressive in their demands, so that, at the inception, the manufacture of bicycles was threatened with financial disaster. It was at this point that we adopted the policy of purchasing outright whatever patents proved to be valid and of value; or, if this was impossible, we took licenses. In this way a control of the business was secured, the industry was practically protected, and we were enabled to go on with the work and license others to manufacture under our rights. It became necessary, also, at the outset, to educate the people to the advantage of this invigorating sport, and, with this end in view, the best literature that was to be had on the subject was gratuitously distributed. At first the prejudice against the bicycle was so intolerant that its use was prohibited in many parks and public thoroughfares; and it cost many thousands of dollars to carry through the cases which resulted in the courts classing the bicycle as a vehicle, and granting to wheelmen the same privileges that were enjoyed by the users of carriages and other vehicles. We spent over $8000 in the Central Park case alone.

During the life of the ordinary or high bicycle, wheeling was a sport, pure and simple, and the trade was pushed practically to its ultimate limit, as the demand was naturally confined to those brave men whose courage and love of the sport could not be dampened by an occasional header. With the advent of the safety those of maturer age and more timid temperament gradually took up the exercise, and their enthusiasm, backed by its beneficial results, added thousands of new riders to the list of wheelmen.

The first safeties were necessarily heavy,—fifty pounds or more,—and, equipped with solid rubber tires, were not particularly comfortable. The next step in the development, therefore, was the adoption of the cushion tire, which, with the spring frame, so lessened the jar of riding over uneven surfaces that the weight of the machine could be reduced. The comfort thus secured broadened the demand. Then came the introduction and perfection of the pneumatic tire, which did away with the jars to such an extent that the manufacturer could with safety again decrease the weight, thus adding greatly to the speed and practical utility of the wheel as a means of easy transit.

With added years of experience the manufacturers have scientifically developed the bicycle as a whole, and put into use hundreds of devices in the detail of its construction. The results are seen in the wonderful wheels of to-day, ranging in weight from seventeen to twenty-four pounds. Wheeling can now be enjoyed by young or old; any one who is able to walk has the strength necessary to propel the bicycle. Furthermore, as the demand increased, makers of medium-grade bicycles came into the field, putting out machines for boys and girls, as well as for men and women, so that now bicycles are practically within reach of even the most moderate means. The cardinal points of development noted above show quite clearly the reason for the increased use of bicycles, and the way in which the field has been broadened, starting with daring young men and ending in the adoption of the wheel by all classes and conditions of mankind. From the outset many doctors have believed in and recommended the use of the bicycle, and now practically all physicians indorse wheeling as one of the best and most health-giving of outdoor sports.

As an industry the manufacture of bicycles is very important. There are now about 200 of these concerns in the United States, many of them large and substantial companies, representing in the aggregate an investment of $20,000,000, exclusive of those who devote their attention to making and marketing accessories. There are 25,000 men engaged in this line of work, and as many more in distributing the product. The center of the best bicycle manufacturing is in the Connecticut Valley. The Pope Manufacturing Company alone employs a force of over 2500 men, and has, in addition to this, branch houses in the large cities and 3000 agencies throughout the entire country.

Early in 1893 a bicycle insurance company, carefully reviewing the field for data on which to estimate chances of loss, concluded that there were in use at that time in the United States not less than 1,000,000 wheels. A very reliable estimate of the product for 1895 puts the number of bicycles at about 550,000, and present prospects indicate that at least fifty per cent. more will be made and sold in 1896.

As the success of one leading merchant assists hundreds of smaller concerns, so the healthy development of a new industry is of material advantage to those who supply the increased demand in special lines. The perfection of the bicycle has opened a large market for steel and rubber, has resulted in revolutionizing the methods of drawing seamless steel tubes, and has wonderfully improved the manufacture of rubber goods. Instead of importing tubing from England, as was done in the early days of the trade, this product is now supplied by American makers, and some of it for the purpose is better than any other tubing now known. It took years to advance from the old-fashioned solid-rubber tire to the single-tube tire of to-day. This one line of development has cost a great deal of money, both in the way of experimentation and in the equipment of plants. There are hundreds of patent devices covering tires, and the methods of attaching them to the felloes of the wheel. A cardinal point of interest to the trade is the fact that a few years of actual use have so changed the public demand that the single-tube tire is now called for by about ninety per cent. of the riders. In addition to these important branches there have grown up side by side with the bicycle industry such profitable lines as the manufacture of saddles, lanterns, bells, costumes, and all the other articles classed under the term "accessories."

The inception of the agitation for good roads was coincident with and started by my early bicycle experience on the suburban roads about Boston. Pioneer work cost high, in both time and money, and though at first it seemed a thankless undertaking to reform the road management throughout the country, recognition was finally obtained as the result of constant attacks on the old system through addresses before meetings of the Carriage-Builders' National Association, Chambers of Commerce, and other assemblies of representative men, as well as by a liberal distribution of pamphlets, and contributions to the press.

At the first meeting of the League of American Wheelmen we took a decided stand on this subject, and urged the advisability of the organization working unitedly for this reform. To-day all wheelmen are earnest advocates for good roads, and much of the success already attained is due to their hearty coöperation and support. To comprehend the financial advantage of good roads one has but to consider that there are throughout the United States over 1,000,000 miles of highways, and that a saving of a few cents per mile in hauling produce to and from the railway stations and shipping points would in one year mount up to a sum sufficient for the construction of a majority of the roads now needed east of the Mississippi River. The increased valuation of property caused by the construction of good roads is well illustrated in Union County, New Jersey, where in one year property advanced $1,359,600. The legislatures of New Jersey and Massachusetts were the first to pass road laws which by actual experience have proved to be practicable.

On several occasions I had the honor to memorialize Congress, and once submitted a monster petition on the importance of this reform; and the national government formally recognized the public demand when, in 1893, a clause was introduced into the Agricultural Bill appropriating $10,000 to "enable the Secretary of Agriculture to make inquiries in regard to the system of road management throughout the United States, to make investigations in regard to the best method of road making, to prepare publications on this subject suitable for distribution, and to enable him to assist agricultural colleges and experimental stations in disseminating information on this subject." A special agent was put in charge of this work, and the information collected is being published in convenient tabulated form and freely distributed. Many of the States have followed the example of Massachusetts and New Jersey, while others are formulating plans with the view of adopting such legislative measures as will be most effective in improving the common ways of the various States.

It is believed that the United States will enlarge its work in this direction, thus in time making American highways second to none in the world. The plan followed by the Old Bay State commends itself because of the good work already accomplished. Massachusetts has a permanent Highway Commission, with the terms of office so arranged that two out of the three members will always be men familiar with the work in hand. Each commissioner receives a salary of $2000 a year, with an additional allowance for traveling and other necessary expenses. The State provides offices for the use of the commissioners, who can be freely consulted during certain hours by town and county commissioners and others having the supervision of road construction. The original enactment has been so modified that, instead of petitioning the legislature for the construction of each highway, a large sum is appropriated annually to be expended at the discretion of the commission. As each section of State road is intended to be an object-lesson in road construction, wisdom has been shown in distributing the work throughout the entire State by building here and there small portions of an elaborate system which, when completed, will furnish an excellent means of communication throughout the commonwealth, and, joining with through roads in other States, will facilitate interstate traffic. Every-

Albert A. Pope.

thing is done in the most systematic manner, and there is being collected a valuable amount of data bearing on the rock deposit suitable for road construction and repair. As this work progresses, sectional topographical maps are being published, showing the exact location of all materials suitable and available for work on the public highways.

The advent of the motor-carriage is bound to increase the interest in good roads. The day of the horse is already beginning to wane, and as soon as a practical motor-carriage can be had by men of moderate means we must have good roads, not only in and about the cities, but throughout the entire country.

Albert A. Pope

CHAPTER LXXXV

THE DRY-GOODS TRADE

IN the beginning of the century the dry-goods trade of this country presented but few features of interest. Indeed, textiles were so often combined with other commodities to form the merchant's stock in trade, that it was difficult to determine where the former began or the latter ended. Trading of all kinds was of a generalized character, merchants handling alike dry-goods, groceries, and sundries in the same establishments. The stocks represented in such stores were incongruous in the extreme; cottons and silks from India, and velvets and woolens from Europe, were placed in juxtaposition with groceries and hardware.

The trade in textiles in those early days was almost entirely of an import character, and the wholesale merchants, as a class, were either directly or indirectly importers. The extent of American cloth manufacture, as a factor in commerce, was inconsiderable. There were then but few specialized industries or departments in trade or traffic, as we now understand such distinctions. The distaff, the spinning-wheel, and the hand-loom were part and parcel of nearly every well-regulated household. The flax and the wool were raised, carded, spun, and woven at home, and the same hands that performed these offices also frequently fashioned the fabrics into wearing apparel for the use of the family. This state of things, as a matter of course, applied more fully to the common people. The rich or more prosperous classes of the community then, as now, imported many of the articles which formed their wardrobes, as well as their bed and table linen. Comparatively little attention was given to the culture of cotton at this period by the American people, and its use in the household, in connection with wool and flax, was by no means general. Its manufacture in an organized way, like wool, was confined to one or two establishments of crude construction and operation. They produced fabrics of no great commercial importance, save that they served to mark the initial stage or starting-point for the greater multiplication and diversification which have followed.

When it is considered that the inventions of Hargreaves, Arkwright, Paul, Crompton, and Cartwright had barely been adopted in this country at the close of the eighteenth century, the development of our textile industries since has been simply marvelous. At the time referred to, our home products, in an organized way, represented, in woolens, a few coarse cloths; in silks, a few lace and braid sundries; and in linens, some coarse sheeting and toweling. Our imports of foreign textiles during the same period were also of moderate proportions, being probably about double the value of the home product. In fact, from the close of the Revolutionary War until 1795, our imports of foreign dry-goods averaged yearly about $24,000,000 to $26,000,000, while the value of the home product varied between $12,000,000 and $13,000,000. The latter, being almost wholly of household manufacture, had but little representation in merchants' stocks.

The village stores in those early days were few and far between, and where they did find location, their stocks, so far as dry-goods were concerned, represented only a few of the coarser textures in woolens, linens, and cottons, with buttons and thread, associated with goodly supplies of rum, molasses, and groceries. A considerable trade with towns located on the banks of inland streams was transacted by means of flatboats similarly stocked. In the cities the wholesale trade was almost entirely confined to the importers, who dealt in those foreign and home commodities, crude or manufactured, which were in the greatest demand and yielded the best profits. With the retail trade in the cities likewise, the distinction in the kind of goods handled by different dealers was not very marked, most of the shopkeepers selling a little of everything. In some of the larger cities, however, a slight tendency toward separate classification began to appear; that is, dry-goods and notions, in the more pretentious establishments, were to some extent sold to the exclusion of other commodities. But the general condition of the people—the fact that they supplied themselves with the manufactures of the household, and preferred in many cases to barter rather than pay the cash—did not tend to develop early any very large retail establishments in separate lines of goods, even in the most populous cities.

In this connection it may be interesting to note that the imports of foreign merchandise paying ad valorem duties into the United States from 1795 to 1800 inclusive, amounted to nearly $212,000,000, of which the textile part represented about two thirds. The kind and character of the latter—especially at New York, which was then, as now, the chief importing city of the country—may be readily inferred from the following names, given in the orthography of the day. They represented goods chiefly from India and China, and the cities of Amsterdam, Hamburg, Liverpool, and London, such as cottons, woolens, silks, velvets, linens, laces, edgings, hosiery, gloves, and shawls, including damasks, dimities, callimancoes, durants, tabarets, platillas, listadoes, mamoodies, gurrahs, cossas, baftas, russets, satinets, duffels, britannias, etc. Among the more important firms in New York importing or handling such goods about 1800 were: Bethune & Smith, Murray's Wharf; John Knox, 97 Water Street; McCready & Reid, 97 William Street; Hector & Scott, 125 Pearl Street; John & William Tabele, 260 Pearl Street; Richard & John Thorne, 141 Pearl Street; Benjamin I. Moore, 103 William Street; Charles J. Vogel & Company, 92 Maiden Lane; William Blackstock & Company, 163 Pearl Street; A. S. Norwood, 127 William Street; Robert & John Sharp, 93 Maiden Lane. These firms, with the exception of A. S. Norwood, who dealt almost exclusively in carpets, rugs, and bedsides, handled dry-goods more largely, perhaps, than other houses, although among the latter, who sold them in connection with other foreign and domestic commodities, might be mentioned: Archibald Gracie, 52 Pine Street; James Stuart, 10 William Street; Eben Watson & Company, 36 Old Slip; Fergurson & Crichton, 84 Broadway; Rogers & Lambert, 232 Pearl Street; H. G. Rutgers & Company, 145 Pearl Street; Rutgers, Seaman & Ogden, 93 Front Street; Thomas Bulkley, 241 Front Street; Suydam & Wyckoff, 21 South Street; Robert Weir & Company, 16 Gold Street; John Knox, 97 Water Street; Thomas Warren, 61 Maiden Lane; John MacGregor, 84 Broadway; and Minturn & Barker, Thomas Napier & Company, Robert Lenox, Frederic de Peyster, Gouverneur & Kemble, John Murray & Sons, and others.

From 1800 to 1815 the country, its trade and industries, passed through some very trying ordeals—complications arising with France, the Embargo and Non-Intervention acts going into effect, and everything finally culminating in the war with Great Britain. The restrictions upon our import trade during this period tended rather to foster our home industries than otherwise. In 1803 a serious panic prevailed in Great Britain, which materially affected our trade interests both at home and abroad. In 1804 the first consignment, for sale, of American cottons was made by Almy & Brown, of Providence, R. I., to Elijah Warren, of Philadelphia, Pa., who became their agent for yarns and threads, and afterward for stripes, plaids, checks, ginghams, tickings, etc. The amount of domestic cottons sold in Philadelphia, the produce of New England factories, from 1804 to 1806 inclusive amounted to only $17,670.

The Embargo went into force in 1807, and as a matter of course, almost wholly cut off our foreign trade. The cotton-spindles in the United States at this date amounted to about 4000, showing that the progress made in this line of industry had been slow, although before the end of the year they had doubled, and by 1809, seventeen mills were in operation in Providence, R. I., and vicinity, working 2296 spindles, and producing about 510,000 pounds of yarn. About 1000 looms were employed in weaving cotton cloth. The census returns for 1810 also gave further evidence of more or less rapid advancement being made in the manufacture of cottons and woolens, as well as in other industries. In round figures, according to the Treasury Department, the value of our product in cottons and woolens, exclusive of clothing and other goods, in 1810 was nominally about $46,000,000. The invention of the cotton-gin by Eli Whitney in 1794 had brought about a great change in both the production and the manufacture of cotton, so that from this time forward it became our leading textile product.

In the years 1815–16 our imports of foreign dry-goods were so enormous as not only to glut our markets, but to paralyze our cotton and woolen industries as well. In fact, many of the leading importing and other merchants of the time were almost ruined by the unprecedented fall in the prices of goods and the general stagnation of trade and business resulting. This state of affairs was not entirely due to the results of the war, and the reopening of our ports to foreign traders who took advantage of the low rates of the ad valorem duties then prevailing, but was caused largely by the cotton and woolen manufacturers of Great Britain who unloaded their surplus stocks in our markets at prices below the cost of production, with the view to cripple our textile mills and control the trade of this country. In this they succeeded for the time being and for some years later. From this period onward, through the decades ending with 1820, 1830, 1840, and 1850, there is but little reliable official information to be gleaned from the census reports respecting our advancement in manufactures, if the year 1850 be excepted; but that it was gradual and steady is evidenced by the increased production of the spindles and the looms, especially in cottons and woolens, distributed by the general dry-goods trade. Our imports of textiles also kept growing apace, but not in like ratio to those of home production. This long period was eminently one of preparation and organization for both our dry-goods and our general textile-manufacturing interests. Many important inventions and processes were perfected during this time, such as the sewing-machine, power-loom, knitting-machine, and other mechanical devices, which not only changed but multiplied and diversified the textile manufactured products of the world, and thus created many of the subdivisions which are such important factors in the dry-goods trade to-day.

The wars, panics, depressions, conflagrations, and other vicissitudes through which the trade and country passed in the first half of the century seemed to spur manufacturers and merchants to make renewed efforts in the upbuilding of our industries. In the latter decade of it there set in a more marked tendency toward the diversification of products, and the inauguration of improved methods in their sale and distribution. The classification of goods was then carried to a much finer point than formerly, and the general trade, both wholesale and retail, outside of the regular dry-goods jobbing houses, began to make more or less separate distinctions in the goods which it sold. There were importers and wholesale dealers who handled special or distinct lines of goods, as silks and dress-goods; cloths, coatings, and cassimeres; notions and small wares; hosiery, underwear, and gloves; laces and embroideries; white goods and linens; and hats and caps. In the retail trade in the cities these distinctions, in many cases, were equally well outlined, although the stores in the larger towns and villages throughout the country still adhered more or less closely to the original policy of carrying miscellaneous stocks of merchandise. The evolution of the clothing trade, and, still later, that of made-up articles for women's and children's wear, not only brought the immigrant garment workers to the front in these particular lines of trade, but also, in the succeeding decades, made the classifications in manufacturing, wholesale, and retail circles still more minute and numerous. If there be added to these the development and more general utilization of the commercial agency and the commercial traveler systems, we have the grand factors which are so potential in the extension and prosperity of the dry-goods trade of to-day. Indeed, when the year 1850 dawned we had reached the basis on which to build a broader national and industrial development. With the founding of new towns and cities in the interior, West and South, there came a larger and more diversified demand, with an increase of stores and shops, while newer and more varied articles of merchandise, suitable to the growing wants and tastes of the people, were being produced. In 1850 the value of our cotton and woolen products aggregated about $112,000,000, while our combined textile output reached $129,000,000. Our imports of foreign dry-goods for the same year approximated $59,000,000. As compared with 1795, the former had increased about tenfold, while the latter had only about doubled. However, this is not altogether a fair showing, for the reason that the dry-goods trade, both wholesale and retail, then, as now, handled large quantities of miscellaneous merchandise not strictly included in the textile class, but which, if enumerated in value, would largely swell the total in sales, and make the increase in general distribution for the fifty-five years the more noteworthy and significant.

Thus it will be seen from the foregoing, that the year 1850 marked a new era in the history of the dry-goods trade of this country. Prior to it there was practically no domestic commission business done in New York City. Boston, Philadelphia, and Baltimore were then the domestic commission centers. The product of the New England mills was mostly controlled by Boston houses. Philadelphia had twenty or more commission-houses selling all kinds of domestic goods, and it was the chief market for what were then designated as "blue goods," which comprised denims, checks, stripes, etc. Some of the Philadelphia houses were organized as early as 1832. About this time, also, a large quantity of dry-goods were sold in Hartford, Conn. New York was the market of this country for imported goods, and the importance of opening domestic commis-

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sion-houses in that city then began to be recognized. At first the Boston merchants, who were the agents of the Eastern mills, discouraged the project, and only a few of them were induced to open small offices in New York. Soon, however, it was found that in these small offices a larger business was being done than in the parent houses in the East, and so one house after another, and mill after mill, opened agencies in New York for the sale of the goods represented or manufactured by them, and the business soon developed into extensive proportions. At this date the jobbing business of New York was still largely done downtown, on Broadway, Cedar, Pine, Liberty, and Broad streets; there were no retail houses above Howard Street. Our home manufactures of textiles were still mostly of a common staple character, all the finer goods being imported from Europe.

In 1857 occurred the memorable panic, which for the time paralyzed the business of the country; and the dry-goods interest, being the largest and most diversified, suffered the most severely. A daily record of one of our New York houses, kept continuously from 1847 to the present time, notes August 27, 1857, "the failure of the Ohio Loan and Trust Company, as the beginning of horrors." October of that year is recalled by all who took part in the struggle as a time which tried men's souls —and their bank-accounts. Numerous failures occurred, and many were the accounts of fortunate turns and of hairbreadth escapes from suspension and failure.

The imports of foreign dry-goods into the United States in 1860 amounted to $112,350,000, while the value of our combined textile manufactures reached $215,000,000. As contrasted with 1795, the former had increased nearly fivefold, and the latter nearly eighteen times. The war between the North and South succeeding, it may be interesting to particularize some of the more important commercial and financial events that ensued, and which specially affected our dry-goods interests. In December, 1861, cotton goods began to advance, and the average increase in prices during the first two years of the war was about 300 per cent. The following year showed a still sharper rise, and the high prices of the war culminated in the fall of 1864, when the average advance in prices of cotton goods from December, 1861, was about 1000 per cent. In April, 1864, raw cotton sold at $1.90 per pound, and on July 11th gold reached 299. The period intervening between 1861 and 1864 was one of the sternest trials the mercantile world has ever known. In Europe it was known as the "cotton famine," regular shipments of the staple from the United States being almost entirely suspended. General Lee's surrender occurred April 9, 1865, and on June 30th of that year cotton sold at forty cents per pound. Manufactured cottons, however, did not show proportionate decrease in price. In October following cotton had risen to sixty-four cents per pound, while prints, sheetings, etc., were about half the price which had been current for them in the fall of 1864. It was during this year that the largest dry-goods jobbing house not only in this country, but in the world, distributed goods broadcast throughout the Union to the enormous amount of $72,000,000. Turning again to our imports of foreign dry-goods and the home manufactures of textiles, we find that the former in 1870 aggregated only $98,290,000, while the value of the combined product of the latter exceeded $520,000,000. The increase, as compared with 1795, in imports was barely fourfold, while in home products it represented about 2500 per cent.

From this date vast strides were made in the character and scope of our domestic manufactures. The rapid increase in immigration, the development of the great Northwest, causing an enlarged demand for dry-goods, were met by our manufacturers with largely increased and improved facilities for producing them. A special impetus was also given to the production of the finer and better grades and more varied styles of merchandise by the Centennial Exhibition of 1876. Our people then began to realize what could be done in this country.

By 1880 the value of our textile products was nearly $533,000,000, while our imports of foreign dry-goods approximated to $136,000,000. The showing in this decade for the former, as compared with 1870, did not exhibit a very large increase; still it must be borne in mind that our manufacturers encountered some very severe vicissitudes during this period, and besides, from the close of the war onward, there had been a gradual and steady decline in the prices of nearly all kinds and classes of textiles, due to the improving and cheapening of facilities for production. While the value of the output showed but little appreciable augmentation, the increase in quantity and variety was especially noteworthy. From 1881 to 1887 inclusive, Mulhall, one of the most reliable of foreign statisticians, estimates the aggregate value of the output of American textile manufactures at $3,250,000,000, which would give an annual average value for the seven years of $465,000,000. But he was considerably below the mark in his figures, since the output three years later (1890), according to the census reports, represented nearly $722,000,000. This large amount, added to our imports of foreign dry-goods for the same year,—nearly $156,000,000,—made the grand total of $878,000,000 of textiles imported from abroad and produced at home. Compared with 1795, this shows an increase of nearly 4600 per cent. The home manufactures alone show a gain of over 5500 per cent., while the imports exhibit a gain of less than 170 per cent. On the basis of an increase of at least fifteen per cent. from 1890 to 1895 in the value of the product of our textile manufactures, it would make the same approximate in the latter year to $830,000,000, which, if added to the imports of foreign dry-goods for the fiscal year ending June 30th,—$137,000,000,—would swell the grand total of textile manufactures for sale or distribution to $967,000,000. However, the foregoing estimates do not include the freight, insurance, duties, etc., on foreign dry-goods, nor the sellers' profits on the same, as well as on domestic goods. If all these be added, the annual aggregate value of textiles alone handled by the dry-goods trade of the United States to-day would largely exceed $1,000,000,000.

We have now the final comparison of 1795, with $40,000,000, and of 1895, with nearly $1,000,000,000, to show the growth and the development of the dry-goods business of the country for the century. This would give the ratio of increase for the one hundred years as about 4000 per cent. This is wonderful, considering all things. But textiles only have so far been considered, while the dry-goods merchant of to-day, both wholesale and retail, handles multitudes of articles not included in that category which serve to increase his sales to a very large extent. Owing to the great subdivisions now existing in the trade, as well as to the fact that the large commission-houses, importers, jobbers, and retailers have intermixed dry-goods proper with many other lines of merchandise, it is utterly impossible to get at the exact value of the annual distribution. In fact, in the later decades of the century there has been a manifest disposition on the part of the large retail houses in our cities and more enterprising towns to buy and sell, like the early importers, promiscuous merchandise and wares in connection with dry and fancy goods proper. The census reports of the United States have divided the manufacturing industries into 363 classes, of which the dry-goods establishments of the present day contain not less than one sixth of the whole. In many of these stores are to be found nearly all the modern appointments and conveniences that serve to attract, please, and satisfy the wants of customers. The refectories, cash, delivery, sample, mailing, and express systems are now some of the more prominent features of some of these establishments, which have patrons living thousands of miles away that perhaps never visit the store, having their wants as efficiently attended to as those living nearer at hand.

While the retail branches of the trade have grown apace, the wholesale departments have not lagged behind. The older importing and jobbing centers still maintain their due share of the country's trade, but it is nevertheless centralized in fewer houses. The gain in trade and traffic by interior, Western, and Southern distributing centers represents no very material loss to the older Eastern cities, from the fact that there has been in many instances such an unprecedented increase in the wants of the people of those sections, due to growth of population, geographical and other reasons, that the organization of wholesale distributing houses there became a necessity. An estimate of the textiles manufactured in this country during the past century, based upon the United States census reports and upon the figures of reliable statisticians, would place the aggregate value of the same at over $20,000,000,000, while the imports of foreign dry-goods for the same period would probably represent one third of that amount, or nearly $7,000,000,000. Adding to this total of $27,000,000,000, the freight, insurance, exchange, and duties on the foreign part, and the sellers' profit on the whole amount as the goods reach the consumer, we would have the enormous aggregate of nearly $40,000,000,000.

The merchants of America who have handled the immense quantity of merchandise instanced have, as a rule, been men who have borne favorable comparison with those in other varied walks of life. A standard of integrity and honor was formed by the early merchants, which their successors have maintained. Before the days of "rapid transit," when a journey from Buffalo to New York was more of an undertaking than is now a trip to California or to Europe, the village merchant who made his annual or semi-annual visit to the city was the oracle of his neighborhood. His return home was hailed as an important event. He was immediately surrounded by his neighbors, anxious to hear all the news from the city. The answer as to whether goods were "high or low" settled the market with them for the season, as "new goods" would not again make their appearance for six months at least.

Those who were in a position to secure the first selections were to be congratulated. After the advent of new goods ceased to attract attention the merchant would find time to attend to certain duties which, by virtue of his position in the community, were apt to be placed upon him. As a rule, he held the office of postmaster, town clerk, school trustee, and exchange banker, for his customers. He wrote their wills, and in due time executed many of them.

Numbers of such old-time retail merchants can now be recalled by our city jobbers. They were, in the main, honest men—as is true of the great majority of the merchants of to-day. While dishonest failures occur, and always have, and always will, they are the exception and not the rule. The safety with which wholesale merchants distribute millions upon millions of dollars of merchandise far and near, throughout the length and breadth of this land, lies essentially in the fact that they are dealing with honest men, whose ambition is to make themselves more and more worthy of credit. Mutual confidence exists, and forms the basis of the immense volume of business of the present day. The aggregate transactions of a single day in any of our large houses often reach hundreds of thousands of dollars, and many of them are based upon the simple word of honor. A prominent dry-goods merchant, accustomed to large offhand transactions with his fellow-merchants, was recently closing up a real-estate deal. Being somewhat wearied with red-tape delays and repetitions, he exclaimed, "I suppose all this is necessary with you real-estate people; but in my office I would have transacted ten times this amount of business, with perhaps not a written word between my customer and myself, and our obligations to each other would have been carried out as faithfully as will these which you have taken volumes to express."

In the early days of mercantile paper, and not very far back in the century, a banker said to a dry-goods merchant, "Where is your collateral upon which you ask for this loan?" The merchant, with becoming dignity, replied, "My collateral is in my warehouses, upon the pages of my ledger, and in my bank-account. These constitute my ability to pay, and you must have faith in my simple promise to do so." Faith thus wisely placed is not very often betrayed, and commercial paper has become a safe and favorite means of investment. A leading member of the New York bar, upon a recent visit to one of our large dry-goods establishments, was greatly surprised, and expressed it as "a new revelation" to him, that thousands of packages of merchandise were shown him, the contents of which had never been examined since they left the mills, and would, without examination, be shipped in every direction, some of them thousands of miles distant, with the minimum risk that they would fail to conform to the invoice or that unjust claims would be made against them. Transactions of this character are enormous, and are made with safety. The present facilities for finding out the correct standing of "far-away merchants," not only as to their financial ability, but also as to their moral character, business habits, and general reputation, are so good that in adjusting credits space is in a great measure eliminated.

Since the establishment of the first mercantile agency in 1841, these agencies have multiplied and improved so as to be of vast service in determining credits. While far from infallible, they are indispensable. The uniform courtesy existing between merchants in the exchange of references is also of great value, and with all the means of information now at hand the "far-off merchant" worthy of credit suffers no disadvantage by reason of distance from market. While rivalries exist, and rightly so, between merchants and between cities, it is worthy of note that petty jealousies are rapidly fading away. The development of this country is so great, and the interests of the people are so closely allied to one another, that anything affecting one part of the country affects the whole, and sectional differences and strifes are rapidly disappearing. The constant growth of this country in population and wealth, and in the legitimate means of obtaining the latter, has a broadening influence upon the people. With our enormous immigration, reaching as high as 750,000 in a single year; with the admission of five States into the Union within the past five years, having an area exceeding that of Germany, France, Great Britain, Ireland, Belgium, and Holland combined; and with four Territories yet to be admitted, equaling the area of the United States in 1800, the industrial and commercial interests of this country must continue to make rapid strides forward, and the dry-goods trade will not fail to maintain its prominence as the chief distributing industry of the country.

In point of capital and labor employed, and magnitude of proportions, it has no equal. The tendency of this country to concentrate and to centralize business interests applies to the dry-goods trade in a very marked degree. The business is being more and more merged into large establishments. The present number of dry-goods houses in New York, for example, falls far below that of twenty-five or even fifty years ago; but the aggregate amount of merchandise sold there exceeds by far that in any previous period in the history of the city, and this notwithstanding the numerous large and important outlets which have since been added to the list. As an illustration of this it may be related that the head of one of the prominent dry-goods houses of New York, upon reaching his counting-room one morning since the "days of large things," opened the sales register, and proceeded to compare the sales of the preceding day with those of his first year in New York. Turning to one of his partners, he remarked, "It is rather a singular coincidence that the sales yesterday of this house exactly represent the aggregate sales of the first six months of its existence." This is but a single instance pointing to the fact that New York City, as well as the other older cities, maintains its supremacy as one of the great commercial centers of this country.

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CHAPTER LXXXVI

THE CLOTHING AND FURNISHING TRADE

THE history of the manufacture of ready-made clothing in the United States is comprehended in a period of perhaps seventy years. There do not appear to be any records of the earliest days of the trade, and its origin is lost in the obscurity of time. It is probable, however, that the cradle of this important industry, in which vast fortunes have been made and lost, was at New Bedford, Mass., where, so far as I can learn, the first ready-made clothing was manufactured to supply the immediate and pressing needs of the sailors returning from whaling voyages, or to stock their slop-chests for new adventures on the sea. These goods were of the coarsest materials, but they served the purpose. This first systematic attempt to make up clothing for immediate wear must have been at least as early as 1830, and it is possible that it was before that date. At the beginning of the century whose commercial history is comprehended in the present work, every man went to the draper, as he was called, for his raiment, as in England and in Europe generally he still does. Clothing ready to wear, according to our modern development of the idea, had not then been thought of. Whoever he was who first conceived the idea of ready-made clothing, though he left no name for posterity to honor, his invention was destined to have a great influence upon the industries of his day, and upon the commercial history of his country. Beginning in a small way by supplying returning sailors who could not wait for the usual slow processes of shears and goose, the demands increased so that presently many dealers found it expedient to make up in advance a small stock of garments, to meet a sudden, if not overcritical, demand. The idea reached Boston in due course, and then New York City, where the trade was stimulated, a few years later, by the requirements of emigrants to the newly discovered gold-fields of California. The business soon assumed a considerable importance, and the dealers began systematically to operate small factories on their premises.

In the earlier days the demand for ready-made clothing grew fastest in the West and South. In those then somewhat remote parts of the country there were not the facilities for manufacture that existed about the commercial centers of the East. The wholesale production of ready-made clothing here naturally followed. George Opdyke, once mayor of New York, was one of the earliest to engage in this business. About 1831 he commenced to manufacture clothing in Hudson Street, opening a store in New Orleans. Some three years later, his brother-in-law, John D. Scott, moved from Baptisttown, N. J., to this city, and took charge of the business of the factory, the firm being changed to John D. Scott & Company. They subsequently opened retail stores in Charleston and Memphis, which with the wholesale store were carried on until 1865, the firm being then dissolved by the death of Mr. Scott. They made their clothing of the coarser grades, largely for field hands in the South, but supplied the planters with garments of good quality. John T. Martin, who is still living in Brooklyn, went to St. Louis, where he did a very prosperous business in the days before the war, retiring upon a large fortune many years ago. Mr. Thomas Chatterton, still alive and hearty, began in New Haven as a dealer about 1840, and in 1846 he first handled ready-made clothing and entered the field as a manufacturer. In 1856 he came to New York, where his store was at 60 Liberty Street. It is interesting to note that he paid a rental for the whole building that he occupied of but $2800 a year. He afterward moved to Warren Street, the firm then being Lewis, Chatterton & Company. John H. Browning, the father of the writer of this article, commenced business in New York City in 1832 as a dry-goods jobber, under the firm name of Browning & Hull. In 1848 Mr. John H. Browning started a branch store in California, making his first shipments mostly of dry-goods; but soon changed it into a clothing store and forwarded large amounts of cheap clothing, mostly gray flannel shirts and trousers for the use of the miners. The writer of this article commenced to take charge of the clothing department of his father's business in 1850, and remained with him until the spring of 1858, when he became associated with John E. Hanford, formerly of the firm of Lewis & Hanford, and engaged in the manufacture of clothing for the South and West. Their business was exceedingly prosperous until the breaking out of the war, when they had over $500,000 worth of assets in the Southern Confederacy confiscated. After the war broke out, the firm of Hanford & Browning, in the month of May, 1861, procured a contract from Quartermaster-General Thomas, of Philadelphia, for $1,250,000 worth of clothing, which in those days was considered a very large undertaking. After this large contract had been entered into and the cloth purchased from the mills, one Saturday afternoon the firm received a telegram from Quartermaster-General Meigs, of Washington, repeated by Quartermaster-General Thomas, of Philadelphia, which read:

"We understand you have awarded a contract to Hanford & Browning, of New York City, of $1,250,000 for army clothing. Is it possible? If so, stop it at once, as it is largely in excess of any possible demand.

"(Signed) Quartermaster Meigs."

John E. Hanford immediately started for Washington, and arrived there as our soldiers were returning from the unfortunate battle of Bull Run, and, on being admitted to Quartermaster-General Meigs's office, and with him going over the figures at which the contract was taken, the firm was again ordered to go ahead and supply the goods as quickly as possible. So rapid was the demand for army goods that cloth purchased for overcoats under that contract at seventy-six cents a yard, from Hunt & Tillinghast advanced to $1.50 a yard before the contract was completed. The original price to the government for the overcoats was $6, but the price had to be raised to $10. The firm of Hanford & Browning dissolved about 1862, and the business was conducted for the next three years under the firm name of Browning, Button & Kimball, and then changed to William C. Browning & Company, under which name it continued until 1868, when the present firm of Browning, King & Company was started. The house has retail stores to-day in fifteen cities, a wholesale house in Chicago, and a large factory in New York City.

It is impossible at this date to preserve anything like a chronological order in recalling the names of others of the early manufacturers whose operations developed the industry that to-day has attained such great proportions. But among them, as they are called to mind haphazard, were John T. Martin & Company, from whom, through a succession of changes, has sprung the present house of Rogers, Peet & Company, in which Mr. Martin is a special partner, and his son, William R. H. Martin, is a partner; Brooks Brothers, who started business at Catherine and Cherry streets in 1845, trading with the sailors along the water-front, and whose descendants still conduct the business at Broadway and Twenty-second Street; Lewis B. Brown & Company, who were in the Southern trade, and the head of which, having been forced under by the war, went into the real-estate business and founded the New Jersey summer resort called, in imitation of his own name, Elberon; A. T. Bruce & Company; Little, Pyan & Carhart, afterward, in 1862, becoming successively Schaeffer, Whitford & Company, Carhart, Whitford & Company, and, in more recent days, Hackett, Carhart & Company; H. & J. Paret; Daniel Devlin; C. T. Longstreet & Company; Archibald Young & Company; and Garrett, Young & Scott. Among other ante-bellum clothiers who have since achieved distinction in other fields of activity are the late Jesse Seligman, who began as a clothing dealer, then engaged in selling British dry-goods, and finally wound up in the banking business in Wall Street; and John J. Cisco, at one time assistant subtreasurer of New York. In those early days there was but a single Hebrew in the wholesale business; but a large number of Hebrews went to California as retailers of goods made in New York. They made a great deal of money, partly by the difference in exchange. Now the big wholesale business is largely in the hands of the Jews, as one may see by the bewildering array of signs in Broadway; while the retail business is largely in the hands of Christians.

The breaking out of the war caused great changes in the clothing business. Many New York manufacturers having a large trade with the South lost enormous sums, while others whose trade was in the West and North derived great benefits by the sudden demand for clothing in large quantities. Mr. John T. Martin and many others did a very large business in manufacturing uniforms for the government troops. These goods were made in the homes of the workmen at first, but afterward, as the demands increased, factories were established, and the business was greatly stimulated. The unsettled conditions, due to the prolongation of the war and the depreciation of the certificates with which the government paid, made the business one of many hazards; but a few of the larger and more responsible dealers, having faith in the government, reaped their reward in the reëstablishment of credit and the corresponding appreciation of the government certificates from seventy or eighty cents to par. In the fall of 1865, when the war closed, the clothing business took its greatest jump, and the manufacturers were not able to supply the immediate demand for clothing for the soldiers returning home. Millions of dollars were spent for clothes that year.

The first circumstance to increase the powers of production to a point somewhat equaling the demand for cheap clothing was the introduction of the Singer sewing-machine about the year 1850. It was not regarded as wholly satisfactory at first, because machine-stitching would rip, and the hand-made garments were much firmer. The invention of the lock-stitch, remedying the principal fault, brought the machines into general use, and made possible the manufacture of the enormous volume of clothing used during the war. Previous to the invention of the sewing-machine clothing had of necessity been made by hand, and great quantities of it were sent out to the country towns round about New York, Boston, and Philadelphia, to be sewed by the wives and daughters of farmers and sailors through the winter. This clothing was used to supply the country trade, and was not as fine as that made in the cities; for, as a rule, the labor employed in the villages was cheap and unskilled.

It was not until some years after the war—perhaps about 1870—that cutting-machines were first introduced into the wholesale manufacture of clothing. The long knife was the first improvement upon the old-fashioned shears of former years, and this, operating something like a saw, made possible the cutting of some eighteen thicknesses of clothing to one thickness cut by shears. The Fenno and Worth cutting-machines came later, the blade being a circular disk, revolving rapidly, and cutting as many as twenty-four thicknesses of clothing with the speed and accuracy of a buzz-saw. By these modern agencies hundreds of suits can be cut and sewed by machinery in the time formerly required by the delving draper in fashioning a single garment. The ancient goose still holds its supremacy, however, as the only accepted implement for pressing garments, no improvements having suggested themselves in its form. Electricity has, however, taken the place of the furnace, in some instances, for heating the goose.

As the industry grew apace, and the number of persons to whom it gave employment increased, a certain method was naturally evolved, and a division of labor was arranged by which specialists in different details of the work of manufacture were developed. Formerly one tailor made a whole suit; now a dozen hands may be employed to advantage on a single garment. There is, first of all, the skilled designer, upon whose taste much depends in these *fin de siècle* days; the cutter, who in the best-regulated shops is a deft artist in his way; another sews certain parts of a garment only; there are vest makers and "hands on pants," as the phrase is; and still others make buttonholes, that difficult operation now being performed by machinery.

Clothing for boys developed separately and along its own lines. Smith & Davidson were among the earliest to devote themselves to children's garments. During the war the firm became Peck, Randolph & Smith, and in 1865 Mr. Smith went to Williamsburg and started the present house of Smith, Gray & Company. W. T. Runk & Company was another pioneer house in the manufacture of clothes for boys, and it continues to-day under the firm name of Hippel, Tillard & Runk, a son of the founder of the house perpetuating the name. Dayton & Gilbert were very large handlers of children's garments, and the house still survives as Dayton & Close. William Banks & Company, in Chambers Street, and Barrett & Schaeffer, in Murray Street, were also in the business up to the time of the war. Previously children's clothing had been made at home, as women's gowns are nowadays, by dressmakers.

With all these vast improvements in the methods of manufacture came a wider demand for clothing of higher grade, and at about the time of the close of the war persons of taste began to wear ready-made garments. A few leading houses in New York led the way, and, though progress was slow, little by little the early prejudice, founded upon the character of the "slop" clothes first introduced, was overcome. Men who had fancied that they could never wear "hand-me-downs," as they were vulgarly called, soon found that neither in respect of style nor materials was the best ready-made clothing inferior to the handiwork of the merchant tailor. That point being once made clear, there was a wonderful advance in the quality of goods manufactured, until to-day one can hardly fancy what an uphill road the early manufacturers traveled before the high quality of their wares was recognized. Now perhaps nine tenths of the men and boys of the country wear clothing made ready to put on, and they are as well dressed as the other one in ten. The custom tailor still has, and I do not doubt will retain, a monopoly of those extreme fancies of the fashionable which justify their claims to exclusiveness. But the multitude is clothed by the clothier, not by the tailor, if that distinction be recognized. And if it be true, as I think it is, that the condition of a people is indicated by its clothing, America's place in the scale of civilized lands is a high one. We have provided not alone abundant clothing at a moderate cost for all classes of citizens, but we have given them at the same time that style and character in dress that is essential to the self-respect of a free, democratic people. In Europe no such advance has been made as yet, although a considerable quantity of ready-made clothing is manufactured in Germany, France, and England. They have not, however, progressed far beyond the point at which we started.

Statistically speaking, the figures of the trade are difficult of access. In 1860 there were 303 manufacturers in New York, making goods to the amount of $17,011,370; and there were 352 manufacturers in Philadelphia, producing goods worth $9,984,497. According to the Census Office reports we find that in 1890 woolen goods and worsteds manufactured in the United States amounted in value to $338,000,000, and cotton and silk manufactures respectively to $268,000,000 and $87,000,000. In the same year the importations of the materials reached $120,000,000, showing a consumption of more than $800,000,000. It is estimated that the value of clothing as sold to the people and made in part of these materials could not have been less than $1,500,000,000. More than three fourths of the woolen cloth made in this country is consumed in the manufacture of ready-made clothing, the remainder going to the individual merchant tailors. A considerable proportion of imported woolens is used also in goods of the better class.

The figures that follow are from the United States census returns for the five years indicated in the table. They present, more compactly than I could put the facts in any other form, a view of the extent and development of the clothing industry since 1850. It must be stated that the figures for 1850 include the clothing and tailoring trades together. Here is the summary:

PRODUCTION OF MEN'S GARMENTS.

Year.	Capital.	Wages.	Materials.	Products.
1850.	$12,509,161	$15,032,340	$25,730,258	$48,311,709
1860..	27,246,093	19,856,246	44,149,752	80,830,555
1870..	49,891,080	30,535,879	86,117,231	147,650,378
1880..	79,861,606	45,940,853	131,363,282	209,548,461
1890..	154,202,672	70,143,627	206,622,553	308,726,786

It was about the year 1870 that art entered definitely into the manufacture of clothing. Following the panic of 1873 there was a great increase in the patronage of the ready-made clothing dealers. At that time the quality of the goods made was raised, and the competition between the clothiers and tailors was more nearly on even terms.

The following table shows in what degree the business of manufacturing clothing has spread out over the country in recent years.

MANUFACTURE OF CLOTHING IN THE PRINCIPAL CITIES IN 1890.

	Number of Establishments.	Capital.	Wages.	Materials.	Products.
New York	1,554	$48,591,055	$22,548,892	$31,240,450	$68,630,780
Chicago	186	19,564,525	3,147,822	17,557,792	32,517,226
Philadelphia	222	17,561,257	4,631,991	12,318,810	21,103,220
Boston	191	15,792,768	3,311,837	10,916,407	19,672,404
Cincinnati	459	14,841,040	4,302,121	8,309,323	17,982,123
Baltimore	125	11,897,563	4,178,971	8,120,981	15,032,924
Rochester	199	7,488,446	1,644,334	5,172,185	9,538,962
Cleveland	24	1,618,178	868,179	2,431,169	3,972,392
Milwaukee	20	3,587,458	632,237	2,099,612	3,541,369
San Francisco	88	2,407,849	1,228,063	1,483,256	3,315,043
Utica	11	2,655,888	639,774	1,583,292	2,833,308
Buffalo	34	2,089,957	686,378	1,584,806	2,520,143
Newark, N. J.	93	1,251,287	850,945	774,831	2,485,395
Syracuse	92	2,422,392	588,379	708,400	1,776,500
Louisville	14	1,202,772	368,323	1,176,692	1,920,250
New Orleans	23	1,230,237	515,381	1,144,547	1,884,747

Of the furnishing-goods trade I can speak only at second-hand. In the year 1820 nearly all of New York's wholesale business was located in Pearl, Water, Cliff, and adjacent streets south from Fulton

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Street; and William Street was the great thoroughfare of the New World metropolis—then a city of 120,000 inhabitants. Two years later, in 1822, was established the firm of Luke Davies, which later became Luke Davies & Son, and subsequently passed out of existence with the failure of their successors, Robert K. Davies & Company, in 1890. Mr. Luke Davies was not only the father of what has since grown to be a large branch of trade, but also the godfather, as he gave the industry its name of "furnishing goods." It was in a building at the corner of William and John streets that this firm had its rise. At that time traveling salesmen had not been invented, and the annual or semiannual visit of the country merchant to New York was an event for him,—and for the jobber,—for during the spring and fall seasons the rush of trade was enormous. Of the country buyers visiting New York, those from the East and North came by Long Island Sound or the North River on sloops or schooners. Over the wholesale and retail stores were boarding-houses where the country merchants stayed while buying goods. There were not many American manufacturers then, and nearly everything that one could wear was imported.

The origin of the men's furnishing trade began with the demand for custom shirts; and as the business of manufacturing shirts increased, other lines were added, as, for example, the making of "stocks" (for neckwear), suspenders, and jean underwear.

Out of the house of Luke Davies have come nearly all of the long-established houses now existing in the trade. In 1857 Joseph S. Lowrey left Davies to organize the firm of Lowrey, Donaldson & Company, which is now conducted under the firm name of Joseph S. Lowrey & Company; in 1867 Messrs. Fisk and Flagg also left the Davies establishment, and founded the present firm and business of Fisk, Clark & Flagg; and from these two branches have grown many of the firms which now control the largest lines in special departments in the manufacture of men's wear.

In 1832 the shirt trade of America was founded as a systematic industry by David & Isaac N. Judson, at that time prosperous clothing merchants in William Street. They had considerable trade with the South, —for in that day luxurious expenditure was mainly confined to that section,—and orders for clothing were frequently accompanied by orders for "custom-made" shirts, whose execution they intrusted to casual seamstresses. Orders for this class of goods increased steadily, and soon a regular department became necessary; and out of this grew the manufacture of "stock" shirts, in distinction to custom-made. What was incidental before 1832, in that year had become of sufficient importance to require a separate establishment, and the first shirt factory in America was founded at the corner of Cherry and Market streets, New York. The old building is standing yet, in a district not much altered by the passage of sixty years, and looking much as it did then, except for the change in the human surroundings that attends the expansion of a little city into a great metropolis. For eight years the Judsons were the only manufacturers of shirts. In 1840 the house of Davies established their factory, and the firm of T. A. Morison & Company also began operations, the latter firm still existing under the title of Hutchinson, Pierce & Company. The manufacture of each of the articles which are comprised in the aggregation known as men's furnishing goods has become a separate industry within the last decade, and the trade is now divided into many branches, of which shirts, collars and cuffs, underwear, neckwear, hosiery, etc., each forms a distinct industry, requiring special skill and special machinery in its manufacture.

It is interesting to recall the fact that the inventor of the Winchester firearms was one of the early manufacturers of shirts; and the circumstances under which he found himself in the business are curious. He was a carpenter in Baltimore, and had fitted up a furnishing-goods store there for a man who had previously failed. Mr. Winchester took the stock as security for his bill, and came to New York for advice as to the expediency of continuing the business himself. He went to New Haven in the early forties to open a shirt factory, and began with one assistant to cut out shirts. It was not long before he was turning out 2000 dozen a week. But Mr. Winchester was a restless genius, and with the outbreak of the war he turned his attention to firearms, and became interested in the manufacture of the weapon that has since made his name famous.

Wm. C. Browning

CHAPTER LXXXVII

THE BOOT AND SHOE TRADE

THE progress of the last century has brought a marvelous change to the "gentle craft" of St. Crispin. The huge, many-windowed factory has superseded the quaint little shop, and whirring wheels and busy machines have replaced the lap-stone, waxed thread, and awl of the old-time shoemaker. Everywhere there are changed methods; supply, manufacture, and demand have varied with the times and are now altered permanently. The only unchanged fact is that the children of men are born barefoot and must devise their own protection. History goes not back to the time when this need has not been recognized and met. The sandal of Greece and Rome, the sabot of the European peasant, the moccasin of the red man, the queer little stilts of Japan and China, as well as the footwear of our modern civilization, all show that the boot and shoe industry is founded on man's necessity—that the business is a legitimate one, and, when conducted with prudence, industry, and enterprise, should offer a fair return to men who have been trained to it.

The shoemaker was among the earliest of the craftsmen to seek the American colonies, and we find recorded in an old document, under date of 1629, that Thomas Beard, with "hides, both upper and bottom, was shipped out" on the *Mayflower*. The governor was recommended "to give him lodging and diet." Fifty acres of land were also allotted to him.

One Isaac Rickman is also mentioned as having been sent out at this time, but no further trace of him appears; whereas Thomas Beard arrived duly, is frequently mentioned in the chronicles of that day, and is undoubtedly the first in the great army of workers that has since raised Massachusetts to the industrial distinction of producing annually more footwear than any similar area of country in the world. Lynn, the "city of shoes," was a later settlement; Philip Kertland and Edmund Bridges arrived there as early as 1635 and worked at their trade of shoemaking.

In the years 1633, 1634, and 1635 we find Thomas Wardhall, Richard Scott, Angel Holland, Edmund Jackson, and James Everell shoemakers in the town of Boston. The latter was selectman from 1647 to 1649. Employing several journeymen, he built up a considerable business, including some foreign trade. He owned the property now bounded by Hanover, Elm, and Union streets. In 1641 the town authorities gave him permission to sink a pit, "so he cover the same," to water his leather in. He died in 1683, possessed of considerable wealth for the times. In consequence of his efforts Boston at that time took the lead in the manufacture of shoes.

William Copp, who owned Copp's Hill, carried on the business in 1640. In 1648 the General Court passed a law incorporating the "shewmakers" of Boston and vicinity, to regulate the trade, for three years. These and others like them manufactured in a small way, without much change during the next hundred years, making shoes to measure for the well-to-do, and a commoner article to be sold in the country stores. Many goods were imported from England; still the number of shoemakers increased with the population, and the production of ready-made footwear kept pace with the growth of the country, especially in Lynn, where in 1750 there were three manufacturers who employed journeymen. In that year one John Adam Dagyr, a Welshman by birth, began manufacturing, and won a reputation for his shoes throughout the colony.

During the Revolution most of the shoes worn by the Continental army, as well as nearly all ready-made shoes sold throughout the colonies, were produced in Massachusetts, and we find it recorded that "for quality and service they were quite as good as those imported from England." Immediately after the Revolution, in consequence of large importations, the business languished somewhat. It soon recovered, however, and was pursued with such vigor that in 1795 there were in Lynn 200 master workmen and 600 journeymen, who produced in the aggregate 300,000 pairs of ladies' shoes. One manufacturer in seven months of the year 1795 made 20,000 pairs. In 1778 men's shoes were made in Reading, Braintree, and other towns in the Old Colony, for the wholesale trade; they were sold to dealers in Boston, Philadelphia, Savannah, and Charleston, a considerable portion being exported to Cuba and other West India islands.

About the year 1795 the business was established in Milford and other Worcester County towns, where brogans were made, and sold to the planters in the Southern States for negro wear. The custom at this time was for the manufacturer to make weekly trips to Boston with his horse and wagon, taking his goods in baskets and barrels, and selling them to the wholesale houses. He was often met at Charlestown Bridge or Boston Neck by the more enterprising dealers, who were thus able to get the first selection of whatever the manufacturer had to sell. Until 1815, with the exception of a few shoes which had been made copper-nailed for export to Cuba, all footwear was hand-sewed; the coarse and heavy boot was welted, while light shoes and slippers were turned. But in the year 1811 wooden shoe-pegs were invented. They came into general use in 1815, and may be said to have brought about the first revolution in the method of shoe manufacture.

Before that time, for centuries, the industry had remained at a standstill so far as improved methods were concerned. The shoemaker sat on his bench or "seat," cut with a knife the upper and sole leather from the side, stitched the upper, while held in a clamp, with awl and waxed end, hammered the sole on a lap-stone, and sewed it on by hand, turning out a complete shoe from beginning to end with hardly any other tools than a hammer, awl, and knife, and a wooden shoulder-stick, with which he finished the edges. Every operation was done precisely as his fathers had done it before him. Indeed, the shoemaker himself often fashioned the lasts from the wooden block to fit the feet of his customer.

Now began what has developed into that marvel of mechanical ingenuity and perfection of method—the modern shoe factory. In Randolph, Abington, Holbrook, and Quincy, in the Old Colony; in Lynn, Salem, Topsfield, Georgetown, and Haverhill, in Essex County; in Stoneham, Reading, and Marlboro, in Middlesex County; and in Milford, Brookfield, and Spencer, in Worcester County, shoemakers hired a few of their fellows and gathered them into what was then called a shop, one cutting the leather, others fitting or sewing the uppers together, and still others putting the uppers and soles together, or bottoming them, much the same as had been done when each shoemaker worked individually. The partial division of labor was a success at once, and soon the uppers were sent out to women and children to be stitched together and bound. "Hannah binding shoes" might have been found in almost every home in the shoe towns in eastern Massachusetts. Little eight-by-ten-foot shops were scattered all through the South Shore, in Essex and Middlesex counties, and in some portions of Worcester County, where the shoemaker with his sons, and perhaps a neighbor, made a "team" which took the fitted uppers and the understock from the manufacturer in a near-by town and bottomed the shoes or boots. One did the lasting, another the pegging (the boys, and sometimes the girls, were taught this branch), another the trimming, and still another the edge-setting; but all was done by hand. When the shoes were made they were taken to the factory, which, although considered at that time a wonder, was but little larger than the offices of some of our modern establishments. Here they were finished, packed in wooden boxes, and sent to the market. In this way the industry prospered, being carried on without any further marked improvement in methods until about 1850, when machinery was introduced.

The first machine to be of practical use was the rolling-machine, by which a man could do in a minute what would require half an hour's hard work with a lap-stone and hammer. Next came the splitting-machine, in 1855; then, in 1857, the racing-machine, to cut the leather from the side into strips. These were all worked by a crank and turned either by hand or foot, and were used to prepare the sole-leather for the shoemaker. The sewing-machine had been invented by Elias Howe in 1845, and came into practical use in 1854. A patent for a hand pegging-machine had been taken out in 1833 by Samuel Preston, of Danvers; but it seemed not to have been a commercial success, for most of the shoes were pegged with hammer and awl until 1851, when A. C. Gallahue, Elmer Townsend, and B. F. Sturtevant patented a pegging-machine which cut and drove a peg from a prepared strip. Although this machine was invented in 1851, it was not perfected so as to become of practical use until 1858 or 1859, when power had been applied to drive machinery.

In 1855, William F. Trowbridge, of Feltonville, Mass. (then a part of Marlboro, now the town of Hudson), a partner in the firm of F. Brigham & Company, conceived the idea of driving by horse-power the machines then in use. In a building attached to the factory he established a sweep, around which a horse known for a score of years in that section as the "Old General" provided the first power other than manual which ever drove shoe machinery. For some years prior to that time two or three stout Irishmen had supplied the motive power in this factory. Soon afterward steam power was used in the factory of John Hill & Company, Stoneham; and one after another of the larger manufacturers throughout the Eastern States found it necessary to adopt modern methods, so that after the year 1860 there were very few of any pretension who did not use either steam or water power to drive their machinery. This opened up the way for numerous improvements. None was of more importance than the Howe sewing-machine, which was now brought into general use. Waxed-thread sewing-machines were also introduced in 1857, by which the uppers of nearly all heavy shoes are stitched together. Buffing-machines had been run by foot as far back as 1855, but were now all driven at high speed by power. Power-machines for dieing out soles and heels were introduced in 1858.

Probably no other machine has caused so great a revolution in the business as the McKay sewing-machine, which came into use in 1860. With it a man can sew the soles of 500 or 600 pairs of shoes in a day. In 1874 there were 1200 of these machines in use in the United States; in 1878 there were 1600, sewing 60,000,000 pairs annually; in 1881 there were 2000 machines, sewing 82,000,000 pairs; and in the present year (1895) there are 4000 machines working more or less, business being rather dull, and the production is estimated at 120,000,000 pairs. The Bigelow heeling-machine, which presses into a solid mass the leather heel and sets the nails ready for driving, and also a machine, called the Bigelow attacher, which drives the nails and attaches the heels, were introduced in 1870. The McKay heeling-machine, which does the same work and also trims the heel, came into use in the same year. In 1871 heels were put on to over 10,000,000 pairs of shoes by the McKay and Bigelow machines; in 1876 over 27,000,000 pairs; in 1881 over 45,000,000 pairs; in 1886, 59,000,000 pairs; and in 1890 over 72,000,000 pairs.

Heel-burnishing machines had been used since 1865. Another important invention shaping the advance in shoe manufacturing was the cable screw wire-machine, invented in 1869, which fastened the sole and upper together with wire, very much as had been done before with pegs. This machine was superseded in 1875 by what is now known as the standard screw wire-machine, which connects the sole with the upper by turning in a screw and automatically cutting off just the right length, making one of the strongest fastenings possible. The edge-trimming machines, chief of which is the Buzzell, were generally introduced in 1876. Various attempts have been made since 1860 to introduce machines for lasting, and there have been in use for some years several which successfully perform the work; they are fast superseding hand-work.

Another great change in the industry has come with the Goodyear welt-machines, which were introduced in 1877, and are now in general use throughout the United States and many foreign countries. By the Goodyear process a shoe is produced very much the same as by the hand-sewed workman, one machine sewing on the welt and another afterward stitching the sole to the welt. In 1880 250 of these machines were running, on which were sewed 2,000,000 pairs of shoes; in 1885 500 machines sewed 4,000,000 pairs; in 1890 1500 machines sewed 12,000,000 pairs; in 1895 2500 machines will sew 25,000,000 pairs. The Campbell lock-stitch machine for stitching the out-sole to the welt was perfected and brought out in 1884, and is used extensively. The Campbell welt-sewing machine was successfully introduced in 1890. The Eppler welter and stitcher have been in successful operation for several years.

All of these machines have shortened and simplified the processes until it is quite within the truth to say that the product of the labor of one man in the modern factory is equal to a dozen on the bench in 1830. While the improvement in method has greatly cheapened the cost of shoes to the wearer, the skilled shoemaker has earned steadily increasing wages. Early in the century, after having served his seven years' apprenticeship, the journeyman shoemaker, if he were active and industrious, could earn $4 to $6 a week. In 1895 the skilled workman is not satisfied with less than three or four times as much.

Although on going through a modern shoe factory one would think perfection had been reached, no season passes without the introduction of some new machine which works a revolution in its particular sphere.

Until well along in the present century there was

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little attempt to establish the shoe industry outside eastern Massachusetts. Yet it was not to be expected that other enterprising sections would be content always to depend entirely on New England for so important an article of merchandise as shoes. In New York City and other cities of New York State, especially in Rochester, the industry has attained large proportions, and has reached a perfection not excelled anywhere. In Newark, N. J., where the business was early established, are made many of the finest shoes for men's wear. Philadelphia has made the shoe industry a leader among the many manufacturing industries for which she is celebrated. At Cincinnati and St. Louis ladies' shoes are produced in great quantities, and of a style and finish that have won a reputation. Chicago has taken up the business with an energy that has already placed her in the front rank. Many of the pioneer shoe jobbers of her early days came from Massachusetts, where they had learned the business; and in the year 1895 she boasts of several factories which equal any others in the country. There is hardly a town of any pretensions that has not its shoe factory, either built or projected. Too many of them, however, are already monuments which tell the old story that a fine building, even when backed by capital contributed by the citizens of a town, is not a guaranty of financial success. In these days of sharp competition a knowledge of the business and a corps of trained shoemakers are requisites which cannot be dispensed with. Still throughout the West, including the Pacific coast, there are many thoroughly equipped, financially successful shoe factories.

Notwithstanding the enterprise of other parts of the country, New England still maintains the lead as the home of this industry. She has steadily advanced, the average increase being about $4,000,000 a year, until in the year 1894 there was produced within her borders an aggregate output valued at about $150,000,000. Boston is the center from which are sold nearly all the goods made in New England, amounting to about two thirds of the entire production of the country. The following table, giving the number of cases shipped annually from Boston for the years mentioned, will show the steady increase in the business. This represents but a part of the New England production, many goods being shipped to the West and South directly from the factories.

Year.	Cases.
1859	684,708
1865	718,660
1870	1,250,201
1875	1,449,180
1880	2,263,890
1885	2,717,795
1890	3,533,239
1892	3,709,564

When it is further considered that the flourishing New England cities and towns of Lynn, Brockton, Haverhill, Marlboro, Milford, Whitman, the Weymouths, and many others, are built up and maintained solely by the boot and shoe and allied interests, the force which this industry has exerted on the community at large becomes apparent. Among the cities of the country where the manufacture of boots and shoes in 1890 constituted all or a portion of the manufacturing industry were the following:

Cities.	Factories.	Capital.	Wages.	Material.	Product.
Lynn	323	$10,569,470	$6,832,938	$14,757,089	$25,850,005
Philadelphia	93	4,185,794	2,391,509	3,151,927	6,851,834
Rochester	51	3,734,025	1,913,625	3,456,385	6,489,382
Brockton	73	6,180,188	4,916,936	8,844,474	16,171,624
Haverhill	201	5,926,222	4,445,164	7,339,815	14,963,642
San Francisco	55	2,425,617	1,228,063	1,483,256	3,315,043
Brooklyn	65	1,327,119	1,032,547	1,432,934	2,813,209
St. Louis	24	4,170,027	1,155,635	2,107,854	4,250,961
Detroit	7	975,907	476,424	913,916	1,611,700
Cincinnati	28	2,029,194	1,554,416	2,622,293	5,032,980
Newark	17	1,190,083	899,797	894,897	2,216,129
Worcester	22	2,042,743	927,084	2,125,358	3,503,877
Milwaukee	17	1,909,255	483,472	818,070	1,617,534
New York	76	2,033,273	1,994,163	2,473,015	5,306,411
Chicago	44	3,133,289	1,749,095	3,977,429	7,257,034
Marlboro, Mass	18	1,437,861	1,463,897	3,889,988	5,831,028

To show the magnitude and importance of this industry to the whole country, and its steady growth, the following comparison from the census of 1880 and 1890 will be interesting:

BOOTS AND SHOES—FACTORY PRODUCT.

	1890.	1880.
Establishments reporting	2,082	1,959
Hands employed	139,333	111,152
Value of material	$118,735,831	$102,442,442
Value of product	$220,649,358	$166,050,354

BOOTS AND SHOES—CUSTOM WORK.

	1890.	1880.
Establishments reporting	20,803	16,013
Hands employed	35,448	22,667
Value of material	$10,403,383	$12,524,133
Value of product	$34,856,651	$30,870,127

Besides the above, in 1890 there were $3,346,000 worth of boot and shoe uppers manufactured and sold. In this same year there were sold about $3,500,000 worth of boot and shoe findings, about $3,000,000 shoe-blacking, and nearly $18,000,000 boot and shoe cut stock. There were manufactured and sold about $1,239,065 worth of lasts.

For an intelligent understanding of the position this industry has secured in the various sections of the United States, the following table, made up for the year 1890, will be interesting:

States and Territories.	Establishments Reporting.	Value of Products.
California	56	$3,395,043
Connecticut	20	1,535,125
Georgia	3	18,542
Illinois	56	8,756,824
Indiana	6	179,936
Iowa	6	574,378
Kentucky	11	526,387
Louisiana	17	968,017
Maine	53	10,335,342
Maryland	28	1,533,761
Massachusetts	1,057	116,387,900
Michigan	12	2,065,531
Minnesota	8	2,032,814
Missouri	29	4,841,004
New Hampshire	64	11,986,003
New Jersey	109	7,255,409
New York	257	23,661,204
North Carolina	4	155,900
Ohio	63	8,489,728
Pennsylvania	158	10,354,850
Rhode Island	3	158,800
Texas	3	109,850
Vermont	7	529,486
Virginia	7	1,279,069
Wisconsin	32	2,972,233
All other States and Territories	13	546,222
Totals	2,082	$220,649,358

No account of the manufacture of boots and shoes could be complete without reference to the employment of convict labor. The business offers many advantages to the authorities of prisons who are seeking work for the men and women in their charge which will bring some remuneration to the State. The great number of operations in producing a shoe make it possible to use all classes of convicts, from the strong to the weak; and as far back as 1850, even before machinery was introduced, it was not an uncommon thing for houses of correction and prisons to produce footwear not only for their own convicts, but to be sold in the market. After the introduction of machinery, and during the demand for cheap shoes which followed the close of the Civil War, many of the States leased the labor of their convicts to shoe manufacturers. In the year 1870 there were employed in this industry in twenty-six different States 6581 convicts, while there were only 129,989 employed in the industry in the same States outside the prisons. In the fiscal year 1886 there were made by 7609 convicts 6,634,960 pairs, valued at $10,990,173. It is difficult to get reliable figures since 1886, but it is probable that the number employed and the annual production are steadily increasing. In States where the system was believed to have a harmful influence on the wages of the workmen outside the prisons the business has been conducted on the States' account, and in some instances, at least, the result has been disastrous. Attempts have been made, in the supposed interest of labor, to forbid prison authorities to use the convicts in any industry which would compete with outside labor. At the present time, and in view of the fact that the boot and shoe factories of the United States can produce in nine months all of the shoes required for consumption in twelve months, and that convicts must be worked nearly every week-day of the year, their employment at shoemaking must have more or less effect on the market.

What were called "gum shoes" had been imported from South America for some time prior to the discovery of the vulcanization of rubber by Goodyear in 1844, although this event laid the foundation of the present prosperous business of manufacturing rubber boots and shoes. In its discovery and early manufacture this industry is purely American, and as early as 1847 we were sending to foreign countries, in limited quantities, the product of our American rubber factories. The business was first established in Rhode Island and Connecticut; later several large concerns were located in New Jersey. Its growth has been steady and sure until the present time. The following table, taken from the census, will show that the business nearly doubled in magnitude from 1880 to 1890:

	1890.	1880.
Establishments reporting	11	9
Hands employed	9,264	4,662
Value of material	$11,650,787	$6,023,053
Value of product	$18,632,060	$9,705,724
Wages paid	$3,966,875	$1,469,038

The amount exported is shown by the following figures: 1885, $89,216; 1890, $149,000; 1892, $183,000; 1893, $252,000. In 1894, probably on account of a sharp rise in prices, it fell to $153,000;

but there is now evidence that the export trade in these articles for 1895 will show a large increase.

In the colonial days there was but one profit, to be paid by the consumer; the shoemaker and retail dealer coming directly together. The merchants sold shoes over the same counter with rum, molasses, dry-goods, hardware, and provisions. It seems certain that one Isaac Ellerton, of Plymouth Plantation, was the first American shoe dealer. In 1628 he was commissioned by Governor Bradford and a syndicate of colonists to proceed to England and purchase a stock of shoes, hosiery, and linen cloth. The syndicate subscribed $250, with which capital the venture was made and proved successful. It was only in the more remote districts and among the poorer settlers, who were contented with a coarse grade of goods, that ready-made shoes found much favor. Barefooted men and women about the clearings and farms were not rare, but the wealthy classes, merchants, and landed gentry all employed the custom shoemakers. For these reasons the boot and shoe trade was but an ordinary item in the ledgers of the general store until well along into the second and third decades of the present century. Nearly all the wholesale dealers of that day were jobbers as well, and the South and West were the great markets. St. Louis was the distributing center for the Southwest, and Savannah for Georgia and the Southern coast region. The New England wholesale dealers sold boots and shoes to the grocers, dry-goods and hardware men throughout the country as well as to the shoe dealers proper. Cases of Massachusetts shoes were kept in country stores all through the South and West, for which the small trader paid only as he sold.

Among the men who were identified with the boot and shoe trade and leather manufacturing about the time the present century opened were Perez Bryant & Company (1810), Isaiah Faxon (1812), Silas Tarkel, Asa Hammond, Amos Stetson, Samuel Train, E. Thayer & Company, Lee Claflin, and T. & E. Batcheller, of Boston; Sheppard Knapp and Gideon Lee & Company, of New York; Nathan Tufts, of Charlestown; the Southwicks, of Vassalboro, Me.; Hunt & Loud and H. H. Reed, of Weymouth; Arza Keith, of Abington; and Isaac Prouty, of Spencer.

In 1828 the total sales from Boston by jobbing-houses were over $1,000,000, and there were four jobbing-houses in New York, who together sold $600,000. From 1828 on, with the exception of 1837 and 1838, the trade in Boston increased very rapidly, until in 1856 there were 200 wholesale and jobbing houses, with domestic and foreign trade annually of over $50,000,000. In New York City there were fifty-six houses, that sold annually $15,000,000. From 1830 on, jobbing-houses were established in all the larger cities of the West and South, which handled boots and shoes and hats and caps. They bought their boots and shoes of Eastern manufacturers on six, eight, and ten months' time, and sold them to their customers to be paid for when the crops came in. The manufacturer seldom received any ready cash. He took notes and depended upon discounting them in bank for money to carry on his business, although at that time he bought his leather on time and made contracts with his help for six months. Settlements were made only at the close of the contract. The employer issued a species of currency called "orders," which could be used at certain specified country stores, so that the workman could obtain necessary supplies; but very little money was ever seen excepting on the semi-annual settlement day. To be sure, by allowing a large "shave," the workman was sometimes able to get his "orders" cashed. It was not uncommon for a well-to-do employer to add to his gains by shaving his own orders.

It can be readily seen that this system of extended credits was dangerous, and the usual result followed in the panics of 1837 and 1857, when many of the large jobbing-houses and manufacturers suspended payments, the Eastern manufacturer having his own notes to take care of and also the notes of his customers which he had indorsed for discount in the bank. It was not an unusual thing for men who were, without question, perfectly solvent to suspend and get an extension on their notes. It was a common thing for the Southern and Western jobbers to expect an extension without any suspension of business. When the Civil War broke out in 1861 large sums were owing to Northern manufacturers by the jobbers in the Southern States. To their great honor, some who were able paid their indebtedness in full at the close of the war; others paid what they could; but more were so impoverished that they could pay nothing. The losses were so great in 1861 that many manufacturers who had supposed themselves wealthy became insolvent. But values, measured by the currency of the country, rose so rapidly after the breaking out of the war that men of enterprise quickly recovered their financial position. It was only necessary to buy merchandise; the profit was secured by the steady advance until toward the close of the war. During this time paper money had grown so plentiful that there appeared in the market an occasional dealer who was ready to pay cash; the usual terms of sale were six months' time or five per cent. off for cash in thirty days. Still the old-time jobber, although he might believe himself wealthy, remained steadfast to his plan of giving his six months' note, selling his merchandise on time, and often extending to his country customer an additional six months, charging and receiving his twenty-five to fifty per cent. profit; while at the end of each year he had less money than the year previous, he could figure on paper that he had made a handsome gain.

But the dealer who paid cash for his goods, getting all the discounts and all the advantages that cash may bring, could sell to retailers who paid him cash at a very much less profit than the old-time jobber thought it was possible to do business upon. Very naturally this new class of jobbers gathered round them the best and more enterprising of the trade, leaving the chaff for their less active competitors. The panic of the year 1873 brought this condition of affairs to a climax. Many of the long-credit houses were forced to suspend payment, and few paid anything more than a fraction of their indebtedness. Since that time on the business has been on a much better basis, so far as losses by bad debts are concerned; but the intense competition, by both manufacturers and dealers, has reduced the profits to a point where a large business must be done in order to make any considerable volume of annual gain. While in 1860 a jobbing-house that did a business of more than $300,000 was an exception, there are in 1895 several throughout the country that claim to do between $4,000,000 and $5,000,000 annually, and the house that does less than $1,000,000 is considered of third or fourth rank.

In 1860 one or two styles of lasts were considered sufficient for a manufacturer to use on any particular line of goods; now no stock is complete that does not have many different styles and many widths of each style, so that there can be found something that will fit nearly every foot.

The quality of the goods, also, has been so materially improved that the tastes of the average consumer can be met at the counter of any good retail store. For this reason the custom of making shoes to measure is passing away. The factory-made goods are in such complete variety that the most fastidious can find something to their taste without the delay of waiting for special workmanship. This great variety compels the wholesale dealer who will be up to date to carry a large stock, and in the busy season it is not uncommon to find $1,000,000 worth of boots and shoes under one roof, while the average stock of all large dealers runs up into hundreds of thousands.

The old-time method was supposed to give first a profit to the manufacturer, then to the jobber, and then to the retailer; and the losses accruing from extended credits made it necessary to charge profits so large that by the time the shoe reached the consumer the price asked for it would be twice the factory cost of production. By the later and improved cash methods the greater portion of factory production reaches the counter of the retailer at a cost often not in excess of ten per cent. over the net cost at the factory. These close profits have compelled manufacturers to adopt the most direct methods of reaching the consumer. Some have made alliances with jobbers who take most of their production and sell it at a nominal profit. Others have opened on their own account retail stores in the larger cities of the country, and claim there is but one profit from the manufacturer to the consumer. In all these methods we are but following out the history of the trade in Great Britain, in Germany, and in France, where now the most of the better retail stores are owned by large manufacturers who supply their goods directly from the factory. It would seem as though this shortening of the road between the manufacturer and the consumer were now complete. Able, enterprising men, with ample capital and every facility for producing footwear, find it possible to make only the most meager margin of profit. Happily for the consumer, there is and can be no combination to control the price of shoes. If it were possible to buy up all the factories and put them under one control, hundreds more would spring up, like mushrooms, in a season. The sharp competition has forced the manufacturer to practise every economy and to study every possible improvement in machinery, until to-day the United States is far in advance of every other nation in the perfection, quality, and low cost of its footwear. While our workmen earn more, they produce more. The conditions under which they work are more favorable to large production. To be sure, the industry is not without its labor troubles. Shoemakers, like other men, have learned that by combination they can secure advantages, and they have occasionally attempted to exercise that power in a way to threaten the prosperity of the industry. The much-talked-about conflict between labor and capital sometimes temporarily appears, but the intelligence, good sense, and pecuniary interest of both so far always have, and no doubt always will assert themselves so strongly as to bring peace, without which there can be no business success.

As has already been said, there is no question but that the United States leads all other countries in the production of footwear in quantity, cost, quality, style, and perfection of manufacture. Our superiority was generally admitted after the World's Fair at Chicago. Here expert shoemakers and shoe dealers came from all parts of the world, and, after complete examination of our methods and our production, returned to their own countries and made clear the fact that in this industry, at least, the United States need not fear foreign competition. But our facilities for production are very much in excess of the home demand for consumption. We need a larger market for our goods.

Our early manufacturers were able to export to the West Indies, and more especially to Cuba, and up to the time of our Civil War the export business was prosecuted with vigor and profit. In 1810 ten per cent. of all the boots and shoes sold in Boston were for export. In the year 1865 we exported more than $2,000,000 worth. From that time on the trade fell off sharply. Perhaps this may be accounted for by the great advance in 1866, when values rose at least fifty per cent. This is illustrated by the fact that where 1,214,468 pairs sold for export in 1863 for $1,329,000 (about $1.10 per pair), 214,567 pairs exported in 1866 brought $590,000 (over $2.75 per pair).

Probably on account of the demand for home consumption little effort was made during the next twenty years to secure any foreign business. The trade seldom rose above $500,000 a year. An examination of the figures will show, however, that after 1872 this was not caused by excessive cost of materials, because our export trade in leather increased sharply from that time on, until in 1894 we exported about $14,000,000 worth.

Within the last few years renewed interest has arisen in the export business. Our manufacturers have become convinced that there is nothing in the conditions which will prevent competition with England, France, or Germany for any part of the trade of the world. We have the raw materials in our own country. While we import many hides and skins, the supply of our domestic product is constantly increasing, and our leather manufacturers have been able to produce, in both quality and price, materials for making shoes as advantageously as any other country. We now need to adapt our styles to the wants of such countries as import their footwear. Large dealers from England, from Australia, from South America, Central America, and South Africa, have visited our market within the past two years, ready to buy our goods if we will meet their views as to shapes. Some of our leading manufacturers are alive to the situation and are making an effort to secure a portion of the world's trade.

It must be admitted that a more determined, energetic spirit on the part of the boot and shoe manufacturers of the United States is necessary if they are to extend their trade to profitable markets they are now neglecting. The export trade of Great Britain in boots and shoes is far greater than our own, but the larger portion of her exports go to Australia, South Africa, and other of her colonies. France, Germany, and Switzerland each exceeds us in amount of exports.

Annexed will be found a table giving our exports of boots and shoes and of leather and manufactures of leather since 1857.

EXPORTS, 1857 TO 1895.

Year ending June 30th.	Boots and Shoes.		Leather and all Manufactures of Leather.
	Pairs.		
1857	561,501	$813,995	$1,359,050
1858	609,982	663,905	1,337,873
1859	627,850	820,175	1,420,228
1860	678,136	782,525	1,547,177
1861	655,808	779,876	1,404,054
1862	679,594	721,241	1,191,056
1863	1,214,468	1,329,009	2,140,013
1864	....	1,415,775	1,931,126
1865	....	2,098,165	3,193,648
1866	214,567	590,307	1,033,829
1867	313,290	681,706	1,049,615
1868	363,419	578,650	1,414,372
1869	303,884	475,607	925,283
1870	276,179	419,612	673,331
1871	301,216	445,466	1,897,395
1872	325,296	502,689	3,684,029
1873	260,759	421,548	5,305,494
1874	243,500	383,417	4,786,518
1875	393,051	429,363	7,324,796
1876	263,508	368,633	10,008,985
1877	300,484	414,630	8,167,301
1878	351,152	468,436	8,080,030
1879	329,355	402,557	7,769,069
1880	378,274	441,069	6,760,186
1881	300,968	374,343	8,088,445
1882	389,120	488,815	8,999,927
1883	442,687	539,957	7,923,662
1884	502,122	602,925	8,305,779
1885	492,906	598,151	9,692,408
1886	554,365	648,069	8,737,682
1887	623,714	732,517	10,436,138
1888	563,871	654,896	9,583,411
1889	518,750	585,902	10,747,710
1890	587,106	662,974	12,438,847
1891	551,343	651,343	13,278,847
1892	745,112	914,974	12,084,781
1893	493,027	590,754	11,912,154
1894	647,318	777,354	14,282,936
1895 (9 months)	700,836	880,652	12,279,480

For the first nine months of 1895 our export trade in shoes amounted to $880,652. Shipments of leather and its manufacture for this same period amounted to $13,885,842.

A comparison of the export trade in boots and shoes of Great Britain and the United States, from 1865, is shown by the following table:

Year.	England Exported.	United States Exported.
1865	$7,310,525	$2,098,165
1871	8,520,725	445,466
1876	7,017,330	368,633
1890	8,460,000	662,974
1892	8,499,870	914,974
1894	....	777,354

For convenience in figuring, the English pound sterling is figured at $5.

The total export trade of Europe in footwear is estimated at $35,000,000. There is nothing to prevent our securing a respectable part of this except our indifference.

In this industry American genius has contributed more than any other factor toward the universal development. Americans are better shod than the inhabitants of any other country. Titled Europeans may wear as fine shoes, but the great, strong middle class, which supports not only itself and the aristocratic pretension, but the very nation, has neither the comfort, elegance, nor convenience in footgear that American invention and enterprise have placed within the reach of every citizen of our land. Supporting more people now than ever before, paying more wages, and rearing up great tributary occupations, the boot and shoe trade has lifted itself into the front rank of American manufacturing interests.

CHAPTER LXXXVIII

THE HARNESS AND SADDLERY TRADE

THE harness and saddlery industry of the United States in the early part of the present century seems to be shrouded in obscurity. In its incipiency this industry showed much crudeness and large room for improvement. Agricultural development was extremely slow. The soil was turned by a wooden plow to which oxen were attached, bearing a heavy wooden yoke tied with coarse rawhide thongs. The process of harvesting was equally crude. The roads were in an almost impassable condition, very little improvement having been made in this direction, except in the towns and cities of the New England States. The condition of the roads to the interior settlements was such that freight could be conveyed only on pack-horses, and later by two-wheeled carts drawn by oxen. Under these conditions it may be easily understood that there would be a very small demand for harness, least of all of the lighter grades, because light vehicles would be entirely unsuited to such roadways.

The horse was chiefly used for saddle riding. The United States mails, the news, and important messages were sent by mounted messengers, the majority of the equipments for this use being imported from England. The saddle-trees, buckles, bits, etc., required for the few riding-saddles made in the United States were necessarily imported, for the reason that those made in this country were of a very primitive form. Saddlery hardware, one of the important accessories to the saddlery business, was first made by Seth J. & Alvin North, at New Britain, Conn. They conducted a blacksmith shop, where, among a large variety of articles that they made, were bridle-bits, harness and shoe buckles and rings. These were produced from wire drawn out at first by hand, but later by horse-power. All the finishing work on these goods, such as polishing, welding, and putting on the tongues of the buckles, was executed manually, naturally a slow process, and but few goods could be turned out in any given month or year.

Learning that a more rapid process than hand-polishing was in use at Middletown, Conn., Alvin North, one of the partners of the above-named firm, went there to learn the process. After paying $25 for the secret he was told to take an old woolen stocking and, after darning the holes, fill it with the articles to be polished, and add a number of small pieces of soap. The whole was to be dipped into a pail of warm water, the stocking then being rubbed between the hands. This process was certainly a quaint and simple one, but the firm found that it would save the labor of half a dozen girls. Subsequently they substituted canvas bags for the stockings, which were used until the introduction of tumbling-barrels.

As civilization advanced, there came a demand for better roads and driveways, and with this arose a greater need of saddlery. Factories were established, the chief of these being in Newark, N. J., Hartford, Conn., Wheeling, W. Va., St. Louis, Mo., Louisville, Ky., and Cincinnati, O. The greater part of the harness made at this time was for heavy stages and wagons, used for transportation of passengers and in business traffic for agricultural purposes. The deep black soil of the Western prairies made carrying goods by wagons during certain seasons of the year impossible, and as a result the call for riding-saddles became urgent. Saddles made in foreign countries were not suited to the undeveloped West, with its rude frontier life, nor were they adapted to the South, where conditions were equally peculiar. Thereupon the inventive genius of the Yankee produced a tree made of wood, covered with rawhide. With its long skirts and fenders it was a protection from the elements and the numerous and deep quagmires.

The inconveniences under which manufacturers labored, especially in the West, were those of obtaining their supplies of saddlery hardware for making these horse equipments. It was necessary to import largely from England, and it required many months after the order was placed before the goods were received. This was because they were shipped by sailing vessels to New Orleans, and then sent up the Mississippi and Ohio rivers to their respective destinations. During the years from 1822 to 1833 the importation of foreign saddlery hardware was large, such things as bits, buckles, spurs, stirrups, rings, and also webs of all kinds being imported. In 1828 the Franklin Institute awarded a medal to Seth Boyden for the first buckles and bits made of annealed cast-iron. It is said that the process was first attempted by putting a few pounds of cast-iron into an ordinary cooking-stove. In this manner it was discovered that the cast-iron by being baked became annealed, and thus a great stride was made toward the successful manufacture of saddlery hardware in this country.

It might be proper at this point to note a little of the personal history of one of the most remarkable men in the saddlery trade—one to whom more is due for the progress and prominence of the saddlery interest than to any other man. This was Peter Hayden. He was born in Oneida County, New York, in September, 1806, and was brought up in Cummington, Mass. He was a member of a family of inventors, and gave evidence in early life of his predilections for mechanical pursuits. About 1828, when Hayden was twenty-two years of age, he commenced the manufacture of hames and saddlery at Auburn, N. Y. Few men were employed at the start. When the stock accumulated he would load up a wagon or sleigh and sell his stock in central New York and Canada. In 1835 Mr. Hayden entered into a contract with the State of Ohio for the employment of convict labor in the manufacture of hames, saddle-trees, saddlery hardware, and chains, employing at different times from 100 to 300 convicts, besides a large force of free labor. He was eminently qualified for the business of manufacturing, as his mechanical skill and ingenuity enabled him readily to determine the best means for accomplishing results. He had industry and perseverance, and united with these a ready willingness to take hold of any branch of his business and by personal effort bring it to a successful issue. As his business increased he extended it into other departments, ultimately opening connection with mercantile houses for the sale of his manufactures in Cincinnati, St. Louis, Chicago, Detroit, Galveston, San Francisco, and New York City. Thus from a very small beginning, aggregating at the start a few thousand dollars per year, his business increased until it reached millions, and the importation of foreign saddlery ceased almost entirely through his efforts.

The business of making horse-collars was first undertaken in this country by Timothy Deming in 1828, at East Hartford. He invented the short-straw collars and the blocks on which to make them, patenting the latter. Previous to this time collar makers lived the life of itinerants. Their practice was to go from place to place and hire themselves to any of the harness makers whose stock of collars needed replenishing.

There was but little change during these years in the mode of manufacturing saddlery. The custom in vogue for twenty-five years still prevailed. Such harnesses as were turned out were intended for hauling and for agricultural uses. Machinery was not in use in the earlier years of this period, and few, if any, wholesale establishments existed during this quarter-century. It needed the introduction of machines to bring about the concentration of capital and the massing of workers into large factories. This may be attributed to the fact that without machines the large establishments would have no particular advantage over the smaller ones, and therefore there would be no incentive to manufacture on a large scale. The principal manufacturers were jobbers as well, and carried a stock of saddlery hardware. They were located in the larger cities, supplying small makers throughout the surrounding territory. In those years the buyers visited the makers—quite a reversal of present-day practices. The modern traveling salesman carries the market to the buyer.

In 1853 the first wax-thread chain-stitch sewing-machine was patented by a New England company. Three years later it was brought into practical use, but was employed almost exclusively upon the sewing of boots and shoes in the New England States. It was nearly ten years later before it was used in the manufacture of harness. The prejudice was very great against machine-stitching. Many years, therefore, passed before it was used to any extent. The rapidity with which the work could be done by this machine, and the great reduction it effected in the cost, gradually brought it into favor with the maker. Another very important improvement was the creasing-machine. This was originally invented by W. K. Thornton, of Niles, Mich., about 1858, and proved to be a great labor-saving device. The small trade, however, was quite slow to adopt anything which made a radical departure from old-time and traditional methods, and the inventor was obliged

Albert Morsbach.

to introduce his machines from shop to shop by leaving them on three months' trial. A few years later he entered into partnership in Cincinnati under the firm name of Thornton & Perkins, the business being in 1865 sold out to Randall & Company, now the manufacturers of the modern and improved machines.

The New England sewing-machine and the creasing-machine were the only two important inventions of which we have any record that proved to be of lasting benefit to the trade, and to them may be credited the beginning which led to the revolution in the manufacture of harness. Probably the most important invention up to this time relating to harness was the iron gigtree. E. A. Cooper, of Lancaster, N. Y., patented a tree April 3, 1866. The most practical gigtree, and one almost universally used by the saddlery trade, was subsequently patented by Samuel E. Thompkins, of Newark, N. J., on January 30, 1872. The importance of this invention may be better understood when it is stated that all the buggy saddles purchased up to this time were made on wooden trees, most of these being imported from England, and it was only a few years after the iron tree was introduced that the wooden tree was discarded.

The government census of the industry made at the close of this period will serve to show its extent. Considering the primitive ways of producing the goods, it is no wonder that the value of the product was small as compared with the report of twenty years later, which, it should be remembered, included only one third as many establishments. The number of establishments was 7607; the total capital employed, $13,935,961; the wages paid, $7,046,207, and the number of employees, 35,555; the total product, $32,709,981.

The progress in the saddlery business at this time was phenomenal. Improvements and labor-saving machinery were introduced into the large factories. As a result the cost of products was naturally lessened, and as a logical sequence the demand for the goods was increased. Light driving or buggy harness, which previous to this time was sold in small quantities only, now found a large market. Factories were taxed to their utmost capacity to supply the needs. The low-priced carriages and buggies which now appeared in the market contributed in no small degree toward swelling the call for harness. Hitherto such vehicles were turned out by hand process only; but now machinery entered into their production, with the inevitable result of cutting down the cost and increasing the demand. A greater use of vehicles of this sort meant, of course, a great stimulus to the manufacture of light harness, which was revolutionized. The apprentice system of turning out skilled mechanics seems to have been abolished, it being no longer the rule to serve long years at the bench. The work was now accomplished by a division of labor. No single workman made a complete harness. He exercised his skill upon the production of single parts, and hence became proficient in turning out that subdivision for which he had special aptitude.

Many labor-saving devices and machines were now used. Space will not permit mention of many of these, but as illustrative of the changes and conditions which were now operative reference might be made to one or two of the principal machines. The Bosworth lock-stitching wax-thread sewing-machine was patented in March, 1872, and reissued in 1880 and 1882; and later the Campbell lock-stitching machine, which was patented in 1880 and reissued about 1888, to a great extent supplanted hand-sewing. The stitches were interlocked, making the sewing alike on both sides, and giving the appearance of hand-sewing. This was a great boon to this industry, for the harness-sewing machines previously used were objectionable to a great degree, as they made a chain-stitch, and the work was not as satisfactory. These new machines were leased upon a payment of a bonus and an additional rent of five cents for each 1000 stitches. Subsequently competition brought about a reduction in the cost of operating the machines, the charge taking the form of a regular monthly rental.

The following kinds of harness machinery have been great labor-saving inventions, and are considered indispensable in well-equipped factories: tubular riveting-machines, dispensing with the hand-riveting entirely; box-loop sewing-machines, sewing up all the long loops, formerly sewed by hand; quilting-machines for quilting pads, gig and riding saddles; power trace-trimmers; power trace-polishers; power splitters; and dieing-out machines. This list takes no account of the many smaller but important tools. Of these a great number could be mentioned.

In 1863 Barbour Brothers established at Paterson, N. J., the first factory for making harness threads in this country, all this product previous to this time having been imported from Ireland.

The introduction of hard-rubber-covered harness trimmings was an event of note. Mr. Andrew Albright, of Newark, N. J., patented this process in 1867. It is purely an American invention, and has figured conspicuously as a mounting for fine harness.

In the manufacture of horse-collars great progress was made. Many experiments were undertaken to stuff horse-collars by machine, but all efforts seemed futile. It was commonly held that such a thing could not be done. Old-line collar makers insisted that to stuff a collar by machine involved so many difficulties that only an exceedingly visionary person would ever seriously consider the scheme. As usual, the seemingly impossible was accomplished. The successful inventor in this instance was William Foglesong, living in Dayton, O., who took out his first patent in 1883. By the use of his machine an immense stride was taken in the manufacture of collars. Large establishments absorbed the many small and insignificant collar-shops. The old slow and laborious hand process gave way to the rapid machine method, its products being astonishingly smooth. It quickly won a place with the trade.

No other improvements of special note were made until the year 1892, when R. Brownson, of St. Paul, Minn., invented a metal-staple machine for sewing collars with metal staples. This was a great innovation in the manner of preparing collars ready for the stuffing-machine, and the rapidity with which this work can be done is marvelous. A set of these machines will do as much work as was formerly done by twenty men.

Machinery, push, and enterprise had by this time raised the business of making harness and saddlery goods from a position of inferiority to a commanding place among the industries of the land. A glance at the brief statistics following will convey some idea of the present proportions of this trade.

The number of establishments was 7931; the number of employees, 30,326; the total wages, $16,030,845; and the total value of products, $52,970,801. We have only returns as to investment from 159 cities over 20,000 population. It amounted to $20,618,104.

By comparison with the returns of the previous decade, which included 7999 establishments, with a total product of $38,081,643, it will be seen that the value of the output the last census year was $14,889,158 more than in the year 1880. It might be interesting to compare the total products of some of the principal cities of the United States, which are as follows:

COMPARATIVE PRODUCTION BY SELECTED CITIES.

Cities.	1880.	1890.
Chicago	$746,247	$1,486,256
Baltimore	857,810	923,503
Louisville	882,542	1,572,658
Newark	1,880,404	1,323,635
New York	1,037,768	1,824,729
St. Louis	2,364,858	2,803,961
Cincinnati	1,155,564	3,636,707

The fever of combinations, trusts, and associations which was spreading throughout the country reached the saddlery manufacturers in 1890, and a move toward organization for conference and mutual improvement was made in that year. The Western manufacturers called a meeting at St. Louis, at which a few manufacturers were represented. An organization was formed which called itself "The National Wholesale Saddlery Association of the United States." The object of the association, as agreed upon at the first gathering, was to correct abuses, adopt uniform terms, and to encourage a fraternal feeling among competitors. Annual meetings and elections were held, and men prominent in the trade were chosen as presidents. A list of those who have been successively elected is as follows:

A. F. Risser, of A. F. Risser & Company, Chicago, Ill.; Owen Gathright, of Harbison & Gathright, Louisville, Ky.; B. W. Campbell, of Perkins, Campbell & Company, Cincinnati, O.; J. S. Medary, of the Medary-Platz Company, La Crosse, Wis.; I. S. Gordon, of the Gordon-Kurtz Company, Indianapolis, Ind.; Albert Morsbach, of Graf, Morsbach & Company, Cincinnati, O.

The last meeting was held in the city of New York, July, 1895, when about fifty manufacturers were added to the membership, making a total of 175 to date.

Albert Morsbach

CHAPTER LXXXIX

THE FUR TRADE

VARIOUS species of animals which inhabit cold climates have a covering upon the skin called fur, coexistent with another and longer covering called the over-hair. The fur differs from the over-hair in that it is soft, silky, curly, downy, and barbed lengthwise, while the over-hair is straight, smooth, and comparatively rigid. Owing to the peculiar properties of fur, it is rendered valuable for the purposes of felting, while silk and wool, which it in some measure resembles, are not well adapted to felting, but must be spun or woven. The over-hair gives the distinctive peculiarity to the various furs, and contributes much to their marking and beauty. Fancy fur is that kind of fur that is considered in connection with and as a part of the pelt, while staple fur is fur that is useful apart from the pelt in the manufacture of the various felts. The manufacture of fur into felt is of comparatively modern origin.

The use of fur pelts as a covering for the body of man is not and was not necessarily a barbarous expedient utilized for want of something more civilized. It is to be noted that the utmost perfection to which the manufacture of woolen garments has been brought does not admit of their substitution for the pelts and furs of animals in high latitudes. The scientific explorers from the centers of civilization take a leaf out of the Eskimo's book and array themselves, as he does, in garments taken from the backs of the native animals. There is good reason for this. The pelt or skin acts as a shield against the driving storm of rain, snow, or hail, while the fur keeps out the piercing cold. Used thus in certain localities as a necessity, furs as apparel have developed into a luxury for the fashionable and wealthy. To supply the demand for furs in earlier times led to troubles among the Indian tribes, and to fierce quarrels and bloodshed among the members of different nations. Furs have played their part in history, and take their place alongside of precious gems, gold, and jewels in the field of ornamentation. Marco Polo has described with enthusiasm the elegant and sumptuous furs worn by the khan of Tartary. They have always played an important part in the decoration of Russian royalty and nobility. They are interwoven with the history of the French and English in Canada, and exerted an important influence upon the early history of New England, New York, and Virginia.

The history of furs is so interwoven with romance that it is difficult to break away from that branch of the subject. The adoption of fur robes by the Venetians was the evolution of the semi-Turkish dresses of the sixteenth century, which gradually merged in the gorgeous fur costumes of the Renaissance; and an ancient diary tells how "ten mules carried the boxes which contained the furs belonging to my lady the duchess [Lucretia Borgia], the majority of which came from the East." The origin of the term "ermine" is interesting from the fact that it was based on a mistake. A recent writer explains that "the Byzantine emperors exacted from the conquered or tributary princes an annual tribute of furs and skins of beasts, and undoubtedly it is to them that we owe the introduction of the ermine as a royal fur. The Greeks, who were very fond of ermine, believed it to be the skin of a white rat. . . . The Byzantines called it the Armenian rat-fur—hence the word 'hermine' or 'ermine'; and until quite late in the seventeenth century it was always termed in France *le rat d'Arménie*." The ermine is of the same family as the English stoat, and its beautiful whiteness is due to the high northern latitude which forms its habitat. It is stated that the late czar of Russia had coronation robes made out of no fewer than 250,000 ermine-skins. "Miniver" is ermine spotted with astrakhan, and "Théophile Gautier, in an essay on Cinderella, assures us that young lady's famous glass slipper was not made of glass at all, but simply lined with *ver* or miniver, wrongly interpreted as *verre*." Ermine became a "royal" fur by decree of Edward III. of England, who also regulated the wearing of furs by his subjects. He decreed that "no person whose income did not amount to £100 a year should wear furs, under penalty of forfeiting them." A letter from Margaret Bryan—who was governess to the children of Catherine of Aragon, Anne Boleyn, and Jane Seymour—to the king asks that money be sent her, as the garments of his Grace, Prince Edward, "are barely decent, and he much needs a fresh set of furs, his being mangy."

Of all industries that of manufacturing the pelts of animals into articles for the use of mankind is the most ancient, and hardly a country exists in which, to some extent, the skins of different beasts are not so used at the present time. The manufacturing of skins into articles of apparel and luxury is an industry apart from all others, and one requiring great knowledge and experience, as the stability as well as the appearance of most furs depends much upon the mode of curing, drying, and making up. From the Arctic circle, where furs are a necessity of existence, to the tropics, and again southward into the Antarctic regions, the furs of wild animals have from time immemorial contributed to the needs and the comfort of mankind; and even in the temperate zone we have learned, from the sudden changes of temperature to which the vagaries of our climate subject us, thoroughly to appreciate the luxury and utility of furs. The rich peltries of North America were the magnet, holding forth the promise of commercial gain, that drew hitherward the pioneers and precursors of civilization. But for the hardy and adventurous Frenchman and Briton who early sought fortune in the traffic in furs, the settlement and advancement of the country would have been much delayed, as it is only after the path through the wilderness has been blazed that the somewhat timorous steps of agriculture and civilization can be led into a newly discovered region. In the early days the fur trade played a most important part in the settlement of the country, those engaged in it journeying into the most distant and inaccessible parts, and being the founders of very many of the first settlements; in fact, the fur traders are to be regarded as the chief pioneers of North America. Important as the business was even in those days, the more general use of furs has made it at present one of the most important factors of our trade and commerce.

The Canadian provinces owe their first start on the road to prosperity to the fur trade. The stimulus of gold mining was lacking there, and in seeking for an outlet for their energy the French pioneers discovered that as the Indians were ignorant of the value of the furs which they accumulated, an enormous profit was possible to the successful trader in those articles. In the infancy of the industry there was absolutely no limit to the percentage of profit, as the Indians would exchange the most valuable of peltries for European trinkets that were worth nothing except the cost of transportation. The trade in furs with the natives soon created a class known as *coureurs des bois*, or rangers of the wood, whose untamable licentiousness brought scandal upon the traffic, and led to the licensing system, which itself soon became subject to abuse. During twelve or more months these men would be absent from the trading-posts, when they would return with canoes laden with packs of beaver and other skins, with the proceeds of the sale of which they would indulge in the most extravagant dissipation. Their funds would thus soon become exhausted, and they would again disappear on a voyage for subsistence.

The British merchants of New York soon began to encroach upon the business of the Canadian traders, which led to bitter feuds regarding the infringement of territorial rights; and matters were still more complicated upon the formation of the Hudson's Bay Company, which was chartered by Charles II. in 1670, having the exclusive privilege of planting trading stations on the shores of Hudson's Bay and its tributaries. When, in 1762, France lost possession of Canada, British subjects gained almost exclusive control of the fur trade. Prior to 1795 the trade was almost wholly monopolized by great trading companies, the Dutch East India Company having been first in the field, with trading-posts at New Amsterdam (New York), Beaverwyck (Albany), and several points on the Delaware and the coasts of Maine. The Hudson's Bay Company for almost two hundred years monopolized the trade in furs, although after 1790 it had a somewhat powerful rival in the Northwest Company. In 1805 the latter company established trading-posts on the Pacific coast. In 1808 John Jacob Astor established the American Fur Company, with its line of posts across the continent, intending to form a depot for furs at the mouth of the Columbia River, and to ship the furs directly to China and India from that point. He subsequently changed its name to the Pacific Fur Company, and was on the highroad to success, when, in 1813, his resident partner there treacherously sold out the whole establishment to the Northwest Company, on the plea that the British forces, with whom we were then at war, would have

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(Died December 3, 1895.)

captured it. The Russian-American Fur Company, having its trading-post at Sitka, in Alaska, and subordinate posts on the Yukon, carried on an immense traffic for many years, but in 1867 transferred its property and rights to the United States, simultaneously with our purchase of Alaska. Mr. Astor, after the treacherous transfer of the Pacific Fur Company to the Northwest Company, confined his operations to the region east of the Rocky Mountains, and with his partner and successor, Mr. Ramsay Crooks, transacted for many years a profitable business in furs.

The name of John Jacob Astor is so interwoven with the history of the fur trade of America that I deem it appropriate at this point to glance briefly at the career of that remarkable man. He was born in Walldorf, near Heidelberg, Germany, July 17, 1763, and his death occurred in New York, March 29, 1848. He sailed for Baltimore in 1783, with a quantity of musical instruments to sell on commission. One of his shipmates was a furrier, who excited young Astor's imagination by stories of the large profits made by purchasing furs from the Indians and trappers and selling them to the wholesale dealers. Arrived in New York, he entered the establishment of a Quaker furrier, in order to familiarize himself with the details of the trade. On his return to New York, after a visit to Europe, he opened a warehouse for the sale of musical instruments, which was the first regular house of the kind in America. It was about 1809 that he conceived his great scheme to render American trade independent of the Hudson's Bay Company, and to spread the civilization of the East throughout the country. To carry out this scheme he asked the aid of Congress. His idea was, briefly, to establish a chain of trading-posts from the lakes to the Pacific Ocean, with a great central depot at the mouth of the Columbia River; to acquire one of the Sandwich Islands, and establish a line of vessels between the west coast of America and the Indian and Chinese ports. Expeditions were sent out, and in 1811 the settlement of Astoria was formed at the mouth of the Columbia, but was abandoned, owing to the War of 1812. Irving's "Astoria" gives a graphic description of the gigantic enterprise. Mr. Astor extended his fur business widely, establishing trade with many countries. The last twenty-five years of his life were passed in retirement. At the suggestion of Washington Irving he left $400,000 for founding the Astor Library. His fortune at the time of his death was estimated at $20,000,000. William Backhouse Astor, the son of John Jacob, was interested with his father in the fur trade, and when, in 1827, the firm of John Jacob Astor & Son was merged in the American Fur Company, he became its president. He retired from business, however, before his father's death, and succeeded to his vast fortune.

St. Louis was one of the principal depots of the fur trade from 1763 to 1859. The first great establishment there was founded by Laclede, Maxon & Company in 1763. The brothers Auguste and Pierre Chouteau were connected with it very early; up to 1808 they employed a large number of trappers and voyageurs, and were very successful. In 1808 the brothers Chouteau and several of their associates formed the Missouri Fur Company, which prospered greatly until 1813 or 1814, when, in consequence of the war with Great Britain, it was dissolved, and several of its members conducted the business independently. In 1827 the Rocky Mountain Fur Company, of St. Louis, was formed, and sent its trappers to the Pacific coast. The perils of the business were very great, forty out of every hundred men perishing in its service; but such was the fascination of this life of adventure that enough were always ready to supply the places of the slain. After some years of successful business this company was dissolved. In 1834, Pierre Chouteau, Jr., who had been brought up in the business with his father and relatives, organized the firm of Pierre Chouteau, Jr., & Company, a name which for the next twenty-five years was familiar to all the trappers and hunters from the Mississippi and the Great Lakes to the Pacific. In 1859 the business was sold to Martin Bates and Francis Bates, of St. Louis and New York. After the consolidation of the Northwest Company with the Hudson's Bay Company, in 1821, and the expiration of the latter's charter and license in 1859, the fur trade became more widely diffused in the hands of individuals. While the aggregated amount collected each year is much greater than it was forty years ago, the opportunities for acquiring colossal fortunes in the trade have gone. Furs are made up now at more than twenty points in the North and West, and London and Leipsic are becoming the best markets for the sale of American furs, as they have long been for those of Europe, Asia, and South America. While the trade in furs in the United States of late years has been very extensive, it has, in a large measure, been the result of individual enterprise rather than that of gigantic corporations. The ancient monopolies of the fur trade have died a natural death, and the immense business in fancy furs alone proves that individual enterprise has taken every advantage of its opportunity.

A writer in "Silliman's Journal" for January, 1834, gives such a lucid review of the fur trade at that time that I feel that it will be instructive to quote a portion of it here. He says:

"The Northwest Company did not long enjoy the sway they had acquired over the trading regions of the Columbia. A competition, ruinous in its expenses, which had long existed between them and the Hudson's Bay Company ended in their downfall and the ruin of most of the partners. The relict of the company became merged in the rival association, and the whole business was conducted under the name of the Hudson's Bay Company.

"This coalition took place in 1821. They then abandoned Astoria, and built a large establishment sixty miles up the river, on the right bank, which they called Fort Vancouver. Mr. Astor has withdrawn entirely from the American Fur Company, as he has, in fact, from active business of every kind. That company is now headed by Mr. Ramsay Crooks. Its principal establishment is at Michilimackinac, and it receives its furs from the posts depending on that station, and from those on the Mississippi, Missouri, and Yellowstone rivers, and the great range of country extending thence to the Rocky Mountains. This company has steamboats in its employ, with which it ascends the rivers, and penetrates to a vast distance into the bosom of those regions formerly so painfully explored in keel-boats and barges, or by weary parties on horseback and on foot.

"In addition to the main companies already mentioned, minor associations have been formed, which push their way in the most intrepid manner to the remote parts of the far West, and beyond the mountain barriers. One of the most noted of these is Ashley's company, from St. Louis, who trap for themselves, and drive an extensive trade with the Indians. The spirit, enterprise, and hardihood of Ashley are themes of the highest eulogy in the far West, and his adventures and exploits furnish abundance of frontier stories.

"Another company of 150 persons from New York, formed in 1831, and headed by Captain Bonneville, of the United States army, has pushed its enterprises into tracts before but little known, and has brought considerable quantities of furs from the region between the Rocky Mountains and the coasts of Monterey and Upper California, on the Buenaventura and Timpanogos rivers.

"The fur companies from the Pacific east to the Rocky Mountains are now occupied (exclusive of private combinations and individual trappers and traders) by the Russians, and on the northwest from Bering's Strait to Queen Charlotte's Island, in north latitude fifty-three degrees; and by the Hudson's Bay Company thence, south of the Columbia River; while Ashley's company and that under Captain Bonneville take the remainder of the region to California. Indeed, the whole compass from the Mississippi to the Pacific Ocean is traversed in every direction. The mountains and forests, from the Arctic Sea to the Gulf of Mexico, are threaded, through every maze, by the hunter. Every river and tributary stream, from the Columbia to the mouth of the Rio del Norte, and from the Mackenzie to the Colorado of the West, from their headsprings to their junction, are searched and trapped for beaver. Almost all the American furs which do not belong to the Hudson's Bay Company find their way to New York, and are either distributed thence for home consumption or sent to foreign markets.

"The Hudson's Bay Company ship their furs from their factories of York Fort and from Moose River, on Hudson's Bay; their collection from Grand River, etc., they ship from Canada; and the collection from Columbia goes to London. None of their furs come to the United States, except through the Indian market.

"The export trade of furs from the United States is chiefly to London. Some quantities have been sent to Canton, and some few to Hamburg; and an increasing export trade in beaver, otter, nutria, and vicugna wool, prepared for the hatter's use, is carried on in Mexico. Some furs are exported from Baltimore, Philadelphia, and Boston; but the principal shipments from the United States are from New York to London, from whence they are sent to Leipsic, a well-known mart for furs, where they are disposed of during the great fair in that city, and distributed to every part of the Continent.

"The United States import from South America nutria, vicugna, chinchilla, and a few deerskins; also fur-seals from the Lobos Islands, off the river Plate. A quantity of beaver, otter, etc., is brought annually from Santa Fé. Dressed furs for edgings, linings, caps, muffs, etc., such as squirrel, genet, fitchskins, and blue rabbit, are received from the north of Europe; also cony and hare's fur; but the largest importations are from London, where is concentrated nearly the whole of the North American fur trade."

Even at this date it was feared that the fur trade must rapidly decline, as there were no new countries to be explored, and the indiscriminate slaughter practised by the hunters bade fair to exterminate fur-bearing animals. In many cases this fear has proved to be without foundation. Many fur-bearing animals have increased in numbers, especially mural ornament. The valuable fur-seal bids fair to follow the buffalo into the shades of oblivion; but as neither of these useful fur-bearing creatures is actually extinct I have included them in the following table of

PRINCIPAL AMERICAN FUR ANIMALS.

Common Name.	Scientific Name.	Habitat.	Color.	Uses.
Beaver	Castor fiber	N. America, N. Europe, Asia	Chestnut brown	Muffs, trimmings, robes.
Silver fox	Canis vulpes	Northern latitudes	Silver gray	Muffs, trimmings, boas, robes.
Cross fox	"	" "	"	"
Red fox	"	" "	Red	"
Arctic fox	"	" "	White	"
Blue fox	"	Alaska, Greenlaud	Slate or purple	"
Gray fox	"	Virginia	Gray	"
Racoon	Procyon lotor	N. America	Grayish yellow	Robes, rugs, gloves.
Wolverene	Gulo luscus	N. America, Europe, Asia	Dark brown	Robes, muffs, trimmings.
Fisher	Mustela pennanti	N. America	"	Muffs, boas.
Mink	Mustela vison	High latitudes	"	Muffs, boas, capes.
Lynx	Felis Canadensis	N. America, Europe	Silver gray	Robes, muffs, boas, collars.
Wildcat	Felis rufa	N. America	Yellowish brown	Robes.
Skunk	Mephitis mephitica	N. America	White and black	Muffs, collars.
Black bear	Ursus Americanus	Northern latitudes	Black	Rugs, robes.
Cinuamon bear	Ursus cinnamonum	" "	Dark brown	"
Grizzly bear	Ursus ferox	" "	Brown	"
Polar bear	Ursus maritimus	High latitudes	White	"
Isabella bear		Northern latitudes		Ladies' goods.
Badger	Taxidea Americana	N. W. America	Sandy gray	Painters' brushes, muffs, boas.
Sea-otter	Enhydris lutris	N. Pacific	Dark brown	Coats, muffs, collars, caps.
Otter	Lutra Canadensis	N. America, Europe	Chestnut	Muffs, collars.
Fur-seal	Callorhinus nrsinus	Alaska, Shetland	Yellowish gray	Mautles, cloaks.
American wolf	Lupus Occidentalis	N. America	Black, gray, white	Robes, rugs.
Prairie-wolf	Lupus latrans	"	Dark gray	"
Panther	Felis concolor	All America	Light duu	"
Musk-ox	Ovibos moschatus	Upper Canada	Dark brown	Sleigh-robes.
Buffalo	Bisou Americauus	N. W. America	Drab brown	Robes, coats.
Marten	Mustela Canadensis	N. America	Light brown	Coat lining, capes.

the small mammals, which seem to thrive in the neighborhood of settlements, feeding on the farmers' crops; but others, especially the larger species, such as bears, beavers, etc., are much reduced in numbers, though it is to be hoped that they will not meet the fate of the buffalo (*Bison Americanus*), which is now reduced to a few scattered herds in southern Canada and the Yellowstone Park, probably numbering less than 500 all told in the United States. Up to 1875 these animals, whose skins were an important commodity in the trade, existed in countless herds on the Western plains, and were valuable alike to the Indian and the white man, whose needs, in the way of food and clothing, they supplied. From 1871 to 1874 it is estimated that between 4,000,000 and 4,500,000 of these animals were recklessly killed, merely for the sake of their hides. The extinction of the buffalo has created among the Indians a need which must now be supplied by the United States government in the shape of meat rations. The Indians excel all others in dressing the skin. The head of the male buffalo is in great demand at present as a

The fur-seal is of paramount interest to the trade. There are many varieties, but four of which are extensively used by the trade, viz., the Alaskan, Victoria or Northwest coast, Copper Island, and Lobos Island.

The Alaskan fur-seal fishery is the most extensive in the world. It was a material element in the value of that province when purchased by the United States from Russia at a heavy cost, and one of the principal inducements upon which the purchase was made. Since Alaska became the property of the United States this fishery has afforded a very considerable revenue to the government by the lease of its privileges, and has engaged a large amount of American capital and the industry of many American people. The product is an important article of commerce and of manufacture, a substitute for which could not easily be found.

For sixty years prior to 1862 these fisheries had been leased by the Russian government to the Russian-American Company, a corporation composed mainly of Siberian merchants; but upon the sale of the province to the United States government the latter became possessed of all its rights there. Even at that time the question of the reduction of seal and their subsequent extinction was being agitated, and soon after acquiring the territory Congress passed laws forbidding the killing of seal upon the islands of St. Paul and St. George, except during the months of June, July, September, and October; prohibiting the killing of females and the use of firearms, none under one year old to be killed, and none to be taken in the adjacent waters or on places where they haul up to remain; also limiting for twenty years the number to be killed on these islands to 100,000 annually, reserving the right to restrict the number if at any time it appeared necessary or advisable to do so in order to prevent serious reduction of the species. In 1870 the Alaska Commercial Company obtained its lease, expiring May 1, 1890, at a rental of $50,000 per annum and $2 revenue for each seal taken. The headquarters of this corporation were in San Francisco, John F. Miller, afterward Senator from California, being the first president, succeeded by Mr. Lewis Gerstle, one of the original stockholders. The affairs of the company were principally managed by Messrs. Gerstle, Sloss, Niebaum, and Neumann on the Pacific coast, by Mr. Hutchinson at Washington, and by Sir Curtis Lampson (since deceased) in London. The number of seals taken by the company during its lease has been startling in its magnitude, and the amount of rent and revenue paid to the United States has corresponded with it.

During the last year of the lease the company was restricted to 60,000 skins, but took only 21,000. At the expiration of the term of the Alaska Commercial Company the North American Commercial Company succeeded in obtaining the lease from the government for the ensuing twenty years, expiring 1910. The government leased to the North American Commercial Company, for twenty years from May 1, 1890, the exclusive right to take seals in Alaska Territory, for an annual rental of $60,000 and a tax of $2 upon each fur-seal taken. It is claimed that during the year ended on April 1st last 16,031 skins were taken. At the present time the case of the United States against the North American Commercial Company of California to recover $214,293.37, alleged to be due on the contract since April 1, 1895, is pending in the United States Circuit Court. The case is regarded as one of great importance.

The first seals to arrive at the Pribylov Islands are the bulls, each one of which immediately locates for himself and future harem a homestead averaging about ten feet square. At first, when they are merely straggling in,—that is, about the 1st to 5th of every May,—the competition among them is not great; but later, when the breeding grounds are becoming more crowded, the efforts of late comers to oust those who have already ensconced themselves result in the most terrific combats, attended with great mutilation and sometimes death. The bulls who do not succeed in obtaining places are obliged to separate themselves from the others. They are mainly those from five years old and under, though some old bulls weakened by age or combat are included in the number. They are called "bachelor seals" by the whites and "holluschickie" by the Aleuts. They number from one third to one half of the whole aggregate of seals at the islands. It is from these bachelor seals that the lessees of the islands take the skins, which are shipped in batches of 200 to 300 casks through San Francisco and New York to London, where they are subsequently sold at public auction at the great "sales" there. Each cask contains forty to forty-five skins, rolled up separately, tied with cord, and packed in salt.

The seals are not killed at the rookeries, but are driven up to near the villages. At daybreak, while the seals are still asleep, a few natives, by stealing along the shore, can turn thousands of the "bachelors" back inland. They walk behind and on the flanks of the herd, and drive them to the killing grounds. This is done slowly, and frequent opportunity is given them to rest and cool off, as the seal is unwieldy and makes very hard work of traveling on terra firma. If they become overheated the fur suffers injury; but notwithstanding all the care taken in driving them, many become exhausted and die on the march, especially the old full-sized bulls or such as may have been injured in combat. As far as possible in starting these drives, the natives select seals about three to four years old, as at this age the fur is at its best. Old bulls are allowed to fall behind on the march and make their escape, as their skins have no commercial value to speak of. Upon arriving at the killing grounds they are permitted to rest for an hour or two, after which the killing takes place. Each member of the killing gang carries a long club, a skinning-knife, and a whetstone. About 100 to 150 of the corralled seal, making what is termed a "pod," are driven out at a time from the others, and after the chief has indicated such as are not to be killed (being too old, or perhaps having been bitten), the others are slaughtered by blows on the head with the clubs, and by incisions with the knives, after which the skins are removed as quickly as possible, to avoid "heating." The Victoria fur-seal, of which so much has been heard of late years through the recent diplomatic controversy and subsequent arbitration with Great Britain before the Paris tribunal, is next in importance.

Most of the vessels engaged in this fishery are owned by Canadians. Many of them carry Indians, who are very experienced hunters. When a herd of seals is discovered a canoe is launched. If the animals are asleep they are approached as quietly as possible and speared, otherwise they are shot; but in the latter case many are lost, as they are apt to sink before the canoe can reach them. The Victoria seals taken are chiefly females, with the exception of a few old bulls, and are generally captured at a rather earlier period of the year than the Alaska seals.

During the past few years the government has restricted the lessees of the Alaska seal-fisheries to a limited catch each year. The following table shows the restriction and the number taken.

FUR-SEALS TAKEN.

Year.	Catch Restricted to	Number Taken.
1890	20,000	....
1891	....	....
1892	....	7,500
1893	....	7,500
1894	7,500 to 20,000	16,000
1895	7,500 to 15,000	15,000

As the matter now stands, the government annually fixes a maximum and minimum number which may be killed, and before the season opens the exact number allowed is fixed upon by an agent stationed at the Alaska fisheries.

Copper Island seals are taken on one of the islands of the Aleutian group, called "Copper Island," which is still the property of Russia, close to Kamchatka. The fur is inferior to that of the Alaska seal, although it is probably the same animal taken at a different season of the year. The color is also lighter, being usually dark brown, and the fur not generally of such good quality. The quality of the fur, owing probably to climatic influences and nature of food, varies considerably, being sometimes equal to the Alaska, and at others vastly inferior. The yearly catch of these skins is about 40,000 to 50,000.

The decision of the Bering Sea Court of Arbitration was made public at Paris on August 15, 1893. A close season was established, to begin May 1st and to continue until July 31st; this season to be observed both in the north Pacific Ocean and in Bering Sea. A protected zone was established, extending for sixty miles around the islands. Pelagic sealing was allowed outside the zone in Bering Sea from August 1st. The use of firearms in sealing was prohibited. In spite of these precautions it is generally conceded that the Paris Court of Arbitration was a signal failure as a means of preventing the extinction of the seals. So alarming has been the slaughter of seals in northern waters that recently an important step has been taken in the direction of discovering new fields. Governor Sheakley, in a report submitted to the Secretary of the Interior, in October of this year, on the condition of affairs in Alaska Territory, says the extinction of the sea-otter and other fur-bearing animals in that region is inevitable. Speaking of the rapidly diminishing seals, he says that the official inspection of skins taken by pelagic sealers last year showed anywhere from fifty-five to eighty per cent. of female skins, thus confirming previous investigation on this point. The governor explains that so long as buckshot is being picked from the hides of young males killed in the Pribylov Islands, and maimed and wounded seals limp about the hauling grounds, and so long as from fifty-five to eighty per cent. of the pelagic catches sent to London are females (none of which is ever taken on the islands), it is needless to inquire further for the cause of demolition of the seals, both upon the hauling and the breeding grounds. He did not see anything in the method of handling seals at the islands which would warrant the views as to decadency presented in the British case. The rehabilitation of the rookeries would be an easy matter if adequate protection were afforded the females. He states that better protection than that afforded by the findings of the Paris tribunal will be necessary for their restoration.

The catch along the northwest coast by American vessels the last spring, Governor Sheakley says, did not reach 100 skins per schooner, while the British average was about 200. Great Britain gave to the Canadian sealers increased facilities by availing herself of a technicality and violating the clear intent of the Paris regulations relating to firearms. The governor recommends that the Treasury Department issue such instructions as will insure the taking, between the 1st of June and the 10th of August of each year, of every marketable sealskin on the Pribylov Islands.

I am led to enlarge somewhat upon this question of the Alaskan fur-seals from its manifest importance to the fur industry, seal-fur being at once the most useful and the most popular of all furs. In September of this year Assistant Secretary of the Treasury Hamlin received from Agent Crowley, stationed on the Pribylov Islands, a report to the effect that the lessees were permitted by him to ship 15,000 skins for the season, this figure being the maximum set by the department. In connection with this report Mr. Hamlin is reported to have said:

"Mr. Crowley was permitted to allow a catch of 15,000, including all the skins left over from last season, if in his judgment the condition of the herd on the islands would warrant it. The reports previously received indicated that a considerable number of skins were left over from last season, which have been counted in this year's catch; and, in addition, we assume that the 15,000 will be found to include a considerable number of young male seals, so that it will hardly be safe for the trade to count on 15,000 full-grown skins. While it had been assumed that owing to the reports from the coast Mr. Crowley would only permit 7500 to be taken, it should be remembered that a 15,000 catch is really very small indeed, and would be wholly insignificant if the seal-herd were not being depleted so rapidly. You will remember that under the *modus vivendi* 7500 seals were permitted to be taken by the natives for food. I cannot now say exactly what the department will do during the coming winter, but no effort will be spared to save the remnant of the herd."

It is of interest to note that for some years after the discovery of the sealing grounds of Alaska by Pribylov, in 1786, the slaughter of seals was unprecedented. In the year following the discovery, 500,000 seals are said to have been killed by the Russian hunters. The natural result followed, and in 1807, when the order was issued to kill no more seals for five years, the herd was on the verge of extinction. That the slaughter of seals progressed at the rate of 100,000 a year for twenty years after the acquisition of Alaska by the United States, is proof of the wonderful recuperative possibilities of these animals, and an earnest and honest effort on the part of the nations interested might yet save from extinction this interesting herd of mammals.

It is not for sealskins alone that the fur trade is indebted to Alaska. That territory sends its quota of the pelts of the sea-otter, the land-otter, the beaver, brown bear, black bear, fox, mink, marten, lynx, wolf, muskrat, and wolverene. The total value of furs shipped from Alaska and Russian America from 1745 to 1890 amounted to $93,102,970. The number of Alaska fur-seal skins sold in London from 1868 to 1890 inclusive was 2,411,099. Of these the Alaska Commercial Company shipped 1,861,052 (salted), other traders 412,254 (salted). Of dried furs there were 50,288, and of dressed, 87,505.

In reviewing the fur trade of the United States it is impossible to ignore the relationship that it bears to that of other countries. Many of the great American houses have partners resident in London and Leipsic and in other parts of the world. London is still the great fur auction mart of the world, although America leads all countries in the art of manufacture, furs in the raw state being admitted here duty free. Leipsic still holds spring and autumn fairs, in which exchanges are made of Leipsic wares for the skins from Russia, Austria, and Turkey. The chief fur fair of European Russia is held at Nijni-Novgorod. Siberia exchanges furs with China for commodities, and a fair for the purpose is held annually at Kiakhta. Staple furs, used largely in the making of hats, are principally those of the hare and rabbit, and come from France, Russia, Germany, England, the western part of America, and from Australia.

The preparation of most skins for packing and transportation is by no means so difficult as might appear. After being stripped from the animal they are carefully cleaned of fat and flesh, and dried in a cool, dry place. When thoroughly dry they are ready for shipment. This method does not apply to the fur-seal, which is an exception to the rule, the manner of packing which is told elsewhere.

The variety of furs is so great, and the cost so variable on account of the fickleness of fashion, that the record of consumption is never the same for two years running. Some of the most exquisite of the peltries are obtained from animals whose habitat is in regions remote and uncultivated. That all of those kinds having the most beautiful fur are not exterminated is due to the sudden and unaccountable changes in fashion. The demand for a certain class of fur ceases for a season or two, and with it ceases the destruction of the animals, who thus have a period in which to recover their normal status as to numbers. A record of the annual collection of furs in America is at best far from reliable, except as to the year to which it refers. The following list is as accurate an average as can be obtained from the data available.

AVERAGE ANNUAL COLLECTION OF AMERICAN FURS.

Badger	5,000
Bear	15,000
Beaver (formerly)	200,000
Buffalo (bison) (formerly)	100,000
Fisher	12,000
Fox, silver (Asia and America)	2,000
" cross (Asia and America)	10,000
" blue (Europe and America)	7,000
" red	60,000
" gray	30,000
" kit	40,000
Marten	130,000
Mink	250,000
Muskrat	3,000,000
Opossum	250,000
Racoon	500,000
Sea-otter	2,000
Skunk	550,000

Following the rule that applies to all modern business and professions, the fur trade has been split up into departments, and very few firms carry on all the branches of the business, as was formerly done, under one roof. The taxidermist may be said to conduct a collateral branch of the fur industry. The manufacturing furriers and fur dealers represent an enormous investment of capital, and most of them are importers and exporters as well. There are a large number of important manufacturing firms in America, notwithstanding the hold on that branch held by London and Leipsic, and furs made here are, as a rule, of superior manufacture. In 1890 the whole number of establishments handling fur goods in the United States was placed at 484. These firms paid $4,749,191 in wages to 8075 employees. The cost of materials used amounted to $11,742,508, and the value of products, including receipts from custom-work and repairing, is set down as $20,526,988. That New York is the great center of the American fur industry is shown by the fact that her proportion of the above totals for 1890 was as follows: establishments, 281; employees, 4983; wages, $3,113,762; cost of material used, $6,897,-292; value of product, $12,434,272. These figures show that New York does considerably more than half of the entire fur business of the country. Of the value of Alaskan business I have spoken elsewhere. Of the Western States, Minnesota makes an excellent showing, with 25 establishments, employing 488 persons, whose wages amount to $276,393. The cost of materials is $727,117, and the value of the product $1,152,369. These figures apply to 1890.

The manufacture of hats and caps can only be referred to as a branch industry allied to the fur trade, inasmuch as the felt is made from fur. Of course there are hats and caps made directly of fur, which come within the province of the furrier. The passing of the beaver hat appears to be permanent, although that species of head-gear had a temporary revival during Mr. Harrison's presidential campaigns. The relative value of the beaver and silk hat is thus written about by George Augustus Sala:

"Let us now take the case of men's hats. The costliest hat, in my youth, was the beaver one. The last occasion when George IV. was seen in public was at Ascot races in 1828 or 1829. He wore a brown beaver hat, and brown beavers for a season or two were fashionable; but ultimately the black or the gray beaver resumed its sway. The very best ones were made entirely of the fur of the beaver, and cost from three to four guineas. A second-class beaver consisted of a body or foundation of rabbit's fur, with a beaver nap; but the latter was frequently mixed with some other fur. This article could be purchased for a guinea or thirty shillings.

"The life of a real beaver hat extended over about three years; the adulterated article wore out in about a twelvemonth; whereas the most economical of gentlemen at present can rarely consume less than four silk hats a year. If he pays ready money for his hats he may obtain them for a guinea each, so that he stands, financially speaking, in a position worse than that of a gentleman of the Georgian era, whose genuine beaver cost four guineas, but lasted four years.

"This is one of the instances in which modern cheapness is only apparent."

It would, of course, be impossible in this article to go into details regarding the processes of manufacturing furs. As a guide to the subject generally I will briefly outline the process by which the skin of the fur-seal is made ready for the market. These skins, on their arrival at the furrier's, packed in salt, are both evil-smelling and unsightly. The first step is to remove the salt by washing. The fat or other extraneous matter adhering to the inside of the pelt is then carefully removed, after which the skins are stretched upon frames and slowly dried. They are next soaked in water and thoroughly washed with soap. The fur is then dried, leaving the skin moist. At this point the operator removes with a knife all of the long hair, leaving nothing but the soft underfur. This process is both tedious and delicate. The pelts are then subjected to moisture and heat on the skin side, and shaved until a smooth, even surface is obtained. The next process is that of drying and softening the skins. This is done by treading them with bare feet in tubs in which is a quantity of fine hard-wood sawdust, which absorbs any natural oil which may still adhere to the fur. The delicate operation of dyeing next takes place, wherein the dye is applied with a brush to the points of the fur, which is then gently agitated to evenly distribute the coloring-matter. After drying and brushing, another coat is applied, and this is continued until eight to twelve coats have been given to the skin. At this point the English process ceases, but the American furriers continue to wash and dry the skins with sawdust after the application of the dye. This insures a beautiful, finished, and lasting product.

Mere mention of a tithe of the enterprising men who are making the fur trade what it is would be impracticable here, the business being so minutely subdivided, as I have before stated. The fur trade of the United States has in the past had associated with it many honored names. Among them were J. J. Astor, William B. Astor, John G. Wendel, Christian G. Gunther, Sir Curtis Lampson, Ramsey Crooks, Gabriel Franchere, J. Carson Brevoort, and Martin Bates. But few, however, of the fine old houses have lineal descendants at present engaged in the trade, which has passed largely into other hands. There are, in addition to the branches mentioned, jobbers of furs, proprietors of skunk farms, dealers in hatters' furs, fur sewing-machine houses, and firms making machinery and material used by furriers, such as muff-blocks, head-forms, skulls, and down muff-beds. All of these branches are represented by houses of enterprise and character. That there are dishonest and disreputable men in the trade, who thrive by dubious practices, is both true and regrettable. They do not last long, however, owing to the fact that their sin soon finds them out, and the customer once tricked by them is more careful in selecting a reputable firm for future dealing. The opportunities for trickery in the fur trade are limitless, and the wonder is that so few scamps have crept into it.

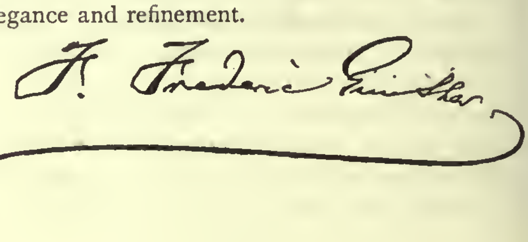
The volume of business shown by the exports and imports of furs can only be approximated as to the early years of the present century, except in regard to Alaska, where by means of the Russian and Chinese records it is tolerably complete for a period of more than a century. The following table gives the value of imports and exports of furs in this country from 1869 to 1894 inclusive:

FURS AND MANUFACTURES OF FURS.

YEAR.	IMPORTS.	EXPORTS.
1869	$3,094,115	$2,039,563
1870	2,236,229	1,941,139
1871	3,217,334	1,590,193
1872	3,503,176	3,343,005
1873	3,890,089	3,725,550
1874	3,379,288	3,334,365
1875	4,530,753	4,396,424
1876	4,551,372	4,398,883
1877	3,963,444	3,788,802
1878	3,944,270	2,618,100
1879	4,516,290	4,828,158
1880	6,424,112	5,404,418
1881	7,001,649	5,451,419
1882	8,030,970	4,747,944
1883	7,959,759	3,935,603
1884	8,178,124	3,998,182
1885	5,257,547	4,153,287
1886	6,813,887	3,321,102
1887	7,285,619	4,807,227
1888	6,735,344	4,777,216
1889	7,416,223	5,034,435
1890	7,553,816	4,661,934
1891	9,828,849	3,236,705
1892	10,197,131	3,586,339
1893	10,567,807	3,699,579
1894	7,620,284	4,238,690

The total domestic exports of furs and fur skins during August, 1895, amounted to $115,985, as against $60,851 for the same month of 1894.

In the interval snatched from business cares it is impossible to do anything like justice to this great subject. I have endeavored, however, to outline a few of its salient points. The difficulties and dangers attendant upon the securing of them lend to furs a sentimental value. They come from the frozen islands of the Arctic Sea, the barren wastes of northern Russia, and the jungles of Africa and India. They are hunted by sea and by land, on snow-shoes and under the equatorial sun. Comfort in furs lies in the use rather than in the pursuit of them. The historian of the American fur trade has before him a subject of entrancing interest. The furs which adorn the beautiful women of America, and ornament their homes, are part of the history of the country. They have been obtained at the sacrifice of much human ingenuity, of marvelous endurance, and, in many instances, of the lives of the adventurous men who have borne the heat and burden of the day in order that our civilization might not lack one of the greatest requisites of elegance and refinement.



CHAPTER XC

THE JEWELRY TRADE

THE manufacture of jewelry in this country is one of the oldest industries of which there is tangible record. It antedates the United States, the foundation of the colonies, and even history itself; for history takes us back only to the discovery of America in 1492, and it is merely a matter of speculation how many centuries previous to that the native Indians had lived on this soil. Next to his girdle of scalps the Indian loved nothing better than his beads and his necklaces of wampum and of bits of ivory, bone, and metal. These were his articles of personal adornment—our definition of jewelry. It is, then, to the native American Indian's love of personal adornment that we trace the origin of jewelry in America. The Indian chiefs covered themselves with the best that the handiwork of their tribes could produce, and we are told that their wrists, ankles, heads, ears, and even noses, all bore tribute to their vanity and their love for adorning their persons with trinkets, though they were entirely indifferent to our modern necessity of clothing.

The history of the early Dutch settlers informs us that they brought with them such articles as they needed for their personal adornment in the new settlements, and it is evident that they were as thoroughly human in this respect as all known races of the human family are reputed to have been; for from the very foundation of the colonies no one's attire was considered complete in the English-speaking towns without buckles, brooches, and rings made of the metals in vogue at that time.

These being the customs of the early settlers, the industry of gold and silver smithing was soon established, and by reference to the history of the three principal towns in the colonies we learn that in each there were numerous gold and silver smiths, whose principal products were medals and other trinkets for Indian chiefs, and snuff-boxes. The use of snuff was then universal, and every man took a pinch when proffered, whether he liked it or not. This usage led to considerable rivalry in the production and possession of beautiful snuff-boxes. Another product of the early silversmiths much in evidence was elaborate boxes in which were inclosed the parchments conferring the freedom of the city upon distinguished guests. These boxes or receptacles were usually made of silver with a lining of gold, and frequently of gold studded with precious stones. After Andrew Hamilton defended the liberty of the press in New York in 1734 the corporation bestowed their citizenship upon him, inclosing the parchment conferring this in a very elaborate box; and later others were presented to Lafayette, Washington, and Scott. The making of ornamental insignia conferred upon distinguished men developed into an important feature of the goldsmith's work, and the craft received so many accessions to its ranks that in 1788, when the adoption of the Federal Constitution was celebrated in Philadelphia, thirty-five goldsmiths and jewelers turned out in the procession.

More than twenty years before this, previous to the Declaration of Independence, the profusion of silverware, jewelry, and other evidences of wealth in a prominent New York residence, it is said, incited Townshend to introduce the historic bill known as the Stamp Act, the entering wedge by which the colonies were finally separated from the mother country. The viands and the silver in the Walton house were so rich and in so great abundance that English officers who dined there declared that they could see no reason why a country whose inhabitants could afford to live so extravagantly should not be taxed. This fell on Townshend's willing ears, and as a result the British House of Commons began to attempt the collection of revenue from the colonies. Those of them which had the richest inhabitants, and as a consequence those who spent most in personal adornment, were South Carolina, Virginia, Maryland, Pennsylvania, New York, and

Massachusetts. Connecticut, although populous, had few citizens distinguished above the rest for means.

There are no returns in the earlier censuses giving the quantity of production or the places where the various arts which are loosely grouped under the head of jewelers and gold and silver smiths were carried on. Providence, Newark, Philadelphia, New York, and Attleboro have long been, and still are, noted centers of the trade. The tools used in the earlier days were much like those used by workers in other metals at that time, except that they were smaller and better finished for finer work. The extreme tenuity and the lack of brittleness of gold and silver gave play to great ingenuity in varying ordinary patterns with fanciful designs, and the attaining of a polished or burnished surface made necessary a more tender treatment. In the earlier years of the century the frosting of gold and the satin finishing of silver were unknown arts, everything coming from the workshop with a glittering surface, most of the ornamental or decorative work being either crude enameling, applied work, or engraving.

Later the precious metals were also used conjointly with other metals, wood, mother-of-pearl, glass, porcelain, pearls, and gems; but most of these attempts were ambitious efforts to realize the ideals formed from studying, in books and single engravings that from time to time found their way to this country, the illustrations of metal-work. However, nearly every one who engaged in the business at that time learned it thoroughly, in the old-fashioned way that embodied all branches of the trade. A good workman could chisel out a ring or repair a clock, could fix your spectacles, put a new spout on your coffee-pot, or "doctor" your watch. Whatever was to be done mattered little to him, for he was equally competent in every branch; and good honest work was invariably the rule, resulting in articles not equaling in delicacy of workmanship those of the present time, but substantially made and suited to the requirements of the day. A hundred years ago it was impossible to draw a distinction between the occupation of jeweler and either goldsmith or silversmith, or between watchmaker and either clockmaker or maker of fine mathematical instruments—each of these branches involving the others. An artisan, though expert, rarely found sufficient work to employ all his time in any one department of his handiwork, and thus, from no matter of choice, but from compulsion, divided his time and skill between his own and kindred trades.

The seller of these goods then was a workman rather than a dealer, and it was essential for him to have an intimate knowledge of all kinds of metal and fancy work. The more progressive of these artisans developed by degrees into manufacturers, beginning usually with one, two, or three articles in stock, such as spoons, forks, rings, and other small pieces; and later hollow silverware, coffee-urns, teapots, etc.

Providence became early one of the centers of the trade; for the industry secured a footing in that city soon after the Revolution, when the manufacture of silverware was begun by Messrs. Sanders & Pitman and Cyril Dodge. In 1805 four establishments were located there. These belonged to Nehemiah Dodge, Ezekiel Burr, John C. Jenckes, and Pitman & Dorrance. Their products were chiefly silver spoons, gold beads, and finger-rings, and they employed in all about thirty men. Some of them soon branched out into cheap gold jewelry, silver and other alloys being largely used, with a very small fraction of gold, while large articles were plated by the hammering process. Breastpins, earrings, sleeve-buttons, and key-rings, in addition to the articles mentioned, were among the early products at Providence. About the same time work was also begun in Attleboro, which town for many years held preëminence in the trade. In 1812 it was stated that there was then sufficient gold and silver ware manufactured to meet every demand in the United States. In Newark the business of manufacturing goods of this kind began early in the century. The town was favorably situated for manufactures, and the men originally interested in the enterprise, Hinsdale & Taylor, combined industry with enterprise. Philadelphia was always very prominent as a manufacturing town, and a large trade, particularly with the South and West, sprang up there. Bailey & Company were one of the jewelry houses early established in that city, and the firm, under a different name, still exists.

More than sixty years ago Maiden Lane, of New York City, became the great center of the jewelry business in this country, and throughout the world the name of that thoroughfare is inseparably linked with the trade. With the improvements in manufacturing elsewhere, new ideas began to affect the trade. People had grown tired of things which had been always in their possession; they valued the jewels of their ancestors for their associations, but they wanted for their own use something new, something different in design; and this feeling gave an impetus to the trade, New York becoming the natural market for the introduction of every new product.

Among the New York houses that became early prominent in the trade was the firm of Marquand & Gelston, later Marquand & Company. In the New York "Mercantile Register" of 1848–49, in the chapter devoted to manufacturers of silverware, watches, jewelry, etc., we find the advertisements of the following houses, in the order named: Ball, Tompkins & Black (late Marquand & Company), 247 Broadway; Allcock & Allen, 341 Broadway; Gale & Hayden, 116 Fulton Street; Tiffany, Young & Ellis, 271 Broadway; Wood & Hughes, 142 Fulton Street; Samuel W. Benedict, 5 Wall Street; George C. Allen, 51 Wall Street; Squire & Brother, 92 Fulton Street and 182 Bowery; and others. Some of these houses have gone out of existence, one still retains its original firm name, and three are conducted under different firm names, which yet embody some part of the original title.

All branches of art education have been developed to a remarkable degree. In 1830 there were probably not in the entire country as many good paintings as the Metropolitan Museum of Art, in Central Park, contains to-day; and the same holds true, in other departments of art, of fine bronzes and marbles, of ceramics, pottery, and glass; indeed, cultivated taste and artistic discrimination find nowhere better expression than in the selection of choice bits of ceramics, porcelain, and bric-à-brac. If, as a nation, we have made, during the past fifty years, exceptional progress in mechanical improvements and inventions that enter into the practical part of life, our artistic faculties have in no sense been neglected; and although all have not become connoisseurs, appreciation of the artistic and the ornate in form and color is a feeling that knows no social or territorial distinction, existing in the largest cities and the smallest hamlets. It finds expression in the beautiful landscape-work of our parks and the architecture of our buildings; in the wares offered in our shops, and in the manner of their display; in the binding and the press-work of our books; in the illustration of our periodicals and other publications; and in divers other directions; but in nothing is it more pronounced than in the art metal-work of the gold and silver smiths, which has long since placed American products at the head of the art metal-work of the world.

With our increased spending capacity, our greater appreciation of the artistic, and our wider knowledge of articles into whose manufacture good taste enters as an important factor, it is not surprising that, relatively to the population, far more jewelry and silverware are demanded than formerly. The designers now employed by gold and silver smiths are men of liberal education, who can, if required, draw and model from life, and paint in oil or water-colors. They have been specially instructed as artists, and in many instances their training in the art schools and the designing-rooms of the workshops here is not restricted to the study of art from books and engravings, but is supplemented by visits to the galleries and museums of Europe; and in their work on jewelry and silverware, although guided by the universal principles of their art, success depends largely upon the individuality of their work and upon their ability to unite utility of form with appropriateness of color and decoration.

Much work in ornamental gold and silver ware has been done in this country within the past forty years, notably in the way of loving-cups, vases, metallic designs, and presentation pieces. As conspicuous among these may be mentioned the gold medals, valued at $1000 and $500, presented by the State of New York in 1858 to Dr. E. K. Kane and Commander H. S. Hartstein, the Arctic explorers; and the silver vase made in honor of William Cullen Bryant, now in the Metropolitan Museum of Art. The testimonials presented to Cyrus Field upon the completion of the Atlantic cable in 1866 include a gold medal struck for the occasion, a gold box, and many pieces of silverware. Other notable specimens are the silver services presented to the arbitrators of the *Alabama* claims in 1873; the silver centerpiece, "Liberty Enlightening the World," presented to August Bartholdi in 1886; the testimonial presented to William Ewart Gladstone in 1887; the loving-cup to Edwin Booth; and a great number of yachting trophies for international and other regattas. Many of these trophies annually made are of exceptional merit, and examples of art metal-work that cannot be duplicated or equaled in any other country.

The discovery of gold in California in 1848 and 1849 gave us a home supply of this metal, and gave employment to metallurgists and miners. The opening of the expositions in London and Paris revealed to us the forms of art and the increasing business of the manufacturing jewelers in this country, and made comparatively easy the acquirement of inventions in machinery and tools necessary to reduce the cost of products. Great improvements have been made in machinery. At present many articles are prepared by the aid of electro-metallurgy. Since 1860 all kinds of goods for which plating is employed have been largely made in this way, the center of production being chiefly in Connecticut, there being also large plants at Newark, N. J., and Providence, R. I. This process is highly valuable, because it places within the reach of people of limited means attractive tableware and other articles of utility now deemed indispensable, which, if not as artistic and as highly finished as solid silverware, are serviceable, and in many instances possess exceptional merit.

The production of silver-plated ware, although a great industry, has not retarded or encroached upon the demand for solid silver; in fact, many instances of recent date would indicate that, with the present low valuation of silver bullion and the mechanical improvements that have further reduced the cost of production, solid silver is rapidly increasing in popular favor and making serious inroads upon the sale of all small articles still manufactured in plated ware.

The production of watches is another American industry closely related to the jewelry trade. They are manufactured in a number of States, notably Massachusetts, Illinois, and New Jersey, the making of the watch-cases forming a separate industry, which thrives especially in Brooklyn and Philadelphia. The highest grades of watches, such as complicated chronographs, calendar and stop watches, and very small watches for ladies, are still imported from Switzerland.

Until about 1850 precious gems and articles of virtu of high order were seldom sold in the United States. Wealthy families bought such things abroad, and these sometimes, owing to reverses or other causes, found their way, in the course of time, to the jewelry shops; but the great variety of beautiful and artistic products that can now be purchased at many establishments could not be found on sale in this country fifty years ago. New York or Philadelphia jewelers acted merely as agents to obtain for patrons some desired articles from a European house. But this state of things no longer exists. The objects of art and other accessories of a modern jeweler's stock represent many thousands of dollars, and include opera-glasses, Sèvres ware, fine pottery, ceramics, enamels, glass, objects in rock-crystal, clocks, bronzes, marbles, plaques, antiquities, curios, and many costly pieces of bric-à-brac and cabinet ornaments that appeal chiefly to collectors and connoisseurs of art.

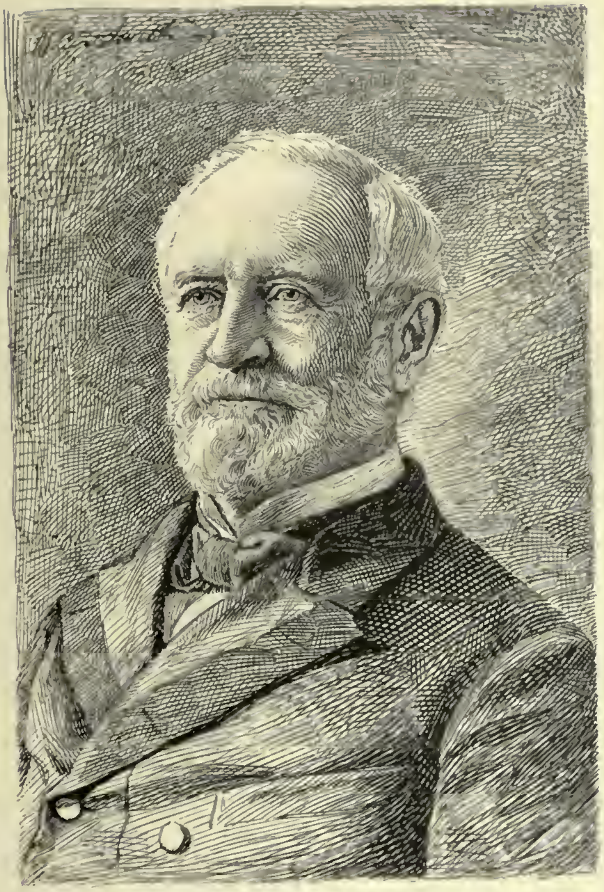
In diamonds and precious stones, that most costly and important department of a jeweler's stock, America is in the front rank of nations, not as producer, but as consumer. It is now conceded that New York is the largest market for gems and precious stones in the world, and that more precious stones are annually consumed—or purchased, in other words—in America than in any other country.

The art of diamond cutting and polishing, although established here for a number of years, recently, through the changes made in the tariff regulations, received such an impetus as to attract many diamond cutters from Holland to this country; and if further revisions are made in the tariff, admitting diamonds in the rough free of duty, it is not unlikely that the industry, which for generations has centered in Amsterdam and Rotterdam, will be centered before many years in New York, Brooklyn, and other cities of the United States.

In the matter of statistics the earliest figures that we have as to the production of jewelry are that in 1812 $100,000 worth was produced in Providence. But as late as 1860 the returns were small. The jewelers and watchmakers of Philadelphia produced in that year $691,430 worth; the silverware men, $516,000; makers of gold watch-cases and chains, $1,714,800. In New York the production was: of gold chains and jewelry, $2,497,761; gold watch-cases, $337,690; silverware, $1,250,695. Newark made $1,341,000 worth of jewelry; Providence, $2,251,382 of jewelry, and $490,000 in silverware.

No summary has yet been made at Washington of the general results of the census of 1890 in manufacturing, but the products of particular towns are given, from which it is learned that the production of jewelry in the previous year in Providence was $7,801,003; New York, $5,605,634; Newark, $4,631,500; Philadelphia, $3,139,596; San Francisco, $1,512,571; Brooklyn, $1,323,234; Cincinnati, $1,317,000; Chicago, $873,000; and Boston, $661,300. The production of silverware was: Providence, $2,509,869; New York, $1,322,235; and Philadelphia, $272,997. Philadelphia leads in watch-cases, with $1,914,222, followed by Brooklyn, with $1,553,993; Newark, with $1,004,584; and New York, with $628,660. Taking the total production in all these articles by cities, Providence comes first, and then, in order, are New York, Newark, Philadelphia, Brooklyn, San Francisco, Cincinnati, Boston, and Chicago. The bulk of the gold and silver products of Providence, Newark, and other Eastern manufacturing centers is sold in New York.

These statistics, however, do not indicate what has been accomplished from an artistic standpoint. American jewelry and silverware have steadily advanced in the quality and the character of products as much as the mere quantity. When the industry was in its infancy we looked to London and Paris for our ideas, our designs, and our models.



Charles L. Tiffany.

Paris, the unchallenged arbiter of all fashions, long held supreme sway in things beautiful and artistic, and in nothing more than rich gems and jewelry; and though we still look to Paris and London for our fashion-plates and many artistic creations which we have not yet mastered here, we no longer accept the models and ideas of our French and English cousins in the designing of our jewelry and silverware. We have marked out a path of our own in this country that has led American products to the foremost ranks of the world. Dealers no longer import foreign jewelry and silverware into this country, because American products are fully equal, and in most cases superior, to those of other countries, in both correctness and originality of designs and workmanship. How our gold and silver manufactures are accepted abroad can best be indicated by a review of some of the press comments in connection with the Paris International Expositions of 1878 and 1889. For obvious reasons the firm names which appeared in these extracts are omitted.

The London "Spectator" of September 21, 1878, says: "It is a modern mistake to assume that the production of good silver-work demands neither special training nor high artistic power. It will not suffice to study old models, however excellent, unless fresh inspiration be gathered from nature, assimilated by the trained mind, and wrought out by the skilful hand into forms of fresh and seemly designs. . . . We confess we were surprised to find at the Paris Exposition that a New York firm . . . had beaten the old country and the Old World in domestic silver plate."

A Parisian publication wrote, about the same time: "Of the many awards which the American section of the Universal Exposition has received, there are certainly none that will excite so little jealousy as those bestowed upon the house of . . . It has been generally conceded that nothing in the whole Palace of the Champs de Mars so richly deserved recognition as the remarkable display made by this famous firm of New York jewelers and silversmiths. Hence the jury were as one with the public, and the palm of honor will be borne away to Union Square."

Speaking of the Parisian awards to American gold and silver ware, the "International Review" of February, 1879, wrote: "The taking of the coveted Grand Prize by an American exhibitor, with the additional distinction of the decoration of the Legion of Honor, is the highest possible official recognition of the supremacy of our metallic art-work."

Closely following these honors and generous tributes, an American house received appointments by Royal Letters as Jewelers, Gold and Silver Smiths, to the following courts of Europe:

Her Most Gracious Majesty the Queen of England;

His Royal Highness the Prince of Wales;
Her Royal Highness the Princess of Wales;
His Royal Highness the Duke of Edinburgh;
His Imperial Majesty the Emperor of Russia;
Her Imperial Majesty the Empress of Russia;
His Imperial Highness the Grand Duke Vladimir;
His Royal Highness the Grand Duke Alexis;
His Imperial Highness the Grand Duke Paul;
His Royal Highness the Grand Duke Sergius;
His Imperial Majesty the Emperor of Austria;
His Majesty the King of Prussia;
His Majesty the King of the Belgians;
His Majesty the King of Italy;
His Majesty the King of Denmark;
His Majesty the King of Greece;
His Majesty the King of Spain;
His Majesty the King of Portugal;
His Majesty the King of Roumania;
His Imperial Majesty the Emperor of Brazil;
His Majesty the Khedive of Egypt;
His Imperial Majesty the Shah of Persia; and other distinguished potentates.

The American displays of gold and silver ware at the Paris Exposition of 1889 resulted in a repetition of the earlier triumphs, and evoked, if possible, even greater enthusiasm and more generous press comments. "Le Figaro," of Paris, June 16, 1889, said among other things, in a review of the exhibit of American jewelry: "It has only taken a few years for the master jeweler and goldsmith of New York to acquire this preëminence in this beautiful art, where the nineteenth century rivals the Renaissance. In the future the metals and precious stones are in his hands, as the potter's clay is in the hands of a Falquire and a Dalou. If the committee of 1878 gave him, joined to the gold medal, the supreme reward of the Cross of the Legion of Honor, I ask, what crown can they give in 1889?"

The selection of press comments from eminent publications, chiefly foreign, deemed free from any bias favorable to American products, has been an extremely embarrassing task, as in every instance the writers included in their laudatory remarks the name of an individual or firm identified with the products which excited their favorable comment, which names have been eliminated from the extracts quoted.

In conclusion, what additional progress has been made, and shown at the World's Columbian Exposition, is of too recent date to present in detail in this article. Much has been written and printed upon the art metal display of the gold and silver smiths, publications at home and abroad for many months dwelling with lavish and minute detail upon the many extraordinary features of the exhibit, which the London "Art Journal" summarizes in an elaborate review, October, 1893, as follows: "Judging by the productions exhibited, one may well be in doubt whether our much-boasted European pre-eminence in these things is to last much longer, and whether, after all, we shall not in the near future be compelled to regard the firms of New York as at least our equals, if not superiors, in the production of high-class gold and silver work."

C. L. Tiffany

CHAPTER XCI

THE GROCERY TRADE

IN all the category of trade there is, perhaps, no one line so distinctively popular in its ministrations as that of the grocery. Other branches of business meet the wants of many and sometimes of the majority of the people, but to none does the universal demand turn as it does toward this one. The grocery stores of the country are the hoppers through which in bountiful supply pours the great grist of life-sustaining products ground out by the mill of national industry. Abundance such as no former time and no other nation on earth have ever known loads the American board. The humblest citizen enjoys and demands as necessities many of those things considered luxuries even by the wealthy a half-century ago.

The advance which has rendered this possible, however, has had another and a more imperative cause than the increased exactions of the public requirement. This cause has been the marvelous growth which has brought a population of 5,000,000 in the course of a century up to nearly 70,000,000. With the facilities and resources of a century ago and the population of to-day New York would be starving inside of forty-eight hours, and famine stalking over the land in another day. Thus it will be seen that our progress has had a most potent moving cause, and that the wonderful development which has placed us in advance of all other nations has come only in response to an equally great necessity.

In the methods by which are obtained and prepared for the market the great food products of which the grocer is the proper distributer many changes have come during the past century. With these changes and their wide-spreading effects the history of the grocery trade is so bound up that it is impossible to separate the one from the other. The perfection of a system of flour-milling which permits an annual production of 80,000,000 barrels at an average profit to the miller of about five cents per barrel has had too great an effect upon the grocer to be ignored. So, too, have the canning and packing industries, each of which worked its own revolution, reacting always upon the grocery trade too powerfully to be passed over in any history of the latter. Transportation, also, with its increased facilities of railroads and fast steamers, has completely formed anew the wholesale and jobbing grocery trade, as the manufacturers' skill and taste, with the resultant neat and conveniently prepared packages, have transformed the retailer's store into a sightly and attractive salesroom. All of these changes, however, have come about in great part during the last thirty years. Prior to that time the grocers were among the most conservative members of the mercantile community, and kept along much as their fathers had before them.

One century ago the grocery business proper of this country was centered in the cities. The general or country store had not yet appeared, the remote and provincial districts being still too thinly populated. In the cities, notably New York, Philadelphia, and Boston, the grocery store, as such, was already in operation. "Flour and provisions" was the favorite announcement of these early grocers, and their shops were more like the wholesale warehouses of to-day than the elegantly finished stores, with their shelves, glass show-cases, and waxy neatness, now familiar to the grocery patron. These early stores dealt mainly in staples handled in bulk —sacks, barrels, boxes, hogsheads, etc.—and transferred in small quantities to the customers' market-baskets. They were scarcely attractive places, for molasses would draw the flies, rice and coffee escape underfoot in harassing quantity from rents in the sacks, while a general odor of vinegar, oil, and soap, indicating the immediate presence of these commodities in quantity, pervaded the atmosphere. West India rum, brandy in pipes, ales, porter, and stout, with Madeira, port, and Bordeaux wines, also lay about the shops in pipes, casks, and barrels, in quantity to delight the bibulous, and of quality and price to attract them equally. Such was the retail trade of one hundred years ago, which centered then and for years afterward in New York, in and about Coenties Slip and Front Street in that immediate vicinity. Its custom was drawn from the same sources, and its proportionate amount in the general business of the day was about the same as now, its lack of dainties and luxuries being offset by the more simple habits of living prevailing at that time. The prices which ruled were relatively high, and as labor was cheap, skilled tradesmen, carpenters, and smiths getting only a little over three shillings per day, the people were forced to live very frugally. Tobacco was sixpence per pound; pork and butter, each eightpence per pound; cheese, fivepence per pound; potatoes, one shilling per bushel; Indian corn, three shillings twopence per bushel; and coffee, tenpence per pound.

The wholesale trade at this time had scarcely dis-associated itself from the general import trade, although it was beginning to show the first signs of a distinctive existence, and during the next twenty-five years reached quite respectable dimensions. At the beginning of the century, however, the great merchants, whose ships were so rapidly seizing the carrying trade of the world, did the general business of importation, and rum, brandies, wines, and liquor, coffee, spices, tea, sugar, and fruits, figured prominently upon their invoices. In addition to these the East India merchant princes were tea importers to a man; and from the time of the Revolution up to the great failure of 1826, when Thompson, of Philadelphia, through questionable practices, and Thomas W. Smith, of New York, through inability to pay the government the duties owed, went under, this trade was in the hands of a very few men. Besides the two already mentioned, Perkins, of Boston, and John Jacob Astor, of New York, were the two largest East India merchants. Other well-known houses operating in the China tea trade were Broome & Platt, who were among the very first to engage in it when Canton became a free port after the Revolution, and later N. L. & G. Griswold and Hoyt & Tom. At that time the annual imports of tea amounted to a little over 3,000,000 pounds; and as it was cheaper in New York than in London, it follows that Americans imported their tea from Canton direct. Bohea tea at that time was worth thirty cents per pound; souchong or black tea, seventy-five cents per pound; and hyson skin or green tea, $1 per pound. The duties here on tea were two or three times as much as the first cost of the article at Canton, and a single ship often had to pay from $200,000 to $300,000 in duties alone. It follows, therefore, that only the largest merchants were engaged in this trade. It was nevertheless immensely profitable once the requisite credit was secured, as the government allowed duties to go over from a year to eighteen months without interest, merely upon the security of a bond deposited. It was this method of doing business that lost the customs several millions of dollars and prostrated the tea trade for some years after the failures of 1826, to which I have before referred. Among the other great tea importers who have been prominent since then are Howland, Aspinwall & Company; A. A. Low & Brother; Talbot, Olyphant & Company; and Wetmore & Company.

Returning again to the grocery trade proper, the opening of the nineteenth century witnessed the advent of the wholesale grocer. He was almost invariably a retailer as well, with the distinction that he carried a larger stock in bulk and catered to the provincial trade, which was then commencing to seek New York as the metropolis. This trade was active only in the spring and autumn, when the country buyers came in. Goods were shipped almost entirely by water, the river and coasting sloop taking them as far as possible, when they would be landed and transferred to carts to continue to their destination. For this trade the wholesalers could only prepare at these particular seasons, and during the rest of the year their market was limited to the local trade. It was the custom of these old-time grocers—among whom were Peter A. Schenck, 66 Front Street; Isaac Clason, 51 Broadway; Samuel Tooke & Company, 74 Coenties Slip; Benjamin Mead, 13 Coenties Slip; Thomas Storm & Son, 9 Coenties Slip; Benjamin Sands; and Voorhees & Scrymson—to club together, and when some large importer received a cargo of coffee, tea, sugar, etc., purchase the whole consignment, which they would then apportion among themselves. Among the importers with whom this early syndicate dealt were Henry A. & John G. Coster, 26 William Street, who dealt in coffee, sugar, rum, and Holland gin; E. Stevens & Sons, 110 South Street, who sold French prunes, Italian fruit, Antigua rum, and wines and brandies; and Bouchard & Thebaud, who dealt in cognacs and wines. The Griswolds also did a heavy West Indian trade, being large exporters of flour, as well as importers of the usual staples. The War of 1812 brought great times to the grocers; but, preceded as it had been first by the Embargo and later by the depredations of privateers, the im-

James E. Nichols.

port trade was caught with the shortest of stock. Prices ran up at an unprecedented rate; speculation was rife, and thousands of dollars were lost in the summer of 1814 through the rumor, brought by a foreign sloop, that peace had been declared. This rumor served to prick the bubble of speculation, and prices again became nearly normal; but as an indication of how far the trade had been carried away by the fever of the time, a few of the prices quoted just prior to the collapse are given: sugar in quantity, forty cents per pound; hyson skin tea, $3 per pound; and molasses, $2 per gallon. Tea at this time or a little later was paying duty of sixty-eight and thirty-four cents per pound for green and black varieties respectively.

The War of 1812, if it did nothing more, made patent to the country at large the increasing importance of New York. The commercial and mercantile interests were rapidly expanding, and owing to its shipping and maritime enterprise it was already becoming the chief port of entry. For this reason, perhaps, its trade being so intimately connected with the leading imports, the grocery business was rapidly centering upon Manhattan Island. The conclusion of the war saw a fresh impetus given to the trade. A venturesome young firm, R. & L. Reed, left the traditional precincts of Coenties Slip and established themselves at 125 Front Street. It was the first grocery house opened above Wall Street, and the course of the Reeds was considered suicidal. They prospered, however, and others followed. Peter G. Hart opened at 196 Front Street, and ten years later, from 1825 to 1830, there were in this neighborhood Reed & Sturges; Lee, Dater & Miller; Jackson & McJimsey; Harper & Sons; Pomeroy & Bull; Wisner & Gale; S. Whitney; Smith, Mills & Company; Isaac Van Cleef; and A. V. Winans. A little further on in the century and we find such names added to our list as Morgan & Earle, 61 Front Street, of whom the senior partner, E. D. Morgan, was at one time governor of this State; Spofford, Tileston & Company, 125 Pearl Street; and Lippincott, Stephens & Company, 52 Front Street. Benjamin Stephens, of this latter house, was the father of Stephens the great explorer. In addition to the importers and wholesale and retail dealers already mentioned in connection with these early days, was the great auction house of M. Hoffman & Sons, 63 Wall Street. This firm sold all the principal cargoes of wines, fruits, molasses, tea, coffee, etc., that were not captured by the wholesalers at first hand, and was a great power in the American grocery world of that day.

Having thus briefly reviewed the personnel of the trade in its earlier days, it becomes necessary to leave the consideration of this phase of the subject for a space, in order to study the conditions and forces which were already working to bring about the development that the last twenty-five years have seen. Many of the men and houses of whom we take leave in 1835–40 we shall find again when we resume the thread of the narrative in 1870. They were the founders of the American grocery trade of to-day, and in their names and achievements have rendered possible the present enormous emporiums and extended commercial interests.

The germ of the greatest and perhaps the earliest force that aided in the evolution of the grocery trade appeared in 1837, when Thomas B. Smith, of Philadelphia, commenced the canning of corn in that city, after the process brought out thirty years before by the Frenchman Appert. It is claimed that Ezra Daggett and Thomas Kensett, of New York, were the first packers in America, having secured a patent for a canning process in 1825. If they were, they failed to introduce their product to general notice; and, indeed, neither Mr. Smith nor Henry W. Crosby, who first placed canned tomatoes on the market in 1847, had achieved any great success up to 1849, when the rush for the California gold-fields began. This created a brisk demand for canned goods, which continued, but in a more or less desultory way, up to the breaking out of the Civil War. The impetus then received has since kept canned goods in the very forefront of the grocery interests. To-day all manner of meats, fowl, fish, fruits, and vegetables are preserved in this way. There are nearly 2000 canning factories in the United States, or more than in all the rest of the world combined.

A second great influence in the enlargement of the grocery trade, that followed the beginning of canning by some years, was the improvement and cheapening of the methods of sugar refining. Fifty years ago raw sugar was worth about ten cents per pound, and as the refiners wanted 100 per cent. more for handling it, a great quantity of raw sugar was imported for direct consumption. This continued until the time of the war, and a feature of the old-fashioned grocery store was the portable sugar-mill in which the "boy" ground the raw and lumpy muscovado from Cuba into such forms as could be sold. Cut loaf-sugar was first known in this country in 1858, when it was brought out by Havemeyer & Moller, the sugar refiners. The same firm has the credit of having introduced granulated sugar some ten years earlier. The war tariff first turned the American consumer toward refined sugars, and the later invention of the centrifugal machine, which reduced the time required for refining from two weeks to twenty-four hours, settled the fate of the raw sugars. Under these conditions, the sugar refiners, who formerly got ten cents per pound for handling, are now able to do it for less than one cent per pound, and the old brown sugar of twenty-five years ago is no longer seen on the table of even the poorest working-man.

It was in this formative period, also, which I have placed between 1840 and 1870, that fancy groceries, table delicacies, prepared condiments and sauces, and the hundred and one little tidbits for the gourmet first began to appear upon the retailers' shelves and in the stock of the great wholesale houses. French fancy groceries first appeared in the American market in 1858, imported by G. G. Yvelin, later Yvelin & Smith, and A. Godillot. The domestic manufacture and trade in these fancy lines antedates the importation of them from France or elsewhere by nearly ten years, and the firm of E. C. Hazard, then located in Barclay Street, is credited with being the pioneer.

Among the canned products, corn, tomatoes, fruits, and corned beef were the earlier goods in the markets. Lobsters were first put up in 1848 at Harpswell, Me., and the salmon from the rivers of that same State was in the market, canned and delicious, as early as 1841, or just twenty-five years before his Western cousin from the Columbia River was introduced to the public. Of the progress this one branch has made since it started it is only necessary to say that from an output of 4000 cases the first year the annual production is now, in round numbers, 1,750,000.

The curing of meats, hams, and flitches of bacon makes another chapter in the story of American progress in the lines under review. The marked improvement seen in this direction to-day is scarcely to be attributed even in its inception to the early period in which we find the other causes moving, but it has proceeded so directly from them that it may most properly be considered here. It accomplishes in a day and a half what formerly took nearly a month and a half. In addition to the economy in time, these improved methods have also resulted in a superior product.

Summarizing thus the influences which for three decades were quietly but steadily tending toward advancement, we come to the year 1870, which may be said to have marked the advent of modernity into the grocery trade and its methods. The retail store was still distinguished by many of the characteristics familiar to the early traders of Coenties Slip. Staples in bulk, doled out in brown-paper parcels to customers, were still the rule; the "shelf goods" of to-day were almost unknown. Fruits in barrels and casks, sugar in boxes, and molasses in hogsheads still stood in unsightly cumbersomeness in the middle of the floor. The sun-cured fruits of California were unknown, the vast resources of that State in this direction being still undeveloped. Evaporated stock, too, was still of the future. The stores were small dingy places compared with the great establishments of to-day; the old sugar-mill, the back-breaking "fall," and stuffy little offices, in place of light and airy counting-rooms, were prominent features. Despite all this the spirit of progress had entered, and innovation in one form or another was an almost daily event.

Of the famous firms of that day, including importers, only a few need be mentioned in tracing the trade descent. Among these were the O'Donohues; E. & R. Mead, Jr., & Company; E. D. Morgan & Company; Carter, Hawley & Company; H. K. Thurber & Company; Fitts & Austin; Rufus Story & Company; Philip Dater & Company; Arnold, Sturges & Company; E. C. Hazard; F. H. Leggett & Company; Rufus Park & Company; Stanton, Sheldon & Company; Bonnett, Schenck & Company; Hoppock & Greenwood; Pool, Nazro, Kimball & Company; Apgar & Company; Henry Welsh; Woodruff, Spencer & Stout; Williams & Potter; S. Burkhalter's Sons; J. & H. Van Nostrand; Penfold, Charfield & Company; Reeves, Osborn & Company; and many others.

The business done by these houses was scarcely of a magnitude that would have placed them in the front ranks to-day. An annual trade of $1,500,000 was rare, and large houses were looked upon as having a very comfortable sales account when it ran above $750,000 per annum. The trade of the country was at that time in its infancy. Buyers still kept up the old-time custom of coming in to purchase stock but twice a year. The railroad systems that have since bound us to every little town and hamlet were then but in their commencement, comparatively speaking. The price-list of the great wholesale house, quoting everything from a barrel of molasses to a ten-cent bottle of flavoring extract, was unknown to the rural shopkeeper, as was its accompanying advantage of being able to drop a postal-card order in the evening and receive the goods by first freight. The delivery systems of the large houses were but meager in their facilities as compared with those by which thousands of dollars and tons of stock are to-day passed smoothly and swiftly through the shipping departments of the great New York establishments.

Fancy groceries were still regarded as a specialty, and the few houses which carried them to any extent considered themselves outside of that general wholesale trade which dealt mainly in the regular staples, such as tea, coffee, sugar, rice, molasses, starch, flour, spices, oil, soap, etc. Raisins, grapes, and olive-oils and fruits from the Mediterranean, in casks and boxes, were also stocked, but to a great degree the liquor department of the business had become a separate trade. A few of the large houses still carried wines, liquors, and cigars, but the proportionate amount of sales for that account, as compared with the total volume of business, was and is much diminished.

The West Side houses have always had the larger and more assorted stocks, and many lines of luxuries and proprietary goods appeared in their inventories nearly twenty-five years ago, although the distinctively fancy lines, including canned specialties, were in the hands of a few dealers. Gradually the increasing demand caused an expansion of stocks and business that drove many of the large firms from their old quarters; and no buildings in that section of town being commodious enough for their rapidly growing needs, the great grocery warehouse, erected and designed solely for that purpose, began to appear. The West Side trade centered naturally around Chambers Street, where it was in easy reach of the ferries and great railroads, gradually moving slightly north; and this section has since remained grocers' territory. Here to-day within a radius of a few blocks are no less than six large establishments, and two whose annual business aggregates about $25,000,000. Within their great warehouses centers the grocery trade of New York. Huge retail establishments uptown and around town, importers over on the East Side and in the lower part of town, all do an enormous trade, but they lack the distributive scope of the West Side warehouses. Not only as distributers, but as importers and manufacturers as well, do these establishments figure. Direct to their depots the products of the whole world are brought. Freights, the bugbear of the grocery merchant, either wholesale or retail, a quarter of a century ago, have been reduced to a degree directly appreciable to the consumer in the prices he pays to-day. Grain and beef are now transported from Chicago to New York for one third and one half respectively of the rates charged in 1870; canned goods and fruits from California come through for less than one quarter of the old-time rate. Ocean freights, too, have fallen, and this is likewise apparent in the prices of many imported articles.

Improvement and invention have everywhere worked changes in methods and processes that have aided equally in lowering prices to the consumer. The great abattoirs of Chicago, where thousands of cattle can be slaughtered in a day and not one scrap of the carcass from the hoof to the horn be lost, make, it is claimed, so small a profit as $1 per head a most remunerative business, simply through the magnitude of the totals. The old-time butcher would have starved to death had he had no wider margin of profit than this. At the same time the price of both the dressed and the preserved or canned meats has fallen far below that formerly charged. In the matter of canned meats especially, as being most closely connected with the grocery interests, the prices in forty years or a little more have dropped fully sixty per cent. So in all the other lines a cheapening of the necessaries of life has resulted, in which the national progress may easily be measured. Flour, better than any ever known since the first miller dusted his white cap, is now in the market at a price that, after deducting handling, transportation, and manufacture, leaves a per-barrel profit so small that only the figures which show that the United States annually consumes about 65,000,000 barrels and exports over 15,000,000 more could make its small cost to the consumer possible. A barrel of flour in 1870 was worth $6.75, that to-day is quoted at less than one half that price. Sugar, which in 1870 cost nearly fourteen cents a pound when granulated, has fallen to between four and five cents. Here again with the narrowed margin of profit is found the vastly increased consumption, the figures having more than doubled, and sixty-four pounds in round numbers being placed to the credit of each inhabitant, where thirty-one pounds per capita were consumed in 1870.

Coffee is one of the few staples that have not fallen in price proportionately as they have increased in general use. This has been due to the fact that the supply has never yet been able to outrun the demand. The establishment of coffee exchanges here and in Europe has also had a sustaining effect on prices, as it has made coffee an article of speculation proportionate to other speculative products limited in quantity and easily controlled, so that capital and skilful manipulation have often sustained prices on a weak market. The effect of the exchange is to concentrate the coffee trade largely in New York, and to-day this market to a considerable degree makes the markets of the world. The United States consumes annually in the neighborhood of 300,000 tons of coffee, and with the exception of the period of three or four years around 1885, when the price for fair grades of green Rio declined as low as nine cents per pound, the price has been uniformly maintained, the greatest variations noticed in nearly thirty years, apart from this brief period, being only a trifle over four cents per pound. Butter, cheese, rice, canned goods, molasses,—nearly everything, in fact, that could be specified,—has meanwhile shrunk in price, and, with but a few exceptions, increased in amount consumed. The exceptions in nearly every case are to be noted where the article in question has been superseded by an improved product. Wines, liquors, and cigars, perhaps, ought to be named as the only lines which fall outside the application of this rule. The increase in the sale of fine brands of these three specialties has been in no way proportionate to the advance noted along other lines; yet it has been sufficiently great to exhaust the choicer qualities of the supply, and hence prices have not diminished.

One other article in the grocery trade of which mention has to be made is tea. It follows along under the general rule of increased quantity and lessened price. From China this country has turned largely to Japan teas, as well as to a few from India. Where nearly all the tea consumed here prior to 1857 came from China, the total imports now show about one half to the credit of that country, with Japan a close second. The increase of the total trade is shown from the fact that one hundred years ago the entire imports were only about 3,000,000 to 4,000,000 pounds, where to-day they are between 90,000,000 and 100,000,000 pounds. Keeping step with this advance, the price has fallen from fifty per cent. to sixty per cent. in most of the grades.

The significance which lies in the foregoing figures is the epitomized story of the grocery trade. It tells more eloquently even than can the immense emporiums where the business has its homes to-day of what the wants of a great people can do in the development of their resources. Huge establishments, frequently having their own manufacturing plants in various lines, furnish price-lists of thousands of articles; and yet with all their mammoth undertakings and endless facilities they are simply filling the field that the grocer of one hundred years ago filled quite as completely after his own fashion. Whether or not that fashion was as satisfactory as the present one is quite beside the question. Even had it been, it would still have failed to-day, just as all the crops of that day would have failed to feed the world of our time, through sheer inadequacy. Millions of capital invested stand to-day where hundreds would have been hard to find a century ago. Transactions have also increased in like proportion. All over the country thousands of stores, neat and commodious, furnish to the poor man what the nabob of a century ago could not have obtained; the larger dealers drawing their supplies from headquarters at New York, the smaller retailers from near-by cities where the stores are larger again and the wholesale dealer appears. These city wholesalers as intermediaries draw on the great central depot of New York, where through the medium of the greatest importing, manufacturing, jobbing, and commission establishments in the world is flowing steadily the current which supplies life with its first and greatest necessity—food. The description of business as conducted in one of these systematically organized great houses thus comes properly to form the final chapter in the history of the American grocery trade.

Beginning with the building itself, the great grocery firms of New York are similar in that they occupy their own homes, some of them covering the greater part of a city block—enormous ten-story buildings, where from basement to top story is stored the most complex stock to be found outside of a department store; lighted by electric lights, reached by fast-running elevators, and filled with every product demanded by the perennial hunger of the human race. On the ground floor is located the shipping department, where from twenty-five to forty great two-horse trucks and delivery wagons can be loaded at once with expedition and accuracy. Another floor is usually given over to the offices and counting-rooms, handsomely finished off, where a force of clerks, the pay of whom alone would have swamped the old-time merchant, is kept busy recording the infinite detail of the firm's transactions. A few houses have their own facilities for roasting coffees, grinding spices, etc., our own house having a modern coffee-roasting plant that is capable of turning out 100,000 pounds a day; also a fireproof spice-grinding room, with high-speed steel mills with a capacity of over 10,000 pounds. Extensive plants for packing various lines of farinaceous goods and olives, and also for compounding and manufacturing extracts, essences, etc., can be found in some of these mammoth wholesale establishments.

In the fancy lines, and in preparations of all sorts, the modern grocery establishment is itself a whole food exposition. With floor-spaces frequently aggregating acres, there is scarcely a square foot not utilized, and thousands of dollars have to be kept locked up in single items of the large stocks required in the business of to-day. Single firms who do an annual business of nearly $5,000,000 are not extraordinary, these figures being frequently exceeded, and in one or more cases nearly trebled. What the aggregate volume of the grocery business of the country is at present it is impossible to say, owing to the great variety of interests connected with it. That it is many hundreds of millions is as certain as it is that in these millions is represented a greater equivalent than ever before in the history of the world. Above all, it is an actual value that they represent, based, as is the grocery trade itself, upon the real worth which attaches to the necessary things of life as contrasted with the long list of its superfluities. With such a foundation, and in the light of the evolution of the last century, there would seem no future too broad and successful for the grocery trade in the United States.

James E. Nichols

CHAPTER XCII

THE FRUIT TRADE

THE fruit trade is among the youngest and most recent of those commercial undertakings which have attained a national importance within a comparatively few years. Based as it is upon the increased prosperity and improved conditions which have rendered the luxury of yesterday the necessity of to-day, it is still further strengthened by the variety of the interests it unites. The grower in distant California finds his welfare inseparably bound up with that of the great eastern commission houses in New York which look to the retail merchant, who in his turn falls back upon the small street-fruiterers who, from upwards of 10,000 stands, are daily supplying the population of the big city with fresh, ripe, and luscious fruit from orchards thousands of miles away. For a penny the poor man has to-day what the dollars of the nabob could not have procured a century ago. The hot-house of fifty years ago, with its limited and practically priceless production, has been superseded, and Nature herself, circumvented by human invention, sees her seasonable gifts to tropic climes whisked in a moment over hundreds of miles to relieve the rigors of northern barrenness. The strawberry that ripened in Florida is scarcely picked before the power of steam is bearing it northward to the winter and the snow-drifts of New York, where it is none the less a strawberry because June is still far away. As it is with this, so with all other fruits, whether quickly perishable or more enduring, their handling is a business where celerity is of the utmost necessity. System and organization, availing themselves of the facilities of the railroad and the steamship, have accomplished wonders; but the fruit trade must always be considered as peculiarly susceptible to market conditions, owing to the fact that a few days, or even a few hours, sometimes suffice to render worthless invoices valued at thousands of dollars. In spite of these risks the fruit trade has increased, and in the face of its most serious difficulties have been evolved some of the most noteworthy of those improvements which have contributed to its development.

One hundred years ago the fruit merchant as such did not exist in this country. Some of the larger importers occasionally received, among the other articles of an assorted Mediterranean cargo, a few half casks of dried prunes, currants, raisins, or grapes, but beyond these even the luxurious did not aspire. It was some years before even so simple a custom as selling native fruit brought to town in season by the neighboring farmer became at all general with the old New York grocers. Having reached this point of development, the fruit trade rested, and it was not until 1830 and later that the importation of foreign fruit was considered seriously. Prior to this, however, in 1804, the first bananas were imported into the United States. Captain John N. Chester, of the little schooner *Reynard*, was the skipper of this original West Indian "fruiter," and thirty bunches were about as many as he thought the American market would stand at one consignment. For twenty-six years after that bananas were only occasionally brought to this country and in but small quantities, until in 1830 John Pearsall, of the firm of J. & T. Pearsall, imported the first cargo. He chartered the schooner *Harriet Smith*, and from her he landed in this city 1500 bunches of bananas — the first large shipment. From that time the banana trade continued in a modest way — a few cargoes annually for a score of years.

The fruit trade meanwhile was not waiting for this branch, but was developing steadily in other directions. In 1832 there arrived at New York by sailing ship the first cargo of oranges from Sicily. Lemons followed almost immediately, and the Mediterranean fruit trade became a recognized interest from that time. The next thirty years saw the Italian fruits, oranges and lemons, holding full possession of the

American market. Sailing ships chartered here and sent across brought back the fruit, much of which was bought from the importers by dealers and speculators before it had been a day at sea, and while its quality and condition were largely matter of guess work. The transatlantic cable not being laid at this time further increased the speculative nature of this trade. From this somewhat hazardous method of buying, and the difficulties it so frequently led to, through the buyer's disappointment with his purchase, arose the auction system of selling fruit. Minturn & Co. were the auctioneers to whom all the early foreign fruit sales in this city were intrusted, and the transactions under the hammer were usually small. Five thousand boxes was a good-sized cargo in those days, and among the many buyers on one invoice those who refused their contracts were so few as to render the auctioneer's services but seldom needed. Little as was the amount thus sold, however, it was not long before some of the shrewd old merchants began to notice that fruit, even when so unsound as to induce a buyer to refuse his contract, was sold in this auction-room readily and at a fair figure. The natural deduction from this was that, if unsound fruit could be sold to advantage at auction, sound fruit could be sold to still greater advantage. Based upon this reasoning, and having the further advantage of quick returns, the auction-houses came into existence, and have continued ever since as important factors in the fruit trade. This method of disposing of fruit did not come in all at once, however, the great importing houses having intrenched themselves too firmly. Until so late as 1865 these houses controlled the market for foreign fruit in this country, and bought directly from Italy. Among these firms, famous thirty-five years ago, were Devlin & Rose; Chamberlain, Phelps & Co.; James Robinson & Co.; and Lawrence, Giles & Co., of New York; Daniel Draper & Co. and Conant & Co., of Boston; Dix & Wilkins, of Baltimore; and S. S. Scattergood & Co. and Isaac Jeanes & Co., of Philadelphia. In this latter year the wholesale commission house having come to be a generally recognized feature of the fruit trade, many of the Italian growers began consigning their fruit directly to American firms. This arrangement, dispensing with the Italian middleman, was found the more profitable for both the grower and the American jobber, and for fifteen years the Mediterranean trade continued on these lines. About 1880, the third and last change in the methods governing the Italian fruit trade began with the establishment here of representatives by several of the large Italian houses. Since then they have increased, and now practically control the Sicilian and mainland output, the foreign shipper naturally preferring to deal with a compatriot rather than with strangers. Spain, once a large shipper of oranges, has been forced from the American market by the Italian growers, and excepting her grapes, of Almeria and Malaga, and latterly her lemons, she sends little now to this country.

The foreign fruit trade of the United States, briefly summarized in the foregoing, has undergone great changes in the last quarter of a century. This period has been the one within which interests amounting to thousands of dollars have been multiplied to millions, and quantities expanded from cart-loads to car-loads. Up to 1867, the foreign fruit grower and shipper saw no cloud on the horizon of the American market. The lemon of Sicily and the sweet Messina orange competed only with the apple for Yankee favor. Grapes, raisins, currants, prunes, every European fruit — green, dried, or preserved — found in the United States a market that was never glutted except by itself. Bananas and pineapples from the West Indies, Cuba, and Central America, cocoanuts and tropical fruits of every description, came, but in limited quantities, and an auction house that could do a business of a million a year would have been considered an impossibility. Nevertheless it has come, and the causes which have led to this marvelous advance are to be found wholly in the development of American resources. Prior to the Civil War and for several years afterward the small fruits of New York, New Jersey, Long Island, and Delaware were the only competitors of the foreign fruit. Occasionally a sloop loaded with watermelons would roll up from one of the Southern ports, or a few crates of the same fruit came by rail, but there was no systematized trade as there is to-day. Peaches were to be had in season, but if the much-bewailed Delaware crop really did fail, the market and prices both appreciated it, and California was not just behind waiting to come to the rescue as she is to-day.

Such was the condition of affairs in 1867, when the first consignment of green fruit from California was shipped by express to New York. It was an experiment, and neither in the condition in which the fruit arrived, nor in the expense involved in its transportation, can it be said to have been a success. Despite this fact, however, the idea having been thus exploited, there were others ready to make trial of it, and in November of the following year one car of grapes and three cars of pears were received in this city, having come through from California consigned to N. R. Doe. The pears were in good condition, and brought from $3.50 to $5.00 per box, while the grapes, principally Tokays, brought from $10 to $15 per forty-pound crate. The transportation charges on the grapes were $1200, and the ventilated car containing them came through attached to a passenger train. Contrasting the prices brought by this early consignment with those of to-day, it seems scarcely possible that so short a time can have worked so great changes. The California overland fruit trade has been one that has grown steadily since its commencement. It has built up the wonderful garden State itself, profits ranging from $500 to $1000 an acre having frequently rewarded the growers; it has swelled the receipts of the transportation companies by hundreds of thousands of dollars; rendered this country independent of external sources of fruit supply; established great agencies in the Central and Eastern cities, and is even now reaching out across the Atlantic to an English market on the other side of the world. Thousands of car-loads of fruit are shipped every year, of which from 1000 to 1500 come to New York. California has been wise enough, furthermore, to see that her best interests are conserved by direct dealings, and the attempt of Chicago a decade ago to intercept all through fruit trade from the West and distribute it, with herself as the center, failed completely.

For the transportation of the California fruit product, private enterprise has provided refrigerator cars, of which there are now several lines. The California Fruit Transportation line was the first to start, and by carefully looking after its interests this line has been largely instrumental in making the cross-continent fruit trade a success. In these cars the fruit is packed and refrigerated in California, and taken out later in New York in practically the same condition as when it left. The great drawback to the California trade at present is the freight rate, which for so long a journey is necessarily far too high to allow the realization of proper profits by all connected with the fruit interests. Already a disposition has been shown to remedy this evil, to some degree at least. The through rates from San Francisco to New York have been reduced in some cases as much as fifty per cent. in the last twenty-five years, and the facilities accorded by the railroads in the matter of speed, and by private enterprise in the way of rolling-stock, have been improved to an equal extent.

In addition to the golden peaches and pears and full clustered Tokay and other grapes so well known on the fruit-stands and peddlers' carts as the product of California, this State also produces a large crop of oranges and perhaps the largest of apricots, and it will also in the near future give us a full supply of lemons superior to and more plentiful than the Sicilian product. In the matter of oranges California is a new comer, not 5000 boxes of fruit, from that State, having been sold in New York up to two years ago, although the Western markets knew them earlier. The California orange groves developed more rapidly than those of Florida, and for this reason their product is already assuming a larger importance than that of the latter State, which has, however, grown them much longer. The commencement in the Florida fruit trade was made early in the seventies, just after California with her pears, peaches, and grapes had so successfully crossed the continent. Oranges were then, as now, the strong advantage of Florida, and with them she first presented herself to the Northern market. Their quality speedily secured their popularity, and in the few years between 1875 and 1880 the foreign dealers began to realize that the American fruit growers of the Gulf Peninsula were seriously in competition with them. While the direct consumption of foreign fruits, notably oranges and lemons, has increased very considerably since that time, it has been due to the growth of the country and the consequently greater demand, and prices have declined materially, the consumer reaping the advantage. Between the foreign and the home dealer in fruits the advantage in freights has, singularly enough, always rested with the former. The Sicilian shipper can box, transport, pay customs duties in New York, and still land his oranges in Washington street, New York, at a less expense than can the Florida grower. Excessive rail rates for local freights, together with the almost inevitable transshipment at Jacksonville, make a great part of the Floridian's expense. Compared to the freight charges from Florida those from California are considerably lower proportionately, although in their gross amounts they exceed the former. In both cases the Italian product is cheaper to its market by from 30 to 60 per cent., exclusive of the original cost and whatever difference the cheaper labor of Italy might make in that item. Nevertheless the native fruit holds its own and more. Excluding the abnormal conditions of last year, when the fruit interests of Florida received such a disastrous blow from the freezing weather, there would have been no reason why the orange crop of that State and California to-day should not have approximated

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8,000,000 boxes at the least. Three years ago, Florida shipped 900,000 boxes of oranges to New York, and this amount was estimated to be only about one quarter of the total crop, which would therefore have been 3,600,000 boxes. California in the same year was producing 2,500,000, which gave as the total for the American crop, not including the Louisiana and Arizona yield, 6,100,000 boxes. The groves were at that particular age where each of the next few succeeding years produced a great increase in the bearing, and had it not been for the unprecedentedly severe weather of last winter, a crop of even so much as 12,000,000 boxes might have been produced. All this has, of course, been altered by the blizzard of December, 1894. Where Italy was sending but 1,000,000 boxes of oranges to 900,000 from Florida in 1893, the present year will see her figures many times greater proportionately; and in the other lines as well, notably lemons, the prices will show that the foreign growers and shippers are again controlling the American market as they have not done before in twenty years. With the exception of these staple fruits, however, Florida is still a purveyor to the northern markets to the extent of about 10,000,000 pineapples annually, while $250,000 worth of limes are grown each season. Around the fruit raising industry in its great strongholds has grown up, in the packing for shipment, a branch which now employs many hands, and which in the supplying of its boxes and wrapping papers has created a most lucrative trade. An expense of thirty-five cents for boxing, nailing, wrapping, packing, and cartage is not excessive for each box of oranges or lemons shipped, and when the shipments run into the millions of boxes, the importance of this one item can be easily appreciated.

Before coming to the fuller discussion of the magnitude and condition of the fruit trade to-day, especially as it centres around the great market of New York, there is one other phase of the general American situation that must be mentioned. This is the export trade, consisting largely of dealings in American apples. A half century ago America sent only a few thousand dollars' worth of dried apples abroad. The sun-drying of California and the evaporated stock of to-day were unknown. In 1850 the exportations of American fruit amounted to only $24,974. Its increase since then is shown in the following table:

FRUIT EXPORTS.

Year.....	1850.	1860.	1870.	1880.	1894.
Value....	$24,974	$206,055	$542,502	$2,090,634	$2,299,006

England is the great receiver of our exported product, and a million barrels of apples can be absorbed by the capacious auction houses of Liverpool, London, and Glasgow during a season. Of the recent experiments to make the Briton a buyer of our finer fruits from California, it is still too early to speak. The insular prejudice which induces the English buyer to demand that fruit brought from California shall be guaranteed to keep sound a week, while he buys fruit from across the channel without any guarantee, is simply in the nature of those encountered at the outset by every American product that has attempted the markets of the United Kingdom. Eventually there can be little doubt that California fruit will find a ready and profitable market on the other side of the Atlantic.

In the meantime, while this advance is still largely in the future, it is most satisfactory to consider the present condition of the fruit trade as contrasted with its status fifty years ago. The last year for which the statistics are complete, that of 1894, shows the total importations of fruit into this country to have been $17,353,559. In the transportation of this great bulk of so fragile and perishable a nature there is now engaged a special marine which has been built for this especial service. The raking and piratical-looking little schooner built for lightness and speed that plied to the West Indies and Central America ten years ago has now been largely superseded by the specially constructed fruit steamer, a fleet of which vessels, numbering more than a hundred, plies between New York and the foreign fruit-shipping ports. These steamers, between the steel outer hull and the inner one of wood, are packed, as is the household refrigerator, with charcoal, a non-conductor of heat. Separated deck planks, insuring to the cargo below a free circulation of air, are also a feature of these ships, which are otherwise equipped in all respects as first-class carriers, with triple expansion engines capable of great and sustained speed, steam steering gear and applied power.

It is in this fleet that the greater part of the $10,000,000 worth of fruit comes which is taken by New York as her share of the total annual importations. Once arrived here, it is handled in any one of the variety of ways that its shippers may have chosen from the methods now in operation among metropolitan fruit-traders, either through the auction room, the wholesale commission merchants, jobbers, brokers, or representative buyers. All these offer avenues along which can be discharged the newly-arrived cargo within twelve hours after passing quarantine. Their particular functions are too apparent to require description. In the further distribution of the fruit, the retail local merchant, the out-of-town dealer, and the regular demand for consumption are important factors. Upon the latter of these depend the two former to a great extent, and this in its turn is dependent upon the weather to a degree little understood. Cold, rainy weather, raw and unpleasant, will invariably depress in a marked degree the price of the more perishable fruits; while, on the other hand, a hot spell, creating a double demand, drains the market and puts prices up as if by magic. Behind the weather, however, we see in this the ultimate responsibility falling upon the character of the stock. Its perishable nature and the many opportunities that irresponsible dealings in consequence offer for fraud, have led the trade of New York, and every other great center as well, to establish certain safeguards and seek in organization to combine the better elements against questionable methods. Among the larger and better known of these organizations are the New York Fruit Exchange, operating on the same principle as the other great exchanges; the Fruit Buyers' Union, which aims to regulate the methods of the green-fruit import and auction business so as to render corrupt practices impossible; the National League of Commission Merchants, the aim of which is to secure uniformity and integrity of method and purpose in the commission business; and such organizations as the great Florida and California Fruit Exchanges, which are designed to support the same ends, for equally potent if somewhat different reasons. Through the medium of these organizations — the other large cities, such as Boston, Baltimore, Philadelphia, Chicago, and New Orleans, having similar ones — is transacted the greater part of that business, which, as already shown, aggregates in its exports and imports very nearly $20,000,000 annually. In addition to this must be reckoned the domestic product, which, while variable, and not reducible to exact statistics as is the customs-classified foreign product, still amounts to at least an equally great sum. A total verging toward $50,000,000 is not excessive to give in representing the annual interests of the fruit trade. The invested capital, either in the growing or in the more mercantile branches of the industry, cannot be estimated. There is no possible standard from which to figure, but the investment is certainly very great and far in excess of what the annual movement might be considered to indicate. A last illustration of the magnitude of the fruit business can be gathered from the fact that fruits considered in the unit have small value, and yet figured from pennies the dollars run into the millions. There are from 13,000,000 to 15,000,000 bunches of bananas imported annually, and last year the sum of $4,285,278 was needed to pay for the lemons imported. Even supposing that so few as twenty-five lemons could be purchased for a dollar, the total number of lemons thus consumed would amount to well over 100,000,000, exclusive of the domestic product. Other values, which will give some idea of the itemized magnitude of the fruit-trade in 1894, are oranges imported, $1,127,005; bananas, $5,122,503; raisins, $554,087; cocoanuts, $786,777; currants, $774,802; plums and prunes, $416,342; and dates and figs, $779,626. For pears, peaches, grapes, apricots, and all the infinite variety of domestic fruits, the figures are even greater. The last crop of Florida oranges was estimated at 6,000,000 boxes, and from California this year 2,500,000 boxes of the same fruit are expected. The apple crop for this season is estimated at upwards of 60,000,000 barrels — a great trade of itself. Around the handling of these large quantities of home fruits has grown up an interest affording employment to an immense force of laborers. The cultivation of the orchards, the gathering of the fruit, the packing, shipping, and handling on the market; all these branches furnish work for thousands of people, and give the fruit trade an economic as well as a commercial importance.

Sufficient has been given to show how vast an interest has grown up around this youthful enterprise. With the progress of the past to encourage, and the conditions of the present to assist, there seems no reason why the next quarter century should not witness a steady advance in the business.

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CHAPTER XCIII

THE DRUG TRADE

VERY different was the drug-store of old from the modern counting-room and clean warehouse, and very different the business methods pursued. The development of the drug trade during the last century has kept pace with the wonderful progress achieved in all lines in this period of advancement and discovery. Pharmaceuticals and chemicals, in this short span of years, have been raised to foremost places in the list of the world's productions, and the United States to-day is able to furnish the world with anything it needs in medicinal wares, having in many instances displaced home products in foreign countries which are now buying our goods.

In order to obtain a comprehensive idea of this wonderful evolution and development it must be borne in mind that the apothecary of old went through a form of apprenticeship, the initiatory steps of which were making the fire, sweeping out, and washing mortars and bottles. Then, after going through various graduations, he was trusted to make up prescriptions, no examination into his qualifications being ever made. Occasionally one with ambition, by study and experiment, would make some discovery in medicine or science.

Formerly a large part of the wholesale druggist's stock consisted of glassware, oils, paints, putty, indigo, and madder, and in dull seasons the apprentices and clerks were kept employed at putting up essences, paregoric, castor-oil, and the like in small vials for the retail trade. Dealers in England and in the Old World generally were then, as to-day, on the lookout for new remedies; so when trade was opened with America all "yarbs" and roots from here were examined for medicinal virtues, and it would seem as if the catalogue of the New World's products is not yet complete, for only very recently cascara sagrada, yerba santa, and damiana have been found valuable. Doubtless many of the old remedies were favorites with the Indian medicine-man, and some are still known by their Indian names. One of the chief advantages which the world derived from the discovery of America was, according to the learned men of that day, the introduction of new and powerful drugs. For a long time, tobacco, sassafras, and Jesuits' bark were commonly used medicaments. The vegetable and animal kingdoms being very different here from those of Europe, it is not surprising that physicians, as well as the unlearned, fancied that among so many new drugs some must be very valuable. All the old chroniclers dwelt much upon the health-giving qualities of American herbs. Everything that grew here was tried. But it would not be fair to put upon the shoulders of our cousins across the ocean the whole burden of this almost superstitious belief in the curative properties of American plants; we must bear a little of it ourselves. Great faith is still placed, in some sections of our country, in the various snake-roots, once popularly believed to be specific for snake-bite.

Throughout the whole history of medicine and pharmacy may be found the misnamed "patent," properly the secret, medicine. The earliest manufacturing druggists were those who made these secret remedies, which are not the outgrowth of the present century, but have been made for hundreds of years. The public used to believe in them even more blindly than to-day; powers were claimed for them far beyond what are claimed for any that are now sold,—extraordinary as this may seem,—and stopped at one limit only, namely, they were not guaranteed to raise the dead. By their use everything else could be accomplished, from the knitting together of a broken arm to the receiving of sight by one born blind. These pretensions had diminished by the beginning of this century, but there was still more natural faith in the community than now, of which the makers of patent medicines availed themselves, and their preparations formed an important item in drug stocks.

Prominent makers of patent medicines in this city fifty years ago were A. B. & D. Sands, Dr. S. P. Townsend, Dr. Jacob Townsend, Dr. Moffat, and Dr. Brandreth. The names of two Drs. Townsend are given, because the two appeared as rival makers of sarsaparilla, although there was always a doubt about the existence of Dr. Jacob Townsend. Both (always assuming that there were two) took advantage of the belief in the curative quality of sarsaparilla, then newly made known to the public, and claimed that their preparations would cure every ill that flesh is heir to. It was difficult for the public to understand the controversy in the newspapers which followed. Young Dr. Townsend (S. P.) accused old Dr. Townsend (Jacob) of imitating him. The old doctor, on the contrary, insinuated that the young doctor stole his ideas and his methods, and they had columns of abuse and denunciation of each other in the papers, and were the largest advertisers of the day; but the mystery surrounding Dr. Jacob Townsend has never been solved. Despite the amusing and mixed condition of the Drs. Townsend, the public continues to have great faith in sarsaparilla, and the manufacture of it is still a source of wealth to the old-established concerns. But aside from patent medicines, which were characteristic of the times and the credulity of the people, the drug business had a much sounder basis for existence and progress. Staples, legitimate drugs, were gathered from all quarters of the globe, and as widely redistributed. The development of American commerce was apparent in this branch of commercial activity. Drugs, such as jalap, ipecac, sarsaparilla, and balsams, imported from Mexico, Central and South America, were exported largely to Europe from New York.

In 1820, through French investigation, the separate alkaloids in cinchona bark—quinine, cinchonine, etc.—were determined, and Pelletier shortly after began their manufacture. About the same time John Farr started a quinine factory in Philadelphia, which was followed at a later day by the building of another in New York by John Currie. Our first supplies of cinchona bark came to us through Spain, but when the ports of South America were opened to our commerce shipments were received direct. A few words might be interpolated here relative to the later history of this most important drug. In 1854 the Dutch government imported some young cinchona-trees and some seeds from South America to Java, where they were planted in the Government Botanical Gardens. It was from this beginning that numerous plantations were set out in the mountains, at proper elevation, which, proving successful, formed the source from which the principal part of the world's consumption is now derived. In India, Ceylon, and Africa plantations were also started, which in a short time increased the supply of bark so greatly that the production exceeded the consumption, resulting in a considerable decline in the market price. In a comparatively few years the prices realized on shipments did not pay the growers for the expense of keeping up their plantations and the cost of transportation. The superior quality of the Java barks, and the low prices accepted for them, tended to reduce the exports from South America, and for the same reasons the shipments of cultivated barks from India and Africa have also been decreasing. For a certain period, while our government continued to tax foreign-made quinine, our manufacturers were able to supply the entire home consumption; but with quinine admitted to our free list in 1879, and the lower cost of manufacture abroad, the foreign makers were enabled to ship their surplus stock to this country. They soon secured a foothold in our market, and now supply more than one half the quinine consumed in the United States.

Stone-oil or Seneca-oil, now known as petroleum, was first found in West Virginia, where it rose to the surface of the ground, heavy and dark; it was locally popular as a liniment. In 1829 a well was drilled in Cumberland County, Kentucky, which yielded a quantity so large as to be then considered a phenomenon. The bulk of it was wasted, but a little was bottled, and sold in Europe under the name of American oil. The device on the label—a derrick—first suggested a means of securing a sufficient supply of crude oil to pay for refining. From so small a beginning has grown an enormous industry, and "a new light has come to the world." From the first it was a medicinal remedy, and later the filtered paraffine residuums have proved valuable, and are known as petrolatum, vaseline, etc. These also have become articles of export, introduced abroad presumably by the demand from our own citizens visiting or residing there.

The earliest mention of the manufacture of drugs in this country is in the instructions given to Sir Francis Wyatt, governor of Virginia, in 1621, to invite attention to the making of oil of walnuts, and to employ apothecaries in its production. The inhabitants were likewise to search for dyes, gums, and

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drugs. The South Carolina Agricultural Society in 1785 offered premiums for the cultivation of drugs such as senna, cassia, rhubarb, hops, madder, and figs. But it is vain to attempt the description of individual articles and their employment in those olden days; a word or two may be said, however, of the business methods then current. In the retail branch it was largely "go as you please," and in the wholesale line, sixty years ago, the hours of business were from seven in the morning until nine at night. There were no railroads, and after the opening of the Erie Canal there was a rush of trade in the spring, and again before the close of navigation, so that at such seasons clerks would often be at work until midnight. Mr. Samuel B. Schieffelin informs the writer that he has seen the leading druggists of that time standing at their desks writing late at night, and that he himself often worked until midnight. He says further: "They were generally a superior class of men, of high social position, educated gentlemen, and successful in business; many of them had their country-seats, and some of them kept their carriages."

The selling terms were six months, or five per cent. off for cash. Interest was charged after six months, and sometimes the Southern trade would take an additional six months when the cotton crop failed. But as banking facilities improved credits were shortened. With the outbreak of the Rebellion large amounts outstanding had to be canceled; but though many houses went out of business, comparatively few failures occurred among the wholesale trade. A perusal of the advertisements of wholesale druggists of one hundred years ago gives the idea that their stock embraced a great variety of articles. Stocks of the present day are about as varied; but we find that the old articles of materia medica have been combined and presented in many new shapes, and these, in connection with the thousands of new articles, present to-day a list whose complexity of nomenclature can be equaled by few lines of trade. The extent of drug stocks of a century ago, compared with those of to-day, might be approximated by a comparison of one of the earlier pharmacopœias with the present edition of 1890. That of 1830 will, perhaps, reflect the condition of affairs for two or three decades previous to its issue. In it 272 articles of materia medica are mentioned, and 349 processes are given for preparations, making a total of 621 titles. The "United States Pharmacopœia" of 1890 has 994 titles, and the "National Formulary," a semi-official work of almost equal practical importance, has 435, making a total of 1429 articles or preparations which the apothecary is supposed to be ready to furnish upon demand. In order to further show this comparison, the following table is presented, and some figures are added showing approximately the number of preparations or articles under the same heading now carried in stock by the wholesale druggist of 1895. The latter figures are necessarily only an approximation, and are averages compiled from the price-lists of various manufacturers and jobbers.

STOCK DRUGS IN PHARMACOPŒIAS, 1830 AND 1890.

Articles or Preparations in "United States Pharmacopœia."			Articles or Preparations under Same Headings Listed by Wholesale Druggists.
Article or Preparation.	1830.	1890.	1895.
Acids	7	32	140
Alcohol	1	3	4
Alnm	2	2	9
Ammonia	6	7	59
Antimony	4	5	19
Arsenic	1	1	14
Bismuth	1	4	35
Cerates	10	6	17
Confections	7	2	10
Copper	3	1	33
Decoctions	15	3	...
Extracts	20	121	780
Gold	1	1	6
Honeys	4	3	...
Infusions	22	5	...
Iron	5	23	63
Lead	2	5	37
Lime	4	6	25
Liniments	11	9	14
Lozenges	5	15	40
Magnesia	1	5	29
Medicinal waters	8	19	51
Medicinal wines	7	10	35
Mercury	11	12	47
Mixtures	10	4	22
Mucilages	2	4	...
Oils	15	50	185
Ointments	20	23	78
Pills	27	15	500
Plasters	11	13	51
Potassium	10	20	76
Powders	6	9	8
Silver	1	6	19
Sodium	4	23	85
Spirits	6	25	34
Sulphur	3	4	9
Syrnps	17	32	202
Tinctures	42	72	267
Vinegars	3	5	11
Zinc	3	10	46

The first column shows, with a few minor exceptions, the classification and number of preparations in the "Pharmacopœia" of 1830; those of the work of 1890 are as follows: acids, 32; cerates, 6;

charta, 2; collodions, 4; confections, 2; decoctions, 3; elixirs, 2; emulsions, 4; extracts, 30; extracts, alcoholic, 1; extracts, compound, 1; extracts, purified, 1; extracts, fluid, 87; extracts, fluid, compound, 1; glycerites, 6; honeys, 3; infusions, 5; liniments, 9; liquors, 24; masses, 3; mixtures, 4; mucilages, 4; oils, fixed, 11; oils, volatile, 39; ointments, 23; oleates, 3; oleoresins, 6; pills, 15; plasters, 13; powders, 9; resins, 5; soaps, 2; spirits, 25; suppositories, 2; syrups, 32; tinctures, 72; triturations, 2; troches, 15; vinegars, 2; waters, 19; wines, 10.

The wholesale druggist of fifty years ago carried, as do his successors of the present day, many articles not mentioned in the pharmacopœias of that time, and this feature of the business has so rapidly increased that reference to recent price-lists of prominent jobbing-houses shows an average number of 5700 articles in the department of drugs, chemicals, oils, etc., and of 7600 articles in the department of "patent" or proprietary medicines. If the vast number of articles known as "druggists' sundries" were included the figures first quoted might be doubled, and by including the large number of secret proprietary medicines with which the country is flooded, but which are confined to local trade and do not appear upon general price-lists, the figures upon patent medicines would also probably double; so that it seems fair to estimate that the drug trade of to-day handles 25,000 articles.

One notable feature distinguishing the methods of the drug trade of to-day from those of a century ago is the division of manufacturing into distinct departments. The retail apothecary was then depended upon to prepare from the crude material the medicines required by the physician. To-day, while his knowledge must include an acquaintance with all processes, his convenience impels him to buy the greater portion of his stock in such a stage of manufacture as renders it ready for dispensing. This has caused the building up of the business of manufacturing pharmacy, developed most extensively during the last quarter of a century, and the partial development of the manufacture of chemicals.

A review of the drug trade would be incomplete without some data respecting the progress made in chemistry, for in no other branch of physical science can such advancement be chronicled as in this. It is scarcely one hundred years since Priestley laid the foundation of our modern chemistry by the discovery of oxygen, that most abundant of all elements. To Scheele chemistry owes many of its early and most important discoveries, some of which, like glycerine and prussic acid, were of great value to the pharmacist. Lavoisier, the unfortunate French chemist who was beheaded in 1794, is also deserving of mention as one of the fathers of modern chemistry. The discovery of morphine by Sertürner in 1804, and the discoveries of strychnine and quinine some years later by Pelletier and Caventou, were of vast importance and interest to the physician and pharmacist, furnishing as they did the active ingredients of valuable remedial agents, and serving as examples of the value of alkaloids and their salts. One of the important alkaloidal discoveries of later and recent years was cocaine, which, in the shape of muriate of cocaine, is very extensively and successfully used as a local anæsthetic. Laughing-gas, chloroform, ether, and their application as anæsthetics, have played so important a part since their discovery as alleviators of the sufferings of humanity, that anæsthesia, an American discovery, and modern antiseptic surgery are ranked with the greatest achievements of the nineteenth century.

The evolution of organic chemistry is one of the scientific triumphs of the latter half of the century. The discovery by Wöhler in 1828 that urea could be manufactured artificially from isocyanate of ammonium was the first step in the synthetic production of organic compounds, for until that period chemists held that no organic compound was possible except through the medium of "vital force." Since 1828 innumerable compounds of an organic nature have been prepared synthetically, and many of them are of such importance that they are produced commercially in extensive quantities, as, for instance, alizarine, the chief coloring principle of madder root, of which perhaps $15,000,000 to $20,000,000 worth are manufactured annually; oxalic acid, formerly prepared from the juice of the sorrel, is now made at one tenth its former cost from sawdust and caustic soda; while salicylic acid, instead of being derived from oil of wintergreen, is now produced by the action of carbon dioxide upon carbolic acid and caustic soda.

The chemist has not only been enabled to prepare many of the organic compounds in his laboratory, but during the past ten or fifteen years a vast number of new and interesting synthetic chemicals which plants and animals do not produce (such as antipyrine, exalgine, phenacetine, etc.) have been discovered. This number is continually increasing, and many of the compounds are of importance therapeutically, and of much interest to the druggist and the drug trade. So great has been the advancement of synthetic chemistry that the chemist of the present day is willing to predict that it is only a question of time when he will be in a position to produce every organic molecule synthetically.

All this progress, this discovery in allied science and labor, has of necessity exerted a powerful influence upon the drug trade, and contributed in no small degree toward making it what we find it to-day. But other agencies, other factors, have been equally operative and effective in molding and shaping it. Of the first in importance among these agencies in its direct effect upon the retail trade, and through it upon the wholesale branch, has unquestionably been the "United States Pharmacopœia."

During the three or four decades following the year 1795 the handling of drugs was carried on in a manner which would be far from reassuring to the invalid of to-day. Between 1810 and 1820, however, was inaugurated a movement which may be designated as one of the most important of the century—that of an authoritative agreement, upon the part of those dealing in and prescribing drugs, regarding the identity and purity of the various medicinal agents then in vogue. This movement resulted in the appearance in 1820 of the "United States Pharmacopœia," a work which has passed through successive decennial revisions up to the present time, and which is recognized as the standard in all the various manipulations of drugs and chemicals, from the identification of the crude material to its proper preparation for the use of the invalid. Although this great work is the result of what might be called private initiative or purely scientific devotion, and is essentially the work of a distinct professional class, it has received governmental recognition to such an extent that the statutes of most of the States recognize it as an authority in legally determining the purity of drugs sold; and as a contribution to the literature of applied science it receives the indorsement of the medical and pharmaceutical professions of all countries. Another successful movement was inaugurated during the period between 1820 and 1830, by the trade and profession as represented by the then newly established colleges of pharmacy at Philadelphia and New York, having for its object governmental inspection of imported drugs, a function which is still exercised by the national government, to the great benefit of all concerned.

From these two movements, which marked what might be called the starting-point for the immense development, both commercial and professional, of pharmacy in this country, may be traced the additional legislation, tending to promote the establishment of correct trade standards, which now appears upon the statute-books of most States, and is known popularly as the "Pure Food and Drug Laws." At the present time such legislation is receiving much earnest attention from the press, the public, and the trade, and unfortunately its assumed theoretical advantages are hampered by suspicions of undue political influence or of governmental paternalism. In keeping with this general trend of affairs are the laws of the various States regulating the handling and sale of drugs, chemicals, and poisons at retail. As it becomes more apparent that skill and experience in handling such articles are necessary to the public welfare, this class of legislation receives increased attention. This feature of the drug-trade history of this country is one of comparatively recent growth, the first law having been passed by Rhode Island in 1870, since which time all the States, with but few exceptions, have taken similar action. Although there is a lack of uniformity of detail in such laws, their effect is to restrict the dealings in drugs and the compounding of prescriptions to those who are able to bring satisfactory evidence of their qualifications before a board of pharmacy, which is authorized to license those whom it deems qualified to engage in the business. The beneficial effect of such legislation is at present only partially felt; for it was decided, as a matter of justice, upon the enactment of such laws, that all those already engaged in the business should be allowed to continue without reference to the new conditions imposed, and as a consequence there are yet many in the retail trade whose qualifications have not been officially determined. But this is a condition which a few years will serve to set right.

The necessity for the better educational qualification of those engaged in the drug business being recognized, the first college of pharmacy—that of Philadelphia—was founded in 1821. In 1826 it graduated three students. During last season its students numbered 757, of whom 197 graduated. The New York College of Pharmacy was organized in 1829, and at about this time colleges were started in Baltimore, Boston, and Cincinnati. There are now about fifty institutions in the United States and Canada where instruction in pharmacy is given, twenty-four of which are regular colleges or schools of pharmacy, the others departments of pharmacy in universities. The first department of pharmacy in a State university was that of Michigan, founded in 1868. During the past year 4200 students—125 of whom were women—attended these schools and colleges of pharmacy, and of this number 1100 were graduated.

Associations or organizations for the conservation and advancement of the material and professional interests of the drug trade have exercised a powerful controlling influence. The first organization was effected in the retail branch when, in 1852, twenty-one active men formed themselves into the American Pharmaceutical Association, having for its object the advancement of pharmacy through increased educational facilities, and the formation of a body which should represent the then newly recognized professional side of the drug business in its relations with the medical profession. This object has been attained in the most gratifying manner, and the list of membership includes the names of the ablest men who have been or are identified with the scientific advancement of pharmacy. The association holds annual meetings for the discussion of scientific questions, trade and educational matters, and has a membership of 1533. One of the features of its work is the annual publication of its proceedings, which contains a review of the scientific progress of pharmacy. Volume xlii., embracing the year ending July, 1894, is a work of nearly 1400 pages, of which 815 are devoted to the progress of pharmacy during the year. Other organized bodies in the retail ranks are the State pharmaceutical associations, the oldest of which is that of New Jersey, founded in 1870 with 44 members, but which now has 350. There are at present forty-six such State associations.

In the wholesale drug trade a notable event of the century was the formation, in 1876, by many of the Western wholesale firms, of an association named the Western Wholesale Druggists' Association, called into existence by the demand of the times. The Civil War caused expansion, which was followed by collapse and a general unsettling of all trade relations. To hold trade, competition became sharp, and concerns that had been doing a prosperous business found it impossible to make profits. A meeting was held in Indianapolis, which was attended by a majority of the prominent druggists of the neighboring cities; and, although no positive action was taken at that time, a better feeling was created. Shortly afterward, at a special meeting, a committee was appointed to try to put into effect what is now known as the "rebate plan." This system was planned and adopted by the proprietors of patent medicines and the wholesale druggists to enable the latter to get a fair profit on patent medicines, which they had formerly been obliged to sell on very close margins. Buyers had to sign a contract that they would maintain established prices, and by so doing were entitled to ten per cent. discount, or rebate, on the wholesale price; but should they sell at cut rates, they would be placed on a "cut-off" list and be debarred from buying from the proprietors.

In 1882 many of the Eastern druggists joined with those of the West at a meeting held in Cleveland, and the name of the association was changed to the National Wholesale Druggists' Association. The following year its first meeting was held in New York. While the various committees have worked hard and reported annually on matters of trade interest, such as the national bankrupt law, fire-insurance, legislation, credits, etc., the committee on rebates has really effected the most important change in trade matters. Up to that time there had not been more than a dozen large distributing centers in the United States; now, by the working of the rebate system, almost all towns of 50,000 inhabitants have one or more wholesale druggists, who are placed on an equal footing with the largest buyer, and each one supplies the retailers in his neighborhood. The National Wholesale Druggists' Association now numbers 258 active and 153 associate members.

One of the undoubted factors in the growth of the drug trade in this country is the pharmaceutical press. It has fostered a spirit of emulation by presenting records of current scientific investigation and progress, and has been a means of bringing the members of the trade or profession into closer touch and sympathy. The people of the United States are said to be the greatest readers in the world, and the large number of ably edited journals devoted to pharmacy shows that the druggist is no exception to this rule. Prominent on its list of publications are the following monthly journals: the "American Journal of Pharmacy," Philadelphia; the "Druggists' Circular and Chemical Gazette," New York; "Pharmaceutische Rundschau," New York; the "Western Druggist," Chicago; the "National Druggist," St. Louis; and the "New England Druggist," Boston. Of semi-monthlies may be mentioned the "American Druggist and Pharmaceutical Record," New York; and of weekly publications, the "Pharmaceutical Era," the "Shipping and Commercial List," and the "Oil, Paint, and Drug Reporter," all of New York. In addition there is a considerable number of similar publications issued by the various colleges and societies and by several of the prominent drug and manufacturing firms.

There are also several devoted to the allied sciences of chemistry, botany, microscopy, etc.

Leaving this phase of the subject, it would be well to make a comparison, hasty and necessarily imperfect, between the conditions governing trade a century ago and those prevailing to-day. In those days the apothecary cut and rolled his pills by hand, and made his plasters with a "spreading-iron." To-day machinery greatly simplifies these operations, and the manufacturing pharmacist by power-machines is enabled to turn out 100,000 pills per day, and plasters *ad libitum*. For making compressed tablets power-machines are used which turn out 500 tablets per minute. Seidlitz powders are mixed, measured, and put up in packages by machinery, and bottles are filled, corked, and labeled by similar means. Marvelous has been the progress in operative, manipulative pharmacy, and the benefit to the drug trade from the results of inventive skill is shown when we consider that the combined rating of 270 wholesale druggists and manufacturers of chemicals and pharmaceuticals is nearly $50,000,000. Of these, eleven are rated at $1,000,000 each; over twenty-nine up to $500,000 each; thirty-seven at $250,000 each; and the balance from $20,000 to $25,000 each. There are eight large factories engaged in manufacturing fine chemicals, and over a dozen firms making pills and other pharmaceutical preparations on an extensive scale. It is stated in the census report of 1890 that the production of pharmaceutical preparations then amounted to $16,747,043; it would be fair to say that it now amounts to $20,000,000.

Let us enumerate a few of the most noteworthy improvements: Fluid extracts, as constituting a class of pharmaceutical preparations, are essentially an American invention. They are made by percolation or displacement, a process in which the powdered drug in a suitable vessel is deprived of its soluble constituents by the descent of a solvent through it. The value of this process cannot be overestimated, as the progress made in pharmacy in America during the last half-century is largely due to the study and development of percolation, and the introduction of preparations which are the direct outgrowth of the process. Percolation was made official in the "Pharmacopœia" of 1840, and has been continued in the various revisions of that work to the present time. None of the pharmacopœias preceding that of 1850 gives formulas for the preparation of fluid extracts; in that year only seven formulas were given; in 1860 the number was increased to twenty-five, and in the present edition there are eighty-eight. This number does not at all represent the great variety of fluid extracts manufactured, for they have become almost as numerous as the vegetable drugs in popular use. Another innovation is the elixirs, which are aromatic, sweetened, spirituous preparations containing small quantities of active medicinal substances. The term "elixir," used by manufacturers as designating a class of pharmaceutical preparations, was introduced prior to 1840, but the first formula published under the name "elixir" for the use of the druggist did not appear until 1859. During the seventies the popularity of this kind of medicament had reached its height, although elixirs of various kinds are still largely prescribed.

In the adaptation of labor-saving machinery to the manufacture of pharmaceutical preparations the American inventor has found a field worthy of his genius, and of the greatest importance to the pharmacist. A century ago the old-fashioned iron or stone mortar for powdering drugs was to be found in every pharmacy. Drug-milling, as understood to-day, was then unknown. Iron and stone mills have been superseded by new machinery which has greatly improved the quality of the product and cheapened the cost of production. Among the most important innovations is the process of grinding by attrition. Rapidly revolving arms in a cylinder soon reduce the introduced substance to any degree of fineness desired. For substances more friable, the rumbler, a revolving cylinder inside of which are porcelain balls, works better, and it requires very little attention. Centrifugals have also brought about great changes in chemical production, and percolators have displaced the wide-mouthed jar and stirring-stick.

Sugar-coated pills were first made in this country by the Tilden Company, of New Lebanon, N. Y. In a recent interview with the president of the company, S. J. Tilden, he told the writer that he had some filled capsules of copaiba and cubebs made over forty years ago, which were as good as they were the day they were made up. The popularizing of gelatine capsules as a means of administering nauseous remedies in a readily assimilable condition is largely due to American push and inventive genius. The process originally outlined for their manufacture was that of Mothes, of Paris. H. Planten & Son claim to have been the first to make and introduce them in the United States. In the early seventies the invention of improved machinery for their manufacture gave the industry a strong impetus, and the business became one of magnitude.

Pure fruit-juices have become a very important article to the retail drug trade. For making "soda-water," fruit flavors from artificial essences were for a long time used, until more cultivated tastes required the natural flavors. The manufacture of these is now carried on on a large scale, and great quantities of fruits, which sometimes become a glut on the market, are thus utilized.

In special fields of manufacturing pharmacy the development of new ideas and processes has been equally prominent. Perhaps one of the most interesting of these special developments has been that characterizing the discovery, commercial exploitation, and rapidly increasing commerce in what are known as the digestive ferments, of which pepsin is the best known. In keeping with the crude speculative views of the ancients on all physiological phenomena, the most absurd theories were advanced to explain the process of digestion in the stomach. It was not until the first quarter of the present century had nearly elapsed that the correct conception of the nature and agencies of the digestive secretions and process was reached, namely, that the solvent action upon food is due to certain peculiar, soluble organic principles or ferments.

Consideration of the commercial and practical application of these digestive ferments leads us easily to America; for here the commercial importance of pepsin and the other digestive ferments is far greater than in any other country, and in America their value and practical usefulness as therapeutic agents and in the artificial digestion of foods have been most fully developed. In physiological chemistry we owe a great debt to the researches of the chemists of the older countries, especially France and Germany; yet the practical significance and promise of these researches have been most clearly conceived and realized by American invention, sagacity, and enterprise. It was an American surgeon, Beaumont, who made (1825–33) the famous classical observations upon the phenomena of digestion in the living stomach, which revealed the functions of the gastric juice and did much to stimulate and suggest the direction of subsequent inquiries. The active principle of the gastric juice was discovered by Schwann, 1836, to which he gave the name of pepsin, although unable to separate it; diastase by Payen and Persoz, 1833; the albumin-digesting ferment of the pancreas, described by Corvisart, 1857–58, but not accepted until confirmed by Kühne, 1867, who separated the ferment and named it trypsin; the emulsive ferment by Eberle, 1834. The history of American commerce in pepsin practically begins with the introduction of Scheffer's pepsin, 1872. Scheffer has the merit of proposing the simple and practical "salt" process, which, being a great improvement over previous methods of obtaining the ferment from the stomach, was soon widely adopted. Pepsin prepared by this method appeared in commerce principally as "saccharated pepsin," the ferment being incorporated with a large proportion of milk-sugar. In 1879 Fairchild introduced the original form of pepsin in scales, "free from added substance or reagents." The appearance of this pepsin of phenomenal strength, with the recognition of the fallacy of administering the ferment in the largely diluted form then in vogue, was the signal for great activity in the manufacture and improvement of commercial pepsins. The obvious importance of stomach digestion naturally directed attention chiefly to the stomach ferments, and the medicinal use of the digestive ferments still remains popularly identified with pepsin; yet the other digestive ferments, especially those of the pancreas, possess far wider scope of activity and are relatively of wider importance. Practical recognition and application of these pancreas ferments must fairly be attributed to Fairchild, who in 1880 introduced the *extractum pancreatis*, containing diastase for the conversion of starch, trypsin for the conversion of albumin, the emulsifying ferment for the digestion of fats, and the milk-curdling ferment. Fairchild demonstrated the very remarkable practical value and adaptability of these pancreas ferments, especially in the artificial digestion of foods for the sick.

In the preparation of infant foods both diastase and trypsin have been extensively employed. In view of the indigestibility of starch for infants, Liebig proposed that the farinaceous foods commonly used with milk as food for infants should first be predigested into soluble form by means of malt diastase. In 1884 Fairchild proposed a method of modifying and adjusting cows' milk to a resemblance to human milk in digestibility and composition. Fairchild's method is based upon the conversion of caseine, by means of trypsin, into the soluble and peptone-like bodies which give to human milk its peculiar digestibility, in contrast with cows' milk. Pepsin now appears in a great number of popular as well as officinal forms, and is prepared generally by pharmaceutical manufacturers everywhere. We have in the United States the only house in the world engaged, as an exclusive specialty, in the manufacture of the digestive ferments and predigested foods.

The digestive ferments occupy a brilliant position in modern therapeutics, and the progress of physiological chemistry suggests still further utilization of the animal organic principles, as recently shown in the successful and important treatment of disease by the thyroid gland.

The india-rubber porous plaster, which was the first improvement made on old methods of applying plaster masses to the human body, was invented by Dr. Shecut, a naval surgeon, who attempted to popularize it with the aid of Horace Day, known in the rubber trade. They conducted the business under the name of Day & Shecut, but later sold it to Thomas Allcock, who was in the employ of James Aspinwall. Allcock failed to make it a success, and sold out to Dr. Brandreth. There were a number of manufacturers of plasters doing business at that time, whose products were made chiefly of isinglass and resinous mixtures, the latter being spread on cloth and plaster skins. Besides there were several makers of common adhesive plasters in five-yard rolls. In this group the following are the most familiar names: Ellis, Husband, Davidson, De la Cour. Of the makers of isinglass, court, corn, bunion, and kid plasters should be mentioned Robbins, Mitchell, Littlefield, Wells, Herrick, and Holloway, who all made specialties of certain lines.

About 1867 Seabury & Porter commenced to experiment with rubber, in order to introduce a general line of improvements. In those days, and up to 1876 or 1877, many of the mixtures were in solution, and the plaster mass was spread on frames with a brush, then cut, and made porous. Seabury was the first who conceived and practically worked out the idea of the use of rubber in medicinal and surgical plasters. All pioneer manufacturers have their trials and tribulations before they perfect their work, but the beginning of the great object striven for was attained when the firm changed from rubber solutions to the mechanical working of plaster masses. Later the firm name was changed to Seabury & Johnson.

Another distinctively American form of medication unknown to our forefathers was introduced in 1878 in New York by Dr. R. M. Fuller, under the name of "tablet triturates." These preparations are made by triturating the active ingredient with either plain sugar of milk or a mixture of sugar of milk and cane-sugar, forming the mixed powders into a paste and pressing the paste into tablets in appropriate molds. In this way small quantities of potent remedies, such as alkaloids, concentrations, etc., could be administered in convenient, palatable, and readily soluble form. The idea was a taking one with the medical profession, and manufacturers began to produce them upon an enormous scale. An idea of the magnitude of this work may be gleaned from the statement that a single manufacturer lists no less than 500 different varieties of these preparations.

These instances of development in individual lines prepare one for a presentment of statistics showing the magnitude of the commerce in which the drug trade is to-day engaged. One of the advantages secured by the organized trade bodies that have come into existence during the past fifty years has been the keeping of statistics and the recording of current history. If such organizations had existed a hundred years ago the work of the present compiler would be comparatively simple. Our government did not keep records of imports and exports of drugs prior to 1830, and even then the list comprised but few items. The exports of medicinal drugs from the United States were then stated as $130,238. For the year ending September 30, 1835, they were reported at about $200,000, whereas last year the exportations of medicines of all kinds amounted to about $8,000,000. Of these, ginseng root alone amounted to 233,236 pounds, valued at $826,713, all of which was exported to China. Our own continent and the West Indies have been the only fields for exports as far as the introduction of our manufactured articles is concerned. Except for a few specialties, Europe has taken our simples only. Probably tobacco was the earliest indigenous drug exported, and its consumption has so increased that it is now of sufficient importance to be classed by itself. Oil of peppermint, which we find quoted in 1804 at fifty cents per pound, for the past few years has been selling at from $1.50 to $3 per pound. It was first cultivated in New York State about seventy-five years ago; and the exports of this product last year amounted to 93,879 pounds, valued at $244,716.

The statistics of imports earlier than 1835 are wanting, and for that year only camphor, 62,134 pounds, castor-oil, 471 casks, and opium, valued at $172,415, are enumerated. For the fiscal year ending June 30, 1875, the Bureau of Statistics reported the importation of drugs, chemicals, and dyes at $38,263,067, and for the fiscal year ending June 30, 1895, at $45,552,569. In these figures crude drugs and manufactured articles are combined. That the imports in 1895 do not more largely exceed those of 1875 may be accounted for by the increase in the number of our home producers, who now supply many articles formerly imported. For comparison the importation of a few selected articles is given, which will afford an interesting study.

COMPARISON OF LEADING IMPORTATIONS, 1876 AND 1895.

Article.	Average Imports of Five Years Ending June 30, 1876.	Average Imports of Five Years Ending June 30, 1894.
Bark cinchona	4,446,563 lb.	2,810,422 lb.
Camphor crude	854,962 "	1,746,017 "
Ext. licorice	1,777,715 "	1,031,070 "
Magnesia carb.	168,958 "	64,643 "
Manna	22,726 "	34,756 "
Morphine	1,934 oz.	28,186 oz.
Nux vomica	364,995 lb.	1,455,446 lb.
Oil anise	16,468 "	38,152 "
" bergamot	42,642 "	54,645 "
" cassia	52,186 "	51,263 "
" castor	1,852 gal.	2,269 gal.
" citronella	47,592 lb.	338,649 lb.
" croton	4,735 "	106 "
" lavender	36,320 "	97,560 "
" lemon and orange	70,642 "	210,996 "
" olive	131,222 gal.	620,599 gal.
" " salad	175,103 "	629,637 "
" rose	10,018 lb.	40,356 lb.
Opium	185,962 "	583,777 "
Pitch Burgundy	39,178 "	238,882 "
Quicksilver	123,445 "	250,065 "
Quinine	52,185 oz.	2,784,973 oz.
Root gentian	57,585 lb.	210,731 lb.
" jalap	60,466 "	106,633 "
" licorice	10,182,531 "	74,430,002 "
" orris	41,345 "	190,931 "
" rhubarb	72,411 "	115,106 "
" sarsaparilla	646,517 "	716,214 "
Seed canary	54,060 bush.	108,673 bush.
" caraway	576,694 lb.	1,312,012 lb.
" cardamom	29,838 "	42,039 "
" castor	1,466 bush.	111,440 bush.
" mustard	1,390,540 lb.	2,689,884 lb.
Senna	180,365 "	51,457 "

A few leading articles are worthy of individual and more extended consideration. Among these one of the most important is opium. The earliest government statistics value the importation of this drug for the year ending September 30, 1835, at $172,415, but the number of pounds is not stated. Probably the cost per pound was much higher than at the present day. During the year ending June 30, 1895, crude opium to the value of $730,669 was imported, representing 388,455 pounds. This, however, is below the average quantity imported during several preceding years. When we take into consideration the increased quantities of morphine and opium now imported, together with the many new remedies for pain and sleeplessness that have been brought into use, we may form a slight idea of the terrible strain our nervous organism is subjected to as compared with that of our ancestors. The average importation of opium for the years 1869, 1870, 1871, viz., 90,000 pounds, has increased to 562,618 pounds, the average of the years 1892, 1893, 1894; and the average importation of morphine, covering the same period, has increased from 1934 ounces to 30,000 ounces.

To show further the extended use of narcotics, we find the average importation of opium prepared for smoking, for the same period, was 14,333 pounds, against 74,151 pounds. Last year the importation of "smoking-opium" greatly exceeded that of any previous year, amounting to 139,765 pounds; of this, 35,638 pounds were carried over in bond at the end of the fiscal year, making the amount entered for consumption 104,127 pounds. It would hardly seem possible that the actual amount consumed could increase so suddenly, and the only deduction is that some speculation has taken place in the article on the Pacific coast, and that the government has been more vigilant than heretofore in stopping smuggling.

IMPORTS OF OPIUM DURING THE PAST TEN FISCAL YEARS.

Year Ending June 30th.	Pounds.	Average Import Cost per Pound.
1886	471,276	$2.20
1887	568,263	2.35
1888	447,020	2.76
1889	391,563	2.07
1890	473,095	2.29
1891	621,749	2.54
1892	587,924	1.76
1893	612,519	1.92
1894	716,883	2.36
1895	358,455	2.04

Cinchona bark has touched during the current year, in the public sales at Amsterdam and London, the lowest figure ever known; and quinine in 1892 also reached its lowest limit, seventeen cents per ounce. Since the above date the surplus stock of quinine has been greatly reduced, and during the past year the market has ruled at from twenty-four to twenty-five cents per ounce. For the fiscal years ending June 30th the importations of cinchona bark were as follows:

IMPORTATIONS CINCHONA BARK, 1885 TO 1895.

Year Ending June 30th.	Pounds.	Value.	Average Cost per Pound.
			Cents.
1895	1,911,489	$117,297	6.2
1894	2,502,224	143,194	5.7
1893	2,374,041	196,867	8.3
1892	3,423,941	299,998	8.8
1891	2,672,364	301,085	11.3
1890	2,838,306	282,737	9.9
1889	2,878,184	371,532	12.8
1888	2,801,457	344,718	12.3
1887	4,787,311	741,830	15.5
1886	4,447,082	925,744	20.2
1885	3,559,691	913,189	25.7

For comparison we add a table of importations of sulphate of quinine for ten years, ending June 1st:

IMPORTATIONS QUININE, 1886 TO 1895.

Year Ending June 1st.	Ounces.	Value.	Average Value per Ounce.
			Cents.
1886	1,251,556	$887,599	71
1887	2,180,157	1,098,547	50
1888	1,603,936	647,654	40.5
1889	2,825,008	917,322	32.5
1890	2,990,239	886,430	29.7
1891	3,079,000	805,821	26.1
1892	2,686,677	542,440	20.2
1893	3,027,819	556,782	18
1894	2,141,130	740,816	21.9
1895	1,420,649	342,348	24.1

Senega or snakeroot has become a popular drug. It was formerly found in the Eastern States, but is now found in sufficient quantities to pay for digging only in Minnesota, Dakota, and Manitoba, except some small quantities that come from the South. This root was quoted at twenty-five cents one hundred years ago. It went up to sixty cents, but during the last five years has declined, until now it is at the old figure. The annual production is estimated at between 300,000 and 400,000 pounds, and about one third the amount now gathered goes abroad to meet the increasing foreign demand. Serpentaria, or Virginia snakeroot, as it is sometimes called, comes mainly from Texas. This was quoted in 1804 at twenty-five cents, and during the past five years it has fluctuated between twenty-two and thirty cents. A demand exists for it for export, as also for goldenseal, sassafras, and mandrake roots, damiana and lobelia herb, and slippery-elm bark; but of all the indigenous drugs exported, cascara-sagrada bark probably is the largest in quantity, although ginseng root doubtless leads in value.

Borax, although not an article of export, has considerable importance as a home product. Formerly our supply came from England or indirectly from Italy. It was first discovered in California in 1856, and later in the deserts of Nevada; now these two States supply the country. Before 1872 borax sold at from twenty-eight to thirty-five cents per pound; since then the increased production has brought the price down to between five and eight cents per pound.

Although we are still large importers of drugs and chemicals, the reason for this is a purely economic one, or rather it is a matter of convenience. The natural resources of the United States will, when developed, furnish nearly everything in the way of medicines. Borax has been cited as an example, but there are many others, especially those materials which enter into the inorganic compounds, and which are easily accessible, such as quicksilver, iron, lead, copper, zinc, aluminium, sulphur, lime, potash, soda, gold, silver, manganese, etc. With a climate ranging from frigid to torrid, nearly all the medicinal products of the vegetable world could with proper care be propagated in this country. Experiments with camphor, cork, licorice, opium, olives, and other foreign plants have demonstrated this fact.

It only remains to mention the personnel of the drug trade of long ago and that of to-day. We have no data as to the number of druggists doing business in the United States a hundred years ago; but though there are now 38,000 in the country, the New York City Directory of 1786 gives the names of only five. On Queen Street, now a part of Pearl Street, there were two, Effingham Lawrence being at No. 227, and Besley & Goodwin at No. 228. Hanover Square had three: at No. 23 was Francis Wainwright; at No. 24, Timothy Hurse; and at No. 26, Oliver Hull. Effingham Lawrence was the druggist and apothecary to the Medical Society, a committee of which examined his store quarterly and certified that his drugs were genuine and his medicines faithfully prepared. Two wholesale drug houses of the present day were founded about a century ago, but only one of these continues under the original name, though quite a number date back fifty or sixty years. The principal houses of that day were Lawrence & Keese, J. A. & W. B. Post, Thomas S. Clark, John & William Penfold, John M. Bradhurst, R. & S. Murray, Silas Carle, John C. Morrison, and Olcott & McKesson.

The firm of Schieffelin & Company, of New York City, is the oldest house in the drug line continuing under the same name in this country. It was founded by Jacob Schieffelin in 1794, and has been continued by his descendants. Mr. S. B. Schieffelin, the oldest living representative, now retired from active business, was a lifelong friend of the father of the writer, to whom it gives great pleasure to testify to the long and honorable career of a worthy house. Business in the past generation seems to have had one specially pleasant feature, and that was the fraternal relation that existed between the different houses. The oldest and best friends of the writer's father were his competitors in trade.

The firm of Powers & Weightman, of Philadelphia, was established in 1818 as Farr & Kunzi. In 1821 they purchased the property still occupied by the present firm; it was then fairly on the outskirts of the city. Mr. Kunzi retired in 1838, and two years later Mr. John Farr took Mr. Powers and his own nephew, Mr. Weightman, into partnership. After the decease of Mr. Farr, in 1847, the firm became Powers & Weightman. Mr. Thomas H. Powers died November 20, 1878, but the firm name has continued unchanged. The history of this firm is identical with the history of the growth of chemical manufacture in America. Commencing in a small way, its great business has been reared by legitimate enterprise, and its reputation made solely by the excellence of its products and its upright business dealings. Mr. Farr, as before noticed, was among the first to manufacture quinine in the United States. He was, in fact, pursuing investigations of the alkaloids contained in cinchona bark about the time that the discovery of quinine by Pelletier, in France, was announced to the world.

McKesson & Robbins, of New York, established in 1833 under the name of Olcott & McKesson, were the first to make and introduce gelatine-coated pills. They were also the first drug house to start an extensive separate laboratory to manufacture a general line of pharmaceutical preparations in a large way with improved methods, and they have kept step with the advance in pharmacy. In order to facilitate the carrying on of the firm's increasing business the system of departments was adopted by the house. Some of these are: the importing of drugs and chemicals; the buying department; the manufacturing of pharmaceutical preparations; the making of chemicals; the cork factory; the drug-grinding department; the printing department; the export department for supplying the West Indies, Central and South America, and another for Europe, Asia, and Africa; one for supplying city pharmacists, and one for out-of-town buyers; one for fancy goods, and one for sponges. Over 450 persons are employed by the firm.

As is natural, much of the early history of the drug business in this country centers around Boston. Half a century ago there were in that city sixty-seven drug-stores. Of these about a score are still on the precise spots where they were situated in 1845, or are still carried on under the same names, but in new places. Perhaps the most interesting relic of the old days is the store of the Theodore Metcalf Company, for the founder was engaged actively in business until his death a comparatively short time ago. At present there are two stores bearing his name. Another sign familiar to the residents of fifty years back was that of T. Restieaux, a modern copy of which is still to be seen on Tremont Street, near Metcalf's. On Green Street may be seen the shop where for a good half-century Emery Souther has been and still is dispensing medicines. On Hancock Street Ashel Boyden's store is carried on by his son. What used to be William Brown's store, at the corner of Washington and Eliot streets, is now owned by William B. Hunt. Carter, Carter & Kilham are the direct successors of the house which, in 1845, bore the name of Carter & Wilson, and was in business on Hanover Street, not far from where the firm is now situated. A drug-store on Prince Street, originally H. D. Fowle's, is now owned by Alfred W. Tilton. George W. Colton's shop, on Cambridge Street, near the bridge over the Charles, which was a landmark for Harvard students, still exists. So, too, do the old stores of D. Henchman and T. Larkin Turner, on the same street, though they have since passed through the hands of several owners. Charles E. Eames carries on to-day the shop at the corner of Hanover and Charter streets, over which W. P. Howard formerly presided. In Maverick Square, East Boston, James Kidder had a drug-store which is open even to this day. Littlefield's pharmacy, in the United States Hotel, has been kept up all these years, with Chapin & Company as the present owners. Dr. R. C. McDonald's Parmenter pharmacy, on Hanover Street, was the modest drug-store of G. W. Parmenter in the forties. John Southwick's shop, on Tremont Street, at the corner of Eliot Street, is to-day Joseph L. Parker's. As far back as 1826 what is now the house of Cutler Brothers & Company was established by Lowe & Reed, so that the firm claims to be the oldest wholesale importing and jobbing drug house in New England. In 1861 the firm became Reed, Cutler & Company, through later changes acquiring its present name. The drug house of Thomas Hollis is one of the oldest in Boston, the stand at 23 Union Street, with the sign of the Golden Mortar, having since 1826 been favorably known to the citizens of Boston and New England generally. The founder, Thomas Hollis, died in 1876, and his sons, Thomas and Francis Hollis, continue the business under the old name.

The first drug-store in Washington was opened in 1796 by Frederick Miller, but its location cannot now be identified. Of the firms who have been fifty years or more in business in that city there are now but four. The store of Z. D. Gilman was established in 1822 by Seth Todd, who was succeeded in 1842 by Z. D. Gilman, since whose death a few years ago the business has been conducted in his name for the widow. The present firm of Sheller & Stevens was established in 1828 by William Gunton, and through a series of successions is maintained now under the name just quoted. Whiteside & Walton's store was established early in the thirties, as was also Thomas L. Crockley's business, whose founder was George W. Sothoron. The oldest druggist now doing business in Washington is Mr. John E. Bates, who entered the business in 1836.

Probably the oldest drug house in the West is that of T. H. Hinchman & Sons, of Detroit, Mich. The business was started in that city in 1819 by Dr. Marshall Chapin, presumably as a branch of the firm of Chapin & Pratt, of Buffalo. In 1833 Dr. Chapin took as a partner John Owen, of Detroit, the firm thus becoming Chapin & Owen. Theodore H. Hinchman went to Detroit to enter the employ of that firm in 1836, was admitted as a partner in 1846, and in 1848 succeeded to the business. His brother, James A. Hinchman, was admitted as a partner in 1852, and continued in business with him until 1860. In 1868, 1869, and 1871 the three sons of Theodore H. Hinchman were admitted to partnership, since which latter date the style has been T. H. Hinchman & Sons. Mr. Theodore H. Hinchman died May 12, 1895.

The earliest Chicago wholesale druggists of whom we have any record are the following, named in the order of establishment: Dr. Clark; Dr. Brinkenhoff, now Peter Van Schaack & Sons; Dr. John Sears; Stebbins & Reed, afterward J. H. Reed & Company; F. Scammon & Company; and Fuller & Roberts, now the Fuller & Fuller Company.

Among the many firms manufacturing medicinal chemicals worthy of mention are: Rosengarten & Son, Philadelphia; Charles Cooper & Company, New York; Charles Pfizer & Company, New York; Mallinckrodt Chemical Works, St. Louis; Larkin & Scheffer, St. Louis; Herf & Frerichs Chemical Company, St. Louis. The most recently established of the chemical manufacturing concerns is the New York Quinine and Chemical Works, Limited. Although this corporation was formed in 1886 only, the quality of its products has placed it in the front rank. It was the first in this country to make, on an extensive scale, caffeine, cocaine, aloin, and acetanilide, and is the second largest American producer of quinine and morphine.

The United States can boast of many extensive laboratories devoted to the manufacture of pharmaceutical preparations. A pioneer in this line was Dr. E. R. Squibb, who in 1854, as a passed assistant surgeon in the United States navy, organized and ran the United States Naval Laboratory, furnishing the medical supplies for the navy for three years. In 1858 he started his present manufacturing business. He has written much, and is considered an authority on matters pertaining to pharmacy. Among other prominent houses in this line may be mentioned the Tilden Company, Lebanon, N. Y. (one of the first); Billings, Clapp & Company, and the E. L. Patch Company, Boston; Sharp & Dohme, and the Burroughs Brothers Manufacturing Company, Baltimore; Henry Thayer & Company, Cambridgeport, Mass.; William R. Warner & Company, John Wyeth & Brother, and H. K. Mulford Company, Philadelphia; Parke, Davis & Company, and Frederick Stearns & Company, Detroit, Mich.; William S. Merrell Chemical Company, Cincinnati, O.; Eli Lilly & Company, Indianapolis, Ind.; Charles S. Baker & Company, and the Searle & Hereth Company, Chicago. In addition, many of the wholesale drug houses maintain extensive laboratories devoted to this branch of manufacturing.

Henry Troemner, of Philadelphia, was, as near as can be ascertained, the pioneer manufacturer of druggists' balances or fine scales. He came here in 1836 from Marburg, Germany, and started in business in Philadelphia two years later. At that time scales for druggists were made to order by jewelers, and were generally of hammered silver, and consequently very expensive. Mr. Troemner sold his first scales in New York City to Mr. Schieffelin. Now the house does a large business in fine scales.

American pharmacy has worthy representatives abroad, the most successful firm being Burroughs, Wellcome & Company, in London, England. Mr. Burroughs received his training with John Wyeth & Brother, and Mr. Wellcome represented McKesson & Robbins for some years in various parts of North and South America, India, and England. As far as New York City is concerned, the number of jobbing druggists has decreased, and much of the importing is now done through foreign agencies. Likewise all the leading manufacturers throughout the country have agencies in this city, which condition tends to divide up the jobbing business; but there is a population of 4,000,000 in its immediate neighborhood to be supplied, in addition to its still being the largest distributing center for the whole country.

John McKesson

CHAPTER XCIV

THE PAINT, OIL, AND VARNISH TRADE

IMITATION of the colors that he found in nature was one of the earliest arts of man. Pigments of one sort or another were known to the rudest nations of antiquity, and every civilization has had its colors and its painters. The crude, earthy ochres with which the savage smeared his body, and the gaudy colors of the Egyptian and the Hebrew, were succeeded by the brilliant tints and lead-bodied oil paints of Rome and Greece. Varnish, whether as the heavy lacquer or japan of China and the island realm of the mikado, or as the waxy preservative beneath which the mural paintings of long-buried Herculaneum and Pompeii still stand forth bright and clear, is of almost equal antiquity. Coeval with all these are the oils, which were recognized in utility and application long before science had learned to differentiate between the animal and vegetable kingdoms, whence their supply was derived.

Between the early civilizations which developed the painter's art and the later era which resumed and carried it to still greater prominence stretches, however, the long break of the dark ages, when Europe relapsed into the barbarism of feudal strife. The fourteenth and fifteenth centuries saw the return of many of the peaceful arts, and among them that of the painter. Then and a little later were developed those wonderful pigments that have left the old masters famous. Never since then have such colors been attained by the artist, and, greatly as modern skill has surpassed them in many respects, the secret which produced some of the glorious and indestructible tints of that time still remains among the lost arts. Apart from its artistic application the use of paints gained but slowly in Europe. Gradually houses and ships took color under the painter's brush, woodwork was preserved by its use, and ornamentation by colors became general. The manufacture and the application of paint became established and recognized industries, and were of considerable importance at the time when the great English companies began despatching colonists to the shores of the New World.

The early American settlers, however, had small use for paint in the wilderness they came to conquer. Log cabins and the roughest mode of life required little of decoration or ornament. They were eminently practical, too, even in the Virginia, Maryland, and neighboring settlements, and so neglected appearances as unconcernedly as the austere and self-mortifying Puritans of the New England colonies. To the commercial rather than to the esthetic side of the colonial character must be attributed, therefore, the first step in establishing the great paint and oil industry of this country. It was in response to home requirements, a strong foreign demand, and the inducement of good prices that the culture of flax, both for the housewife's distaff and to obtain the seed for export, was begun. Once commenced it spread rapidly, and soon in the interior localities, where transportation to the seaport settlements was difficult and expensive, oil-mills were started to crush the surplus flaxseed.

The manufacture of this, the linseed-oil of commerce, was begun in New York in 1715, and three years later John Prout, Jr., commenced it in Connecticut. In 1750 an old record states that the "Dumplers" in Pennsylvania had established among other industries an "oyl-mill." These so-called "Dumplers" were probably the sect of Dunkers in Lancaster County, which view is still further supported by the fact that by 1786 there were four oil-mills in operation in this county and within ten miles of Lancaster. So early as 1774 the first colonial Congress had recommended the growing of flax and the expression of the oil from its seed, and in 1792 this manufacture was established at Easton, Mass. Water, cattle, and wind power were used in operating these early oil-mills, and an annual product of 2000 gallons was very large. The use of

Daniel F. Tiemann.

windmills in crushing the seed was confined chiefly to New York, where the Dutch customs still prevailed. So late as 1790 there was an old windmill which crushed flaxseed in New York City, and was located within a quarter of a mile northeast of the city offices. The price of flaxseed at this time was from two shillings to two shillings sixpence per bushel, and flax was extensively grown throughout all the colonies, and especially in Virginia, Maryland, and Pennsylvania.

The rapid growth of the linseed-oil industry had not been without its effect in stimulating the use of paints. These colors were, however, wholly imported, and grew but slowly in general favor. So intolerant was the prejudice against paint as a badge of worldliness and vanity in the Puritan settlements of New England in 1630 that a clergyman of Charlestown was actually brought before the council on charges of having certain interior finishings of his house painted. Forty years later an official list of mechanics and tradesmen discloses the fact that there was not a single painter in Massachusetts Colony. Nevertheless by 1714 painters' colors were for sale in Boston, and while their employment, even for painting the churches, was frowned upon by the Puritans, they grew slowly in use among the wealthy until the time of the Revolution. In New York whitewashed walls and woodwork painted a sort of bluish gray were quite general so early as 1748, and both here and in Philadelphia the use of paint increased far more rapidly than in New England. In 1767 painters' colors were among the articles taxed in the colonies by England. The disturbance created by this act caused its repeal by Parliament three years later. But to the sentiment aroused by the Stamp Act and this one can be attributed some of the earliest of the symptoms of American revolt.

The Revolutionary War, followed as it was by an internal development necessary to maintain our position of independence, changed conditions in this country very greatly. By 1795, the beginning of the past century of progress, the use of paint had become common. In the towns even the ordinary householder used paint about his dwelling. If he was too poor to indulge in the luxury of an outside coat, the interior woodwork, at least, was painted, and the churches and public buildings all showed the work of the painter. The white house with green blinds was then and for many years afterward the single type of ultra-esthetic decoration. In the New England States, especially in the country districts, this combination of colors is still found as prevalent to-day as it was all over the United States seventy-five years ago. The sole accepted modification of this style was the use of a sort of red paint in the place of the more expensive white. Economy was the only reason for the use of the red, however, and except for school-houses, churches where the congregation was very scanty, and homes where the inmates were poor, the white was always used. The introduction of more tasteful colors and shades and more harmonious tints began early in the present century, but their general adoption as seen in present effects is still a comparatively recent matter.

The first successful attempt to manufacture white lead in this country was made in Philadelphia by Samuel Wetherill in 1804. Red and white lead were made by him of as good quality as that imported, and other manufacturers of these products soon followed him. In 1806 color making was begun experimentally by Anthony Tiemann, who regularly started in the manufacture in 1807. His first products were rose pink, Dutch pink, French green, and blue. The manufacture of Prussian blues was begun in 1809, and in 1820 chrome yellow was added to the products of this firm. This latter color was first made in this country by William Guest, of Baltimore.

Meanwhile by 1811 there were twenty-two different colors of paint being made in Philadelphia, while three small red-lead factories in Pittsburg, the first west of the Alleghanies, were turning out annually a product valued at $13,000. Chrome paints of the first quality commanded in the early days $3 a pound, and their manufacture was a profitable one. Extensive deposits of chromic iron discovered in Chester County, Pennsylvania, gave an added impetus to paint grinding, and its growth was strong and steady.

The succeeding decade saw the industry firmly established in New York. By 1820 there were extensive works in Brooklyn and New York producing red and white leads, chrome and other colors, while a factory in Rensselaer County, New York, was turning out annually $4500 worth of Prussian blue. This establishment used the shavings of leather in obtaining its color, after the process described by Dr. John Pennington in 1790. Factories in Albany, Boston, and other cities, as well as the extensive establishments in Philadelphia, showed how firmly the paint industry had established itself at this time, and the next twenty years brought the natural and resultant development not only of this but of the related manufactures of varnishes and oils.

Prior to 1828 all the varnish consumed in this country was imported. Its use, while less common than that of paint, was nevertheless sufficiently general to recommend it to manufacturers as a profitable product, and accordingly the first establishment for making it was founded by P. B. Smith at 202 Bowery, New York City, in 1828, and the following year he was joined by a Mr. Hurlburt. This partnership was of brief duration, however, and in 1830 the second factory was established by Tilden & Hurlburt, and was the first permanent concern in the business. In 1836 Mr. Smith removed to Newark, N. J., where in company with D. Price he established the first of the great Newark varnish-works. Another early manufacturer of varnish was Christian Schrack, of Philadelphia, who established the industry in that city.

The first importations of gum copal, direct from Zanzibar and the west coast of Africa, were largely used by Tilden & Hurlburt, and this firm was the first to export American varnish, they consigning a quantity to South America and Mexico in 1836. The quality of the American goods proved so exceptional that they not only competed with, but to a great measure supplanted, the exportations of the European manufacturers. The stimulation of a heavy foreign demand joined to increased domestic consumption so augmented the business that the matter of obtaining supplies of the gums used became of great importance. In 1851 such quantities of these raw materials were being used that the manufacturers began the establishment of the system of direct trade relations with the west of Africa.

The growing importance of both the paint and varnish production of the country had meanwhile early affected the oil-mills. Until 1836 these mills used only home-grown seed, and a capacity of fifty bushels a day was a very fair average output. Under the increasing use of linseed-oil new methods were found necessary, and the firm of J. & L. K. Bridge, of Brooklyn, in that year imported the first cargo of flaxseed from Sicily. Odessa, Alexandria, and, in 1846, Calcutta were successively opened as supply points of this rapidly increasing trade. It was during this transition period, also, that the use of machinery other than the old-fashioned screw, lever, and wedge was introduced by Thomas Rowe. To-day a good-sized oil-mill will easily produce from 5000 to 6000 gallons of oil per day—more than the mill of earlier days turned out in a year.

In 1850 the paint industry in this country entered upon a new era. The zinc deposits of New Jersey, opened in that year, gave an adequate and cheaply worked supply of ore from which the oxide could easily be reduced. This zinc oxide, in the form of a white powder, had been recognized since the last decade of the preceding century as a valuable substitute for white lead as a body for paints. It had up to this time, however, received little attention, owing to the restricted amount available for the market. The new and abundant supply turned the manufacturers to experiments in this direction, and its use since has been general. While of an inferior body and opacity to the better qualities of white lead, the zinc oxide was still a most excellent substitute, and in some respects it even excelled the former, particularly in point of decreased cost, and in being unaffected by many of the gases, such as sulphureted hydrogen, which blackened, by chemical reaction, the lead paints. Several mines were immediately opened, and the ore reduced and turned in a furnace, where resultant white and powdery zinc oxide floated upward, was caught in bags, pressed, and sold to the paint manufacturers. Mineral paints, too, made from different earths, came into prominence at about this time, much being claimed for their fire-proof and indestructible qualities.

Of the chemical and technical discoveries and appliances by which new colors, finer and more delicate shades, the bright and vitrifiable pigments of the decorative potter and art-tile manufacturer, and the paints of the artist, either in oil or water-color, have been produced it would be tedious to the general reader to speak. The art of mixing colors to produce the almost innumerable tints of to-day has developed with the increased volume and discriminating demand of the trade. The first paints ready for use were made in 1852 by my house. They were tinted colors in paste form. To-day almost every conceivable shade of color is found thus prepared in hermetically sealed cans, and each country grocery and cross-roads store has an assortment of paints, before which, even in New England, the green-shuttered white house is slowly retiring from the landscape.

About 1857, D. F. Tiemann & Company, who had succeeded Anthony Tiemann, made carmine from cochineal, a monopoly theretofore held by France. In 1860 they made a blue soluble in water for laundry use, and free from acid, that previously made having been a mixture of ordinary Prussian blue and oxalic acid. In 1860 they established, also, the manufacture of quicksilver vermilion, which had previously been monopolized by England.

The manufacture of oil and varnish meanwhile proceeded along the same lines and in response to causes similar to those affecting the paint industry. In all the earlier years of this century, and to some extent even to-day, the use of these substances has been more or less influenced by the fact that lumber was cheap and abundant. To preserve wood at the expense of paint would have been indeed gilding the tinsel. Its use was therefore rather a luxury, a deference to the esthetic sense, than a necessity resulting in practical economy. Gradually it dawned upon men's minds that even if lumber were cheap, wood was not the only expense in construction, and the economy of preservation was seen. So, also, with varnish; and by the middle of the century both of these articles were being used for practical reasons as well as for purposes of decoration or ornamentation. By 1860 there were three varnish factories west of the Alleghanies, and many in the Eastern States, while its consumption was steadily increasing both at home and in the foreign trades. Since then its growth in importance and extent has been steady and rapid, and it is to-day a great factor in the industries of which this chapter treats.

These three allied manufactures have been, in common with the other industrial interests, subjected of late years to modification in methods and appliances. Of the three, the manufacture of varnish has, perhaps, been the one in which Americans have been the most successful in foreign markets. The recognition of the excellence of our product, following almost immediately upon the first exportation in 1836, has increased rather than diminished as time has gone on. To-day we export more than five times as much varnish as we import, the official figures for the year 1894 showing total exportations of $282,278, as against importations during the same time amounting to but $54,746. During the present year our shipments abroad have still further increased. The growth of home consumption has meanwhile continued so rapidly that in keeping pace with its demand the annual output has nearly doubled during each of the past three decades. The exact proportions of this industry since 1870, as given in the census reports, are as follows:

THE VARNISH INDUSTRY, 1870 TO 1890.

Year.	No. Establishments.	Capital.	Employees.	Wages.	Cost of Materials.	Value of Product.
1870........	59	$2,168,740	415	$252,059	$3,311,097	$4,991,405
1880........	81	3,778,100	573	366,716	3,699,684	5,721,524
1890........	140	....	1,851	1,749,061	7,805,663	13,795,510

The manufacture of varnish has remained, in the mean while, in the hands of separate large concerns, without consolidation or combination, although efforts have been made at various times to organize the trade.

The lead, paint, and oil interests of the country have, unlike the varnish manufacture, come during late years to certain centralizations of management, tending to greater uniformity and economy. In paints, of which lead still remains one of the most important components, this movement has resulted in the formation of the National Lead Company, which controls the greater part of the output of white lead in this country. In itself this company includes and operates its own oil and paint-grinding mills, as well as the lead factories proper, and with a capitalization of about $30,000,000 is the largest single interest in the paint business, although there are many great individual firms equally prominent relatively to their output. There is also a large interest concerned in the import branch of the paint and color trade, making a specialty of foreign earths, leads, and mixtures. The development of the manufacture is shown by the following figures:

THE PAINT INDUSTRY, 1870 TO 1890.

Year.	No. Establishments.	Capital.	Employees.	Wages.	Cost of Materials.	Value of Product.
1870........	143	$11,156,400	2,940	$1,567,037	$11,468,728	$16,932,405
1880........	244	13,555,292	4,483	2,132,255	17,062,555	23,290,767
1890.......	382	....	8,737	5,605,626	24,930,532	40,438,171

The growth thus indicated in this industry during the thirty years given does not, however, represent the full increase in consumption for that time, owing to the fact that imports of paints and colors have always exceeded the exports. American colors are found in many foreign countries, and the trade is one that will grow. From a total exportation of only about $20,000 in 1835, the shipments sent abroad in 1894 amounted to $825,987, only about

$150,000 less than the imports of the same period. For the fiscal year of 1895 the exports were only $729,706, while the imports had swelled to a total of $1,246,924 for the paints, pigments, and colors, and $679,637 for clays and earths largely consumed in the production of paint.

Coincident with the development of the paint industry has been the improvement of methods. Mills of modern design and construction obviate much of the danger to the workmen arising from the poisonous nature of the substances used, notably white lead. While the basic principles, both in the manufacture of the staple leads and in the grinding of all paints in oil, remain practically unchanged as they have come down to us from remote times, there are many innovations which have increased the safety and facility of paint manufacture. New processes and radical departures are also being urged and even experimented with on a practical scale.

The manufacture of linseed-oil, formerly divided into numerous small interests, has likewise been largely consolidated by the formation of the National Linseed-Oil Company, which has a capital stock of $18,000,000, and controls the bulk of the product. The single cargo of flaxseed imported from Sicily sixty years ago has become a vast import trade in modern times, and during the present year, owing to the shortness of last year's home crop and the demand for Calcutta seed, its volume has increased to unprecedented proportions. In the first eight months, ending September 1st of the present calendar year, the importations of flaxseed reached the enormous amount of 2,772,718 bushels. Nevertheless the linseed-oil manufacturers have had much to contend against in the adulterated oils produced so largely of late years. Not only have inferior imitations become common, but the residual products, in the shape of oil-cake and meal, are being supplanted to a great extent by the cotton-seed cake and meal. That linseed-oil will ever be superseded, however, as the most reliable vehicle for paints and varnishes is extremely improbable. The census of 1890 gave the annual output of the sixty-two linseed-oil mills of the country at $23,534,306, in producing which 2073 employees earned $1,286,062.

Summed up briefly, the foregoing figures show that the industries of which I have just written have an aggregate annual production of $77,767,987, and distribute in wages to the workmen every year $8,640,749. These are the bare and unadorned figures, expressing neither the benefit nor the magnitude of the contributory branches, in the mining and grinding of earths and ores, the sums paid to the transportation companies of the country, the consumption of tins, the trade in brushes, and the opportunity for labor afforded to artisans and painters all over the country in the application of the product. When it is remembered that in 1795 we were utterly dependent upon foreign countries, I think I need say nothing further or more commendatory of the American paint, oil, and varnish trades.

One of the important features of the trade to-day is the Paint, Oil, and Varnish Club. Nearly every large city in the Union has an organization bearing that name, and so closely are they affiliated that they might be called one body. The idea originated in Boston, Mass., in 1867, but the first club was not formed until 1873. It was preceded in 1871 in the same city by the Boston Commercial Association, the membership of which was composed chiefly of paint and oil manufacturers, with Charles Richardson as president. The experience of the New England club in organized effort and coöperation attracted attention throughout the country, and on a similar basis other organizations have been formed. The clubs, since their formation, have been called upon to deal with many matters of importance to the trade, and in nearly all cases where misunderstandings or wrongs existed amicable adjustments have been made.

A great achievement of these clubs has been the formation and maintenance of credit bureaus, which have not only worked to the satisfaction of all the members, but have accomplished much good to the trade. The paint and oil merchants of New York City had for several years endeavored to organize a business association, but without success, until the Boston club of a social order came into existence. The formation of the New York club was due to the efforts of W. B. Templeton, the present secretary and treasurer. One of the most valuable features of the club is the membership of a subcommittee in the New York Board of Trade and Transportation. This committee was created in order that the trade might have substantial backing in case of particular legislation being required. The accomplishment of the coalition with the Board of Trade is regarded as an important step, as it gives the club strength and importance that it could gain in no other way. The organization of the Boston and New York clubs was closely followed by the formation of similar clubs in Philadelphia, Pittsburg, Chicago, Kansas City, New Orleans, and other cities.

CHAPTER XCV

THE CONFECTIONERY TRADE

THE early history of the confectionery business of this country is somewhat obscure, as little was published in relation to it until within the last fifty years. The term "confectionery" embraces a vast number of edibles or compounds that have sugar as a base or principal ingredient.

The art of manufacturing confections and sweet preparations was at first largely confined to apothecaries and physicians, who used sugar and honey to disguise their medicines; but in later years the making of confectionery became a separate and distinct branch of business, although the druggist is still dependent upon the manufacturing confectioner for an important line of his goods, known as medicated candies. Few modern industries have experienced more frequent or more radical changes during the last century than the confectionery business. Previous to the year 1851 the manufacture of "boiled sweets" was largely an English specialty, and its extension to other countries had its origin in the unique display of these goods made by the London confectioners at the first international exposition in that city in that year. The interest then attracted to the business gave it a new impulse and caused it to extend to Germany, as well as to France, which in the manufacture of chocolate bonbons and comfits excelled all other countries.

In the United States we find that as early as the year 1816 there were published the names of twenty confectioners in the city of Philadelphia who were manufacturing and selling candies. Among the pioneers in the business appear the names of Sebastian Henrion, who was succeeded by Henrion & Chauveau in the year 1844, and Sebastian Chauveau, who was the first to manufacture gum-drops, jujube paste, and marshmallows in this country. Another was Paul Lajas, who in 1831 changed his business from the manufacture of confectionery to that of sugar refining; George Miller in 1833, William N. Herring in 1834, S. S. Rennels in 1838, and J. J. Richardson. In the city of New York, among the old-time confectioners were Ridley & Company, established in 1806, R. L. Stuart in 1828, James Thompson, John Stryker, and Delmonico Brothers. In Boston, in 1816, the names of Arnold Copenhagen, Lawrence Nichols, and William Fenno occur; and in Baltimore, Joseph Bouvey, Augustus M. Price, and John L. Bridges were pioneers in the business before 1831.

Previous to the year 1845 the manufacture of confectionery was in a somewhat crude state. As a rule each confectioner made his own goods, his stock in trade being limited to the ordinary stick candies, sugar-plums, and molasses candy, while all fancy goods were imported from France and other foreign countries. The introduction of machinery in the manufacture of confectionery has added much to the development and increase of the business. The foreign manufacturers were using some machines in their factories, but very little had been done in the United States in this way until about the year 1845, when Sebastian Chauveau, of Philadelphia, imported the first revolving steam-pan used in the country; and in the year 1846 the first machine for making lozenges was invented and built in the city of Boston by Oliver R. Chase, who with his brother formed the firm of Chase & Company, and began the manufacture of lozenges as a special branch of business. In the year 1866 the first machine for making printed work or conversation lozenges was built and used by Daniel G. Chase, also of Boston.

Many improvements are constantly being made, and new and improved machinery has been invented that is adapted to the manufacture of the various kinds of goods, and to meet the constantly growing demands of the business, so that the manufacture of special machinery for confectioners' use has become a separate and important industry. Nothing can convey a more complete idea of the wonderful growth and increase of the industry in the United

States in the last half-century than the official census returns, as published at Washington from 1850 to 1890, with the following comparisons:

THE CONFECTIONERY INDUSTRY, 1850 TO 1890.

YEAR.	NO. OF ESTABLISHMENTS.	HANDS EMPLOYED.	CAPITAL INVESTED.	TOTAL WAGES PAID.	VALUE OF MATERIAL USED.	VALUE OF PRODUCT.
1850......	383	1,733	$1,035,551	$458,904	$1,691,824	$3,040,671
1860......	541	2,340	1,568,478	668,423	2,991,186	5,361,100
1870.... .	941	5,825	4,995,293	2,091,826	8,703,560	15,922,643
1880	1,450	9,801	8,486,874	3,242,852	17,125,775	25,637,033
1890......	2,921	27,212	23,326,799	11,633,448	31,116,629	55,997,101

Imposing as these figures are, they are somewhat misleading as to the real growth and magnitude of the business. They take no account of the large amount in the aggregate that is produced by the small manufacturers in all sections of the country. They give only the result of production in the large manufactories, that are chiefly centered in the great cities. The great increase as noted between the years 1880 and 1890 shows a gain of more than 100 per cent. in value of production in the ten years, and it has been estimated by careful and conservative men in the trade that by the end of the present century the annual output of the large factories of the country will reach a total value of $100,000,000. In addition to the great increase of home production, the growth of the import trade has been an important factor. Previous to the year 1837 all confectionery that was imported was classed with sugars, but in that year the total importation as reported was 8386 pounds, valued at $912. In the ten years following that date the total of imports, as reported for the whole time, was only 12,000 pounds, at a value of $1400. From 1847 to 1857, 258,374 pounds were imported, valued at $34,447; from 1857 to 1867, 260,860 pounds, valued at $39,169; and from 1867 to 1877, 865,812 pounds, valued at $145,797. From 1877 to 1887 the total value of imports was $151,632; and in the eight years following, up to the present time, there has been a gain of more than 150 per cent., the total value being $387,152. The analysis of the returns shows that from the year 1837 up to 1849 the value of foreign confectionery imported in no year equaled that of 1837. But in subsequent years there was a gradual increase in the amount and value up to 1855, when the figures reached 74,371 pounds and $8949 in value. From that date there was an irregular falling off in the importations until 1865, when there were 35,388 pounds, valued at $4094. Following that period there was an irregular increase up to 1876, when the returns showed 87,955 pounds, valued at $18,500; and this increase continued in successive years until 1892, when confectionery to the value of $97,741 was received from foreign countries. This was the largest amount in any one year, the figures rapidly falling in the three following years, the amount in 1895 having dropped to $30,745. While the rapid increase and growth of our home market has made large demands upon the facilities of our manufacturers for their productions, the enterprise and push of the men who have been and are now engaged in the business has led them to reach out into other fields and larger markets.

The foundation of the American export trade in confectionery was laid in 1865, when goods to the value of $26,429 were exported. This was a good start, and with the exception of the following year, when none was shipped or the amount was overlooked, this branch of our foreign trade showed a fairly steady increase between that date and 1880, when the total export was valued at $81,757, the quantity in pounds not being given. Since then the United States has sent large amounts of confectionery to foreign countries every year, as shown by the following table, covering from 1881 to 1895, inclusive:

EXPORTS OF CONFECTIONERY, 1881 TO 1895.

YEAR.	AMOUNT.	YEAR.	AMOUNT.	YEAR.	AMOUNT.
1881..	$73,253	1886..	$98,570	1891..	$181,501
1882..	62,391	1887..	173,570	1892..	204,609
1883..	103,290	1888..	155,521	1893..	334,607
1884..	112,046	1889..	151,685	1894..	491,748
1885..	88,549	1890..	179,276	1895..	712,552

From the above statistics it appears that while our home market has been constantly broadening and extending, and the consumption of the products of our factories has largely increased, the markets of the world are being opened to us. Our foreign trade is steadily enlarging, American confections meeting with much favor in all markets where they have been introduced.

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Of the important factors that have largely contributed to the wonderful development and growth of this industry, more especially in the last thirty-five or forty years, may be mentioned the rapid growth and increase of our population during this period, the opening up of new territory, and the development of new industries that have resulted in bringing general prosperity to all classes of our citizens. The low price of sugars and other materials used in the manufacture of confectionery, together with the introduction of new and improved machinery in our factories, has made it possible to produce goods of superior quality at a comparatively low price, thus bringing them within the reach of the poor as well as the rich. There has been constant rivalry among our leading manufacturers to improve the quality of their productions.

The late Edward A. Heintz, of Philadelphia, who in the year 1874 established the "Confectioners' Journal," the pioneer trade paper in the interests of our business, and who through its columns constantly advocated progress and suggested improvements, thereby giving to the members of the trade a new impulse and inspiration, rendered incalculable service in popularizing the confectionery business among the people. The two great international expositions of Philadelphia and Chicago, where the fine display made by our manufacturers attracted the attention of the world, gave new importance to the industry and added much to the extension of the business. The organization of the National Confectioners' Association of the United States in the year 1884 was an important and prominent factor in this development. It was organized by and included in its membership all the leading manufacturers of the country, having for its declared purpose, as stated in its constitution, "to advance the standard of confectionery in all practicable ways, and absolutely to prevent hurtful adulterations; to promote the common business interests of its members, and to establish and maintain more intimate relations between them; to take united action upon all matters affecting the welfare of the trade at large."

The results of the work of this association are clearly manifest on every hand in the securing of necessary legislation in the different States whereby the manufacture or sale of any candy containing any harmful ingredients or poisonous colors is prohibited by law; by the effectual stamping out of adulterations in the manufacture of our goods, and by establishing in the minds of consumers a feeling of confidence in the purity of our productions.

The results of this combination of factors are shown in the investment of many millions of capital in this industry; in the building of large factories and warehouses for the transaction of its business; in the employment of many thousands of working-people in the manufacture of confectionery; in the enormous value of the annual product of all these establishments; and in the birth and successful growth of a competition in the United States against the markets of the world. Of the men who have been actively engaged in this development and growth of an important industry we may not speak in detail. Those who have honored their calling, men of sterling integrity and uprightness of character, men of courage, energy, and foresight, constantly pushing forward toward larger and better achievements than their predecessors, would make a long list of names. Their work is evidenced in the record that has been made of the growth and development of an industry which, though small in its beginnings, has in these latter days of the century become a business of such large proportions as to be entitled to rank with other important manufacturing and mercantile industries of our country.

A. J. Hayward

CHAPTER XCVI

THE FURNITURE TRADE

IT is a singular fact that we should now, after a century of commercial independence, return to the same modes and fashions in furniture which prevailed one hundred years ago; and although we adapt them to our present requirements, we cannot refrain from admiring even to-day the lines on which our forefathers built their chairs, tables, bedsteads, and other articles of furniture. Although we had become politically independent of England, she was to impress us for a long time to come with her literature and arts; so that the American furniture of that time differs but little from that of England, not, however, being so ornate. This furniture, known under the name of colonial, has frequently been exploited lately, and is too well known to need description. At that time, if we except those who possessed ample means, people had little furniture, and it was of the most simple character.

The early cabinet-shops were like the second-hand repair-shops to be seen to-day in New York, Boston, Philadelphia, and other large cities. A great many cabinet makers continued to use for years the patterns they had produced, and consequently made furniture until late in the century on simple Chippendale lines. It is impossible to state the amount of furniture made during this early period, but it must have been small when we consider that the population of this country was then only about 4,000,000 people. Gradually the Empire fashions, which were making themselves felt all over Europe, spread to America, and shapes became heavier and more pretentious, mahogany being used almost exclusively. Heads of animals were used, and claw-feet became a general feature. Common furniture was heavy and unattractive. The condition of things at this time was not particularly favorable to the development of art industries. Europe was a great battle-field, and even this country became involved in war with England.

Under these conditions little thought was given to the manufacture of furniture, and for some years there was a decline in this industry, which was considered of so little importance that no mention is made of it in the official records. Cabinet makers soon after changed their style, and began producing a debased rococo style, which did not have the elegance or character of the Louis XV., but was covered with a florid ornamentation in which the only consideration seems to have been that of display. The extravagance of curves and lavish ornamentation brought about a reaction, and toward 1830, following the fashion in England and France, an attempt was made to construct furniture in the Gothic style, but with very unsatisfactory results. The lack of artistic training of the manufacturers, who were, as a rule, cabinet makers or carvers by trade, made it very difficult for them to handle a method of decoration and construction so little appropriate in itself to the requirements of home comfort. This Gothic style of furniture, monumental in appearance, was made to a limited extent only, although its influence is to be noticed on other furniture placed on the market at this time and later. The making of rococo furniture was kept up by a large number of cabinet makers, the cheaper furniture being for many years made in this style. It was also during this period that steam, applied to cabinet-makers' machinery for the first time in 1815, occasioned a revolution in the manufacture of furniture, bringing labor-saving devices into more general use, and enabling the cabinet maker to supply the rapidly increasing demand for his product. In 1825, Mr. Richardson, of Philadelphia, introduced the circular saw, and Taylor, Rich & Company at this time erected the first mahogany-mill in America, a number of these saws being used there. Ordinary furniture, which until now had been very plain, was covered with endless scroll-work and moldings, pro-

George W. Gay.

duced so easily by the new machines. The manufacturers indulged for a time without restraint in this ornamentation.

The use of machinery in shops, and the increased facilities for transportation, wrought a wonderful improvement in the furniture trade; and the cabinet-shop, which had until this time been of small importance, making to order various kinds of furniture and kindred articles produced from wood, suddenly assumed large proportions, and confined itself to furniture only, using in the making of it the new devices which were constantly being brought forth by ingenious inventors. The value of the furniture product in the year 1850 may be estimated at about $15,000,000, and the industry gave employment to 37,000 people, out of a population of a little over 23,000,000.

For a long time a great number of hand-shops survived, making to order special high-grade work; and they succeeded in impressing their patrons with the idea of the inferiority of machine-made furniture, which at this early stage in the introduction of machinery was not entirely without foundation. The extensive use of machinery in shops had the immediate effect of again changing the style of furniture. Manufacturers looked for a fashion in which they could use their facilities to the best advantage, and at the same time retain the attractiveness of their earlier work. This they found in the Renaissance, which for a number of years superseded all other styles in the best class of furniture.

Up to this time the furniture industry had been confined to the Eastern States, principally in and around Boston; but a number of factories were now started in the West, which, situated as they were in proximity to large forests and regions where population and wealth were rapidly increasing, soon became important factors in the production of furniture in the United States. These factories, equipped with new machinery and using native timber, such as oak, ash, walnut, etc., produced at first a low grade of furniture in which art seems to have been but very little considered, the main object being to supply this prosperous population with the articles that their new conditions enabled them to buy. Those who wanted more artistic furniture purchased it from the East. The art revival which had taken place in Boston and New York was fostered by increased travel in Europe, where exhibitions were taking place at short intervals in London and Paris. Moreover, the consideration that old furniture was beginning to receive brought forcibly to the people the inferiority of that then made, and manufacturers gave more attention and study to its appearance than before. Trade kept increasing with the general wealth, and in 1860 the production reached $25,500,000; but the number of working-men employed in this industry, owing to the improvements in machinery, had fallen to 28,000. The population had then reached almost 31,500,000.

Industries in general were now to receive another blow, on account of the War of the Rebellion. As soon as this conflict was over, the extraordinary activity which had prevailed in military circles was transferred to the industrial field, and from this time on it is by leaps and bounds that improvements can be noted. The furniture trade was in the hands of two classes of manufacturers, one class of whom, having taken the place of the old hand-shop workers, made high-class work to order,—not only furniture, but interior woodwork and decoration as well,—continuing the old traditions, but now using machinery extensively. The other class of manufacturers studied the wants of the people, and produced suitable articles at prices which were within the reach of the masses. It is to them that we are indebted for the gigantic development of the industry, they having placed within the reach of all, strong, ornamental, and practical furniture. We have seen that men of taste had recognized for some time that our furniture was inferior to that made at the end of the last century, and had begun to study not only the styles of that period, but also those of the English and French prevailing in the past. As a result we find that a great variety of styles were employed in the productions of the leading firms, who were always striving for novel effects.

A work published in London, England, in 1868, entitled "Hints on Household Taste," by Mr. C. Eastlake, had a great influence on the purchasers and makers of American furniture at this time. This publication created unbounded enthusiasm in America as well as in England. It waged war on modern work, and advocated returning to the primitive principles of Gothic construction, more intelligently interpreted than in the first attempt; and gave positive instructions as to what was right or wrong, not only in the line of furniture, but in draperies, carpets, and other household decoration, as precisely as if the art had been a science. This book was looked upon as a sort of gospel treatise on furnishing, and however much we may at this time ridicule some of the ideas conveyed, it directed the public mind in its search for more artistic surroundings at home. From that time the other styles—rococo, Renaissance, etc.—were discarded, and designs in accordance with the newly developed taste took their places. The movement in favor of more perfect construction and the use of straight lines exclusively became general, the stiff appearance being relieved by an abundant use of arches, spindles, turnings, etc. This style allowed the manufacturers to do the greater part of the work by machinery, for which it seemed specially adapted. The increased interest that the public took in furniture developed the trade in an unprecedented manner, the production for 1870 being $68,500,000, or two and one half times that for 1860. The number of men employed at this time shows a similar increase, being 55,800, out of a population of 38,500,000 people.

The financial depression of 1873 caused a reaction in the furniture industry, as it did in all other branches; but, without doing any more harm than to reduce the output for a time, it stimulated manufacturers in making better goods so as to meet the keener competition in trade. The Centennial Exhibition in Philadelphia in 1876 had a far-reaching influence, especially on Western manufacturers, who until this time had not had occasion to compare their products with those of the best manufacturers of America and Europe. This exhibition marks the highest point that the Eastlake or early English—whose most able exponent was the English architect and designer, Mr. B. J. Talbert—was to attain. A number of the most prominent manufacturers of this country had their exhibits made in this particular style. It was quickly taken up by the manufacturers of cheaper furniture, who until then had given very little attention to artistic form, and they are responsible for the enormous quantity of furniture of this description that can yet be seen in the auction-rooms of large cities, the only relation of which to the true Eastlake seems to be the quantity of spindles introduced in its construction. The strife for originality, which was soon to be one of the characteristics of Western manufacturers, had now begun to show itself; but an insufficient knowledge of art subjects rendered many of their designs more strange than beautiful, and more noticeably so when they were working on the lines of any given style; but through diligent efforts their designs were steadily improved, and this, in connection with their superior facilities, has secured to them a large part of the Eastern trade.

The volume of business showed a substantial increase during this decade,—1870 to 1880,—although not as large as during the preceding period. The value of the output of furniture for 1880 was $77,-845,000—an increase of thirteen and five tenths per cent. in value, but a decrease from $1.77 to $1.55 per capita of the population.

The Eastlake style, based on foreign ideas, and little in keeping with our style of work, could not possibly get a lasting hold on the American people. It was accepted only as an improvement over previous styles. The wonderful changes which occurred in architecture, investing it for the first time in American history with a purely American spirit, could not fail to have a strong influence on furniture. Mr. H. H. Richardson, a man of extraordinary ability, after having brought out several original and striking architectural designs of classic excellence, won general admiration for his later works, in which he revived the beauty of the old Romanesque decoration, adapted to modern ideas and modern needs. A monument to his genius is Trinity Church, Boston, designed early in the seventies, and which attracted considerable attention by its radical departure from the generally accepted Gothic style of church architecture; but it was not until subsequently to 1880, after Mr. Richardson had used the Romanesque for private residences, and had himself designed a part of the furniture, that it became popular. Once started, however, its growth knew no bounds. In fact, in a few years everything was Romanesque or Byzantine, —houses, furniture, house decoration, jewels, etc.,—and it looked at one time as though it were eventually to become our national style. As much was claimed for it by eminent men. Furniture manufacturers eagerly welcomed this departure, for the ceaseless demand for new things, as strong then as it is now, obliged them to change their patterns very frequently. Unfortunately, by passing through the hands of manufacturers of cheap furniture, it lost all of its original beauty. There is a delicacy required in the Romanesque carving which cannot be produced cheaply; and the universal use of the pointed acanthus leaf as the only type of decoration soon became monotonous, and, under the enormous production of inferior goods, the public lost the interest which the work of eminent artists had succeeded in creating.

During this decade great improvements were made in woodworking machinery, and a large number of new devices were invented. Among them, and probably the most important, was the carving-machine, which enabled manufacturers to ornament even the cheapest kind of furniture, sometimes to excess; and although this machine is not yet perfected, it has reached a high state of usefulness. The amount of business done in 1890, large as it was, did not keep up with the increase of population, and the present depression, which has been by many attributed to over-production, is certainly the result of lessened consumption as well. The value of the product in 1890 was $86,362,685, an increase of eleven per cent. over that of 1880; but the amount per capita of population dropped to $1.38, as compared with $1.55 in 1880, and $1.77 in 1870. No doubt the facilities for the production of furniture are such that even should the home consumption reach the level of 1870 it would not be sufficient to absorb the possible output of our manufacturing institutions.

The International Paris Exposition of 1889, where the French cabinet makers showed a great quantity of eighteenth-century furniture, especially of the Louis XV. style, generally beautifully designed and of excellent workmanship, revived a taste for the costumes and furniture of that period which spread rapidly to other countries, and was quickly followed by the people of the United States. In spite of the seeming difficulty of making such work by machinery, our manufacturers made, and are making to-day, a great quantity of furniture in that dainty mode, which certainly equals that of the same class made in Europe, and is generally better constructed. At this same time the style of the First Empire, which had been largely used in the higher classes of ordered work and decoration, was receiving some attention, but without such brilliant success as had attended the Louis XV.; the chasing and gilding of the brass ornamentation being too expensive for most of the manufacturers, and lacquered castings were used instead, which, a short time after being made, assumed a faded appearance, that lost for this furniture the public favor.

All the eighteenth-century styles, French or English, have been used by our manufacturers—Louis XV., Chippendale, Louis XVI., Sheraton, Hepplewhite, Empire, and also the Flemish Renaissance, so well suited for oak work, with its bold carvings and heavy turnings. So far all the efforts of manufacturers and designers have not succeeded in evolving a style of our own epoch, and we will probably continue to use for some time to come the ideas of the past, and more particularly those designs which were used in this country in the latter part of the last century, which, in addition to their beautiful simplicity, always appeal to the heart of an American. At the Chicago World's Fair, although the furniture trade had a very creditable exhibit, the public could not fully realize its importance, as, unfortunately, a large proportion of manufacturers did not display samples of their goods; and it is all the more to be deplored that among these retiring ones were some of the most important of the furniture manufacturers of the United States. But the furniture exhibited can be taken as a fair sample of the products of our factories, very little having been made especially for this display. The greater part of the work exhibited was taken from the regular stock of the various manufacturers, and compared favorably with the product of other countries.

Many of the numerous articles of furniture manufactured are distinctively American. The bureau, the rocking-chair, the folding-bed, the chiffonnier as now made with toilet, and in general most of the combination pieces of furniture made with a view of economizing space in apartments in large cities, are of this class.

The American bureau is a combination of the old chest of drawers and the dressing-table, having the drawer-room of the one and the swinging mirror and table-top of the other. This has been imitated in Europe to a limited extent, in the production of what is known as the English dressing-table. As made in this country, the bureau is one of the most practical pieces of furniture used.

The rocking-chair, almost entirely unknown in Europe, is found in every home in this country, yet it is difficult to ascertain when it was first put in use. We do not find any mention of it in the descriptions of articles of furniture in the last century. The first patent issued for improvements in rocking-chairs is dated as far back as 1830.

The folding-bed, in the shape of a sofa, with a box-seat for bedding, has been used in Europe for over a hundred years, but America can claim the folding-bed in other forms, such as the wardrobe, the cabinet, the mantel, and the combination; some of these were made as early as 1847. The demand for folding-beds, which reached its climax a few years since, is now showing a material decline.

The woods used in the manufacture of furniture are varied, and subject to frequent changes. Early in the century, mahogany, maple, and black walnut were in favor; then cherry and ash became fashionable; toward 1880, oak, so long forgotten, took a prominent place. At the present time black walnut is almost entirely out of use. Oak has kept its popularity for the hall, the library, and the dining-room. Mahogany, curly birch, and maple are still extensively used; all of them for the bedroom, and mahogany for the dining-room and the drawing-room in the better grades of furniture.

The changes in furniture coverings have been more frequent and radical than those in the woods. Haircloth and other coverings in use thirty years ago have been superseded by materials more varied in texture and coloring. Their variety is almost endless, and they show, perhaps as much as anything else, the advance that art as applied to furniture has made in this country.

The present centers of the furniture industry are, with one exception, the largest cities, which, with their densely populated suburbs and surroundings, offer large markets. Of the cities whose productions amount to more than $4,000,000 per annum, I find as follows:

FURNITURE PRODUCTION.

New York	$15,661,491
Chicago	14,764,435
Philadelphia	8,288,333
Grand Rapids	5,688,240
Boston	5,455,389
Cincinnati	5,339,394
St. Louis	4,461,546

Grand Rapids, a city of less than 100,000 population, occupies a unique position as a furniture-producing center, in that the principal buyers of the country visit this market twice a year, in January and July, and this has become so general that manufacturers from the larger producing centers have their samples here at the regular trade sales. A celebrated writer, in describing this industry in Grand Rapids, refers to "furniture of the sort that proclaims Grand Rapids the mother of art and comfort."

The furniture industry of the United States has to-day reached a magnitude unknown elsewhere, and the perfect equipment and organization of our mammoth factories, capable of an enormous production, make it imperative that some outlet should be found for it outside of the home demand. Intelligent efforts are now being made in this direction by a number of manufacturers, principally from the West, and there is every prospect of our being able eventually to secure a large foreign trade for our American product.

Geo. W. Gay

CHAPTER XCVII

THE HARDWARE TRADE

HARDWARE is essentially a business that belongs to a new section of country. It has been pertinently said by the pioneer, going into a new and unsettled district, that the first thing he wants is "grub," and simultaneously with that, something in the hardware line with which to cut and cook it. Following this line of thought, it can readily be seen that the larger distributing centers for the hardware business would naturally be in the central-western country, where for the past twenty years the United States has been so rapidly growing. In the eastern part of our country, on the contrary, the necessity has been for improvement and enlargement rather than for pioneer development. At the present time it is safe to say that there are larger distributers of hardware (jobbers) in the cities of Chicago and St. Louis than anywhere else in the world.

There is no other branch of manufacturing in this country which is so distinctly American as hardware; that is to say, there is no other line upon which the peculiar Yankee ingenuity so distinctly impresses itself; no other line that is so entirely free from imitation of the ideas of the Old World; no other line that has so quickly asserted its claim to its own birthright and turned the universal import trade into a great and constantly increasing export business.

All this has been done within the brief period of the last half-century. Prior to that, the American hardware trade was but in its swaddling-clothes, struggling against the flood of cheap and ill-constructed foreign goods, but with victory already in its grasp; for, with far-seeing ken, it had been founded on broad and deep principles of success. Knowing well the temper of the people, it lay awake at night inventing and scheming for better and more economical methods, while the slow-going makers of the Old World were content with the ways that their grandfathers knew.

Hardware is very comprehensive, for, at the present time, it embraces almost everything that is not, strictly speaking, assignable to any other specific line of trade. At the beginning of this century it meant chiefly mechanics' tools and builders' hardware, whereas at this time it includes so vast a variety of goods as to make it difficult to enumerate them correctly. Comprising, as it does, almost all the small articles made of metal that are patented and used in the construction of houses or for household purposes, as well as tools for all classes of mechanics or professional men, it simplifies farm labor and economizes the time of the housewife; it covers all that could be classed as house-furnishing goods for kitchen and dining-room service, the product of the tin-shop and of stamped-ware manufactories, as well as tin-plate, sheet-iron, barbed wire, etc., and has within its range sporting goods, such as guns, rifles, pistols, ammunition, base-ball supplies—in fact, goods for all kinds of outdoor sports, not least among which are found bicycles. An idea of its vast range is conveyed by the fact that one hardware house in this country alone has in its catalogue about 45,000 kinds and sizes of articles, all of which it carries regularly in stock.

Before the first commercial treaty with England, in 1795, all of our supplies in this line, substantially speaking, came from England and Germany. Emigrants could frequently be seen bringing with them their hoes, rakes, and forks, upon which were strung their bundles of clothing. Later the German goods made great gain over the English. As will be seen by a more specific reference later on in this article, these goods were, as a rule, very crude, poorly made, and not at all to be compared with the articles that were manufactured even at first in this country.

The genesis of hardware in the United States was undoubtedly in Connecticut, where the village blacksmith was the manufacturer of such goods (chiefly implements and tools) as were wanted, which he fashioned to order as best he could. A very important individual was this same village blacksmith.

He was, so to speak, an autocrat in the community; without him it was impossible to obtain the necessary implements for the cultivation of the soil.

But little progress was made in this line of manufacture until the last half-century, so slowly did this industry take root in America. In 1850 the manufacture of hardware, speaking generally, was commenced in the United States. Until that time it is safe to say that an exceedingly large percentage—say, perhaps, four fifths of all that was used in this country—was imported from England and Germany. The goods were still practically the same crude and rough products they were a hundred years ago. No change worth noting had been made in the method of manufacture of these goods in Germany.

At the present time this country excels the rest of the world immeasurably in the manner and method of putting up hardware, as well as in the superiority of the goods in style, finish, quality, temper, and durability. Who that was in business during the decade of 1850–60 cannot remember the Spear and Jackson hand-saw, made in Sheffield, England, the then recognized only good saw in the world; and the stiff English paper in which these goods were wrapped, three of them constituting a shipping package; and what an ungainly seeming bundle it made after one had been taken out, leaving the remaining two to be done up as best they could in this unmanageable paper? Who can forget the old, and at that time the only good, horse-nail, "Griffin," with the letter G stamped upon the head of each nail, which came to us in twenty-five pound sacks, with almost as many points sticking through the bags to lacerate our hands as there were nails in the package? And who fails to recall the Butchers' file, which came in paper bundles, three dozen in a package, with the sharp point of every file peeping out of its cover, as if trying to see what America looked like?

Small goods, such as padlocks, door-locks, screwdrivers, scissors, rules, etc., were all put up in rough but strong English paper, which, while substantial, was very clumsy and inconvenient. All these goods, and many more, have long since ceased to be imported, and are made in this country of a quality so superior to foreign manufacture as to leave no room for comparison. It must be borne in mind, however, even at the risk of repetition, that the manufacturers of this country particularly excel in their method of packing and putting up for the convenience of the retailer. Files we put in half-dozen or dozen wooden boxes, with dovetail corners and slide-lids—an immense convenience to the retailer. Hand-saws come in compact pasteboard boxes (four in a package), and the box looks as well on the customer's shelf when partly empty, or entirely so, as when filled.

Horse-nails in wooden boxes have long since superseded the bag or sack of the English maker; and all small goods, even such commonplace and cheap articles as screws and tacks, are put up in boxes of most convenient form and shape for the small dealer, yet preserving—in fact, enhancing—the neatness of their appearance on the shelves.

The makers of American hardware seem to have had one central idea at all times; that is, to produce the best, most suitable, most economical, and handsomest articles that could be manufactured, and then to incase them in the best possible package. If it was an edge-tool, it avoided the clumsiness and overweight of the English on the one hand, and the homeliness and poor quality of the German on the other; if a measuring-tool, it exceeded even the French product in accuracy and beauty; if a file, it was produced by machinery, insuring absolute regularity and evenness of cut, and produced at a cost, perhaps, of one half of the foreign hand-made file.

All this time the introduction of labor-saving machinery was continued, so that the foreign article could compete with ours neither in price nor in quality. It has come to pass that our imports of hardware have almost entirely ceased, although there is yet some cutlery imported, and each year our export business in hardware shows a considerable and substantial gain. As will be noted in the detailed items which follow, we send our hardware all over the world; and in London, and even Sheffield itself, the birthplace of mechanical ingenuity, our American edge-tools are advertised as special attractions.

Figures convey but a faint idea of the magnitude and extent of the business, but it will be interesting to the readers of this article to know that one wire-nail factory in this country has a capacity of 1,000,000 kegs per annum; and that one horseshoe manufacturer, employing 2000 men, has an output of 750,000 kegs of horseshoes yearly.

There are enough screws and tacks made in this country, or at least there is a sufficient manufacturing plant to produce enough, to supply all the world and have a large quantity left over to be gathered up, like the loaves and fishes.

The experience of the last few years has thoroughly demonstrated the fact that the hardware business and its kindred lines is the pulse of the country's prosperity or depression; for so closely is it allied with the iron-producing interests, as also with the railway interests, that it shows more quickly than any other branch the first approach of storm, and recovers sooner from the effects of it. When the hardware business prospers, so is the whole country prospering; when it is depressed, so also is every other line. Hardware is essentially a business based on utility and necessity, and as it comprises goods that are not luxuries, they seldom go out of fashion; although in one of its branches—builders' hardware—patterns and designs are often quickly superseded by something more modern, which drives out the first product by reason of the superiority of the improvement.

It is a fact worthy of attention that of all the goods that are sold by the hardware jobbers of the United States to-day fully thirty-five per cent. have been made or originated within the past fifteen years, so rapid has been the development of this business within the last quarter of a century. The difficulty of giving space, in detail, to the varied items of hardware can be realized in some slight degree from the statement that one single jobbing hardware house in this country purchases goods from about 3000 manufacturers, both foreign and domestic, although the number of foreign manufacturers from whom purchases are made does not amount to three per cent. of the sum total. No article upon hardware, however, would be complete without specific mention of a few of the leading items.

In the item of door-locks, latches, padlocks, and small builders' hardware, Americans have been particularly successful. In point of fact, their goods possess so many advantages over those made abroad as to defy comparison. In England, France, and Germany, they are still using a large, weighty wrought-iron door-lock, with its heavy brass key eight or ten inches long, clumsy and awkward; while in America that class of goods has long since been superseded by a smaller, more compact, and handsomer lock, with a small, flat steel key not more than an inch and a half in length, and easily carried in the waistcoat pocket.

Door-lock manufacture was first begun in Connecticut. Authorities differ as to just where it originated, some claiming the honor for New Haven and others for New Britain. From the best information obtainable it appears that this industry was begun in both these places at about the same time—1834. The first goods manufactured were the cheaper grades, chiefly plate and wood stock locks; and later English patterns in wrought-iron were copied. Very soon thereafter, and not later than 1840, door-locks were made successfully from cast-iron, and these immediately supplanted the old and clumsy wrought-iron locks, which have since that day almost entirely passed out of use in the United States. There is no article in the hardware business which so distinctly bears the impress of American originality, Yankee ingenuity, and New World progressive ideas as door-locks. Foreign locks and hardware are in each country the outgrowth of its civilization and the characteristics of its people. They differ markedly in each case. European peoples are conservative in their tastes, and changes occur very slowly. The influence of this characteristic is adverse to the development of inventors, and operates to discourage the few who appear by making their work unappreciated and unprofitable. The conditions in the United States are the reverse of this, invention being encouraged and rewarded, with consequent stimulation to fresh endeavor. As a result, the art of using cast-iron freely and effectively in light forms, so well known in this country, has never been acquired in Europe, and a prejudice in favor of wrought-metal exists there, which condemns, unheard and without trial, many American products because they are made of cast-iron, although the latter is often better adapted than the former to the intended use. These conditions have always stood in the way of the introduction of American hardware into Europe, but this prejudice is gradually melting under the absolute merit of the goods made by American manufacturers. American locks have been sold all over Europe for many years, but the trade in them grows slowly and is limited to the wealthier classes, and more especially those who by travel here, or by contact with Americans, have become imbued with the American spirit of progress.

American builders' hardware has in recent years been lifted to a new and higher plane in both design and execution. Formerly each new article was originated by the pattern maker or the lock maker, working with sheet-metal and file. Now, in one or more establishments, and perhaps in a number, the work of designing and originating proceeds in the same manner as similar work relating to the designing of machinery, steam-engines, or other mechanical and engineering productions, viz., by skilled draftsmen and designers working at the drawing-board, guided by the best obtainable skill and knowledge, and assisted by the fullest record of experience and data pertaining to the art. There is no reasonable doubt that a very large export trade in door-locks and builders' hardware generally will be had in the near future, because the merit of the American goods has been more thoroughly appreciated within the past two or three years than at any other time in the past century. There are fifteen manufacturers engaged in making door-locks and builders' hardware in this country, with a capital of perhaps $25,000,000, employing 20,000 people, with an annual product of over $20,000,000. An item of interest is the fact that there are melted for use in the manufacture of these goods annually over 100,000 tons of metal.

There is probably nothing in the hardware line in which the American dealer takes more pride than saws, and especially hand-saws and such other small saws as are used by the carpenter and cabinet maker. It is believed that the first saws of any kind manufactured in the United States were made by William Rowland, in the year 1806, in Philadelphia. In 1823 a small plant was started by Aaron Nichols in the same place. In 1828 or 1829, in New York City, the firm of R. Hoe & Co. began to make circular saws from English steel, which were about the first manufactured in this country. In 1835 Noah Worrall started in New York City the manufacture of small circular saws. The following year (1836) William & Charles Johnson commenced the manufacture of saws in Philadelphia; and it was with this firm that Henry Disston, who afterward achieved a world-wide reputation for his wonderful success, learned his trade. In 1840 the firm of William & Charles Johnson failed, and Henry Disston accepted from them some tools, steel, and such material as he could get in the saw line, on account of wages that were due him, and with these he began to manufacture saws in his own name. After this there were several small industries started—by Jonathan Paul in 1840, J. Bringhaust in 1842, James Turner in 1843, and Walter Cresson in 1845. These four were each in turn bought out by Henry Disston. William Andrews was one of the first saw makers in this country, and his nephew still possesses the anvil brought here by his uncle in 1819. This is said to be the first saw-anvil used in this country.

Prior to 1863 all of the steel used in this country in the manufacture of saws was brought from England. In that year Henry Disston built and operated the first crucible-steel melting plant for saw-steel in the United States. He also built a rolling-mill, and from that time on used nothing but steel of his own production. It was a long and hard struggle for Henry Disston to secure recognition and command trade for his American-made goods, but how well he succeeded is known to all Americans. Up to this time the American market was supplied almost entirely by English manufacturers; but the growth and development of this business in the United States since have been phenomenal, and for many years past there have been, practically speaking, no saws imported into this country, while, on the other hand, the American-made goods are exported largely to every civilized nation on the face of the globe. But little or no advances were made in the manufacture of hand-saws before the time of Henry Disston, so that practically all the improvements in quality, style, methods of manufacture, etc., were made by him and his successors since the year 1865, and to them is due the credit of placing American saws in their present position, at the head of the "market of the world" for quality, finish, and correctness of pattern. The American manufacturers, having improved on the old patterns from time to time, aiming to make each as perfect as possible and distinctly suited to the particular class of work for which it was intended, have entirely passed the foreign maker, who is still producing the old clumsy style, with inferior finish, with none or scant improvements over the goods turned out a hundred years ago. It is safe to say that there is no other manufacturing concern in the hardware line in the United States that reflects more credit upon American genius, skill, ingenuity, and enterprise than that of Henry Disston & Sons, whose works are located at Tacony, a suburb of Philadelphia.

There are about 2700 persons employed in this industry, with an annual product of about $5,000,000; and there is nothing made in this country that advertises the United States better, more substantially, more practically, or more permanently than American hand-saws, so excellent is their quality, and so beautiful are their design and finish. There are consumed annually in the factory of Henry Disston & Sons 12,000 tons of steel, all of it used in their various productions. They make an average of 2500 dozen hand-saws each week in the year, every one of which is a practical illustration of the superiority of the American manufacturer. The capital invested in the manufacture of saws in the United States is $7,000,000 to $8,000,000.

The item of small farming-tools, such as forks, hoes, and rakes, is one of the exceedingly interesting manufactures in the hardware line, because, as has been stated, they were one century ago being brought here literally on the backs of the emigrants, and from them were suspended their bundles of clothing and household goods. Immediately thereafter the village blacksmith began to make them, forging the goods by hand in his crude attempt to copy those that were brought over by the emigrants.

Edward C. Simmons.

Iron was the sole material used (except the handles, which, of course, were wood). The goods were very clumsy, unshapely, awkward to use, and heavy. In the decade of 1820–30 the introduction of the trip-hammer revolutionized the entire business and made possible the production of goods by machinery. At the present time there are probably twenty-five different manufacturing works in the United States engaged on these goods, which are commonly called "hand agricultural tools," employing perhaps 1500 people, with a capital of $1,500,000, and an annual product of over $2,000,000. The steel consumed in these productions is more than 4000 tons annually. Of this product of $2,000,000, at least $250,000, and perhaps twice as much, is exported to foreign countries, leaving about $1,500,000 for home consumption.

It is a thoroughly well-recognized fact all over the world that American forks, hoes, and rakes are greatly superior to those made in foreign countries, chiefly because of their lightness and great strength, as well as their marked superiority of finish. In this one single class of goods foreigners have improved in their quality by reason of our competition—a condition that does not exist in any other line of hardware. These goods are exported to England, France, Italy, Switzerland, Germany, Austria, Norway, and Sweden, and the demand for them in those countries is steadily growing.

The cutlery business of the United States has an interesting history. While the American manufacturer of table cutlery has to a large extent—in fact, almost wholly—driven out the foreign goods, by reason of the excellence of quality and the economy of manufacture, the pocket-cutlery makers have not been so successful. However, they are to-day making a very considerable proportion of the goods that are consumed in the United States, and the goods they manufacture are fully the equal of anything made abroad. But when it is remembered that the cost of making pocket-knives is eighty-five per cent. labor and fifteen per cent. material, it can be seen how difficult it is for the manufacturer of pocket-knives in this country to compete with the cheap labor of England and Germany, and that he must rely greatly upon their excellence of quality, their beauty of design, and their taste in finish. The origin of pocket-knives in this country is traced back to the State of Connecticut, as is so much in the hardware line, beginning in the year 1842. The first factory was quickly followed by the establishment of five others in the same State. The result of this was that many of the best English operatives from the works in Sheffield came here, because they could find steady employment and higher wages than they had previously known. After a while some of these operatives combined their experience and savings, and formed a new company in the village of Walden, N. Y., on the coöperative plan, which is to-day the largest concern of the kind in the United States. The pocket-knife industry of this country is unquestionably in New York and Connecticut. Of fifty-five ventures since 1844 more than thirty-two have experienced failure, owing chiefly to their short-sighted policy of making goods for price rather than for merit—attempting to compete with the cheap labor of the old country in price rather than in the excellence of quality and finish. The successful ones (as is always the case) have been the long-headed business men, following the time-honored principle that "the best is always the cheapest." A large majority of these pocket-knife manufactories have been founded on the coöperative plan, locating in small villages where cheap water-power was abundant. To-day the investments represent about $1,800,000, with the employment of about 2000 persons. During prosperous times the consumption of pocket cutlery in the United States is in the neighborhood of 1,200,000 dozen per annum, representing perhaps $3,000,000. The larger part of this is imported from Germany and England, in the proportion of two to one in favor of Germany. Prior to 1850 the American market was supplied almost entirely from England, but the cheaper German grades are gradually driving out the higher-priced English goods. The home-made product has steadily improved in quality, and while it is not always as absolutely uniform as the English product, yet the best American knives are not surpassed by anything produced in Sheffield, and are far superior to the German in quality, temper, and finish. The genius of American manufacturers is much handicapped in one respect, by the impossibility, so far, of employing any labor-saving machinery worth mentioning, since the quality of the knife depends entirely upon the skill in manipulation and tempering of the mechanic. Although there is no export business in pocket cutlery, the manufacturers, at times, have given evidence of what they can do in the line of cheapness. Recently a single-blade knife with a wood handle, all handsomely finished, of a quality of steel which would take a razor edge, was produced by the manufacturers so cheaply that after the jobber and retailer had each had his profit it passed into the hands of the consumer for ten cents. I do not recall in all my business experience where an article of so much value was given for so little money. Let me put it more plainly and emphasize it. I think this ten-cent knife is the cheapest thing I have ever seen, quality and usefulness considered. And bear in mind it is made in the United States. The complexity of the business may be gathered from the statement that in the manufacture of pocket-knives it is necessary to import mother-of-pearl from the Philippine Islands, tortoise-shell from the Indies, stag-horn from the parks and forests of Germany and India, ebony from the spicy isle of Ceylon and from Madagascar, cocoa-wood from unhappy Cuba, and rosewood from South America. Those of us who can recall our boyhood experiences when the village blacksmith was the recognized cutlery maker can well marvel at the enormous output, the amount of capital to-day invested in this branch of cutlery, and the exceedingly low prices at which these goods are sold.

Table cutlery was first manufactured in this country in 1832, before which period everything in this line came from England. Within thirty years thereafter, or say by 1865, the business was pretty much in the hands of the home manufacturers, and has been drifting steadily that way ever since, so that in the year 1893 the entire amount of foreign table cutlery imported into the United States was only $195,000, and there was not five per cent. of the consumption of this country exported. The table cutlery made in the United States, and especially the medium-grade article, far excels in beauty, finish, and design all foreign goods. Attempts have been made by foreigners to copy American patterns of table cutlery, but in no instance were they successful in producing so good an article, and the effort was finally abandoned. The State of Maine was probably the birthplace and cradle of the manufacture of table cutlery, the first effort being made at Saccarappa. In the "market of the world" there is no such great middle class as there is in the United States, and for that reason there is specifically a demand for medium-grade, well-finished goods in this country which does not exist in others, and which makes it possible to manufacture more largely of this class of table cutlery here than elsewhere. The amount of table cutlery exported is a mere trifle—probably not more than five per cent. of the product of the country. The estimated value of the production of the various table-cutlery manufactories of this country is $3,000,000.

American shear makers have set the pace for the world in that line of goods. They were the first to solve the problem of welding a high-grade steel blade to an iron backing or soft casting made to fit the hand. This was the invention of Seth Boyden in 1826. The manufacture of shears in this country was started in a crude way the year before, at Elizabethport, N. J. Welding by hand was carried on from that date until early in the sixties, when a drop-hammer was constructed by Mr. H. Wendt, the ram of which was raised by the friction of a rope pulled by hand around a revolving wheel or pulley. This rope later gave way to a flat leather strap, and was afterward succeeded by power drop-hammers operated by friction-rolls upon a flat board, under perfect control by the foot of the operator, the hands being free for the proper manipulation of the work. Our American shears are far superior to those made in foreign countries, and are exported in great quantities, especially to England, South America, and Australia. None of the foreign countries has adopted our method of manufacturing shears, and for that reason their goods do not compare with the American product. There are eight manufacturers engaged in this business in this country; total capital about $750,000, employing about 1000 people, with a product of about $1,500,000.

In the manufacture of fine mechanics' tools, such as are used by the higher class of machinists, the United States is the peer of any country. To-day one of the foremost concerns in this line, located in Providence, R. I., sends its tools to England, France, and Germany, where they are called for and given preference because of their great accuracy and almost infallible uniformity of manufacture. An illustration of the esteem in which they are held is shown in the fact that these American tools are used in the manufacture of the new French rifle which is attracting so much attention. Some idea of the exactness of such work may be gathered from the statement that in the production of fine firearms it is necessary that thousands of parts should be interchangeable, and should not vary by the thousandth part of an inch. Some of the micrometer calipers from these works will measure the two-hundred-and-fifty-thousandth part of an inch with accuracy; and this same firm, the Brown & Sharpe Manufacturing Company, have in their office a tool whereby the difference in diameter between two steel bars of the ten-thousandth part of an inch is made perceptible to both the eye and the touch. In the face of such excellence as this, is it any wonder that the export business in this class of goods should be growing rapidly?

The manufacture of wire cloth, such as is used for window and door protection, to keep out mosquitos, flies, insects, and similar pests, has become a large industry in this country, although its beginnings date back only about twenty-five years, at which time the price was ten cents per square foot, and it was all made by hand-looms in a small way. It was first introduced into this country from Germany in the year 1870, and it cost at that time to import it from ten to twelve cents per square foot. In 1873 an improved hand-loom was operated in Cortlandt, N. Y., made by Mr. Wickwire; and in 1874 he invented and patented a shuttle motion known as the positive motion, the shuttle being carried through the cloth instead of being thrown, as was the case in former manufacture. With this principle to work upon he succeeded in making a power-loom in 1876, which was the first power-loom to make a hard-drawn wire cloth. This principle is now used by all manufacturers of wire cloth. The present price is less than one and one half cents per square foot, which is only a small fraction of the price of twenty-five years ago. In 1876 the consumption in this country was about 10,000,000 square feet. At the present time it is about 125,000,000. There is a total capital of about $3,500,000 invested in the manufacture of wire cloth in this country, consuming about 6000 tons of steel. The export trade in wire cloth is chiefly with Canada, Nova Scotia, South America, Mexico, and the West Indies, and, although light at present, is growing steadily. The American product far excels that of foreign manufactories in quality. There is no country that uses screen-cloth in windows and doors so generally as does the United States, because there is no country that approaches the magnitude of manufacture that we do.

The manufacture of files in this country was begun half a century ago in Providence, R. I. The product at first was entirely hand-cut, with the old-fashioned hammer and chisel; for although machines were invented at an early date, they were not used until about 1858. These first machines, however, were not successful, and it was not until 1865 that machine-made files can be said to have been fairly under way. The first year's output was only about 90,000 dozen, whereas now it is something like 2,500,000 dozen, aggregating over 5000 tons in weight. Up to 1870 the importation of files from England and from Switzerland was very large; but in that year imports began to fall off rapidly, and have now practically ceased, with the exception of a few fine Swiss files which are still brought over for special purposes. On the other hand, the exports are steadily growing, American files now being used in China, Japan, India, Africa, in many of the European centers, and in Great Britain itself. The merits of the American files are so pronounced, both as to wearing qualities, handsome appearance, and cheapness of price, that the preference is given them over files made in other countries. The manufacture is extremely intricate and involves the most careful inspection, and the marvel is that so few imperfect files manage finally to come through. It is a well-recognized fact in this country that machine-made files are more evenly cut than hand-made files can possibly be; and as nearly all the foreign files are still made by hand, the American product has a great advantage. In addition to this, Americans put up their files in very much better, more convenient, and more attractive packages than does any manufacturer in foreign countries. This particularly appeals to the trade of Australia, South America, and the West Indies. A very large percentage of the files manufactured in the United States is made by the Nicholson File Company of Providence, R. I., and Henry Disston & Sons of Philadelphia, in the various factories which they own or control. There are 148 file manufacturers in this country, employing 2400 people. The estimated capital invested is $3,000,000, and the total value of the annual product about $3,200,000.

The name of wood-screws recalls the somewhat familiar, time-honored joke of the would-be legislator who was one of the committee to revise the tariff, and who visited New England to consult the manufacturers of wood-screws. He was a native of the wild and woolly West, and saw no reason why New England manufacturers needed a tariff on wood-screws, for, according to his observation, the raw material, in the shape of growing trees, was abundantly cheap all through the New England States. There seems to be good evidence, as in the case of many other apparently modern inventions, that the gimlet-pointed screw was made as far back as 1755. The first application of machinery on record for making screws was in France in 1569. The first English patent was obtained in 1760. From 1846 to 1849 came the inventions of Thomas J. Sloan, and these, in connection with the inventions of Mr. Harvey, form the basis of the screw-machinery of to-day. Screw-machinery was in operation in this country in 1810 in threading wood-screws, and was known as French machinery, having originated in eastern France. Some of it was in use as far back as 1798 in New York State. In 1835 came the invention of machines for heading, nicking, and shaving screws, and in 1842 the very important invention of the automatic feed for supplying blanks to screw threading and shaving machines.

One of the earliest manufactories in this country was established in 1838, with a capital of only $20,000. About 1841 the first American gimlet-pointed screws were placed on the market. Since that time screw-machinery of this character has been exported to England, France, Germany, Russia, Austria, and Italy. At present there are twenty screw-manufacturing concerns in this country, employing many thousand men, and with many millions of dollars' capital invested, as the business is very complicated, requiring large capital and delicately organized machinery. The machinery itself is among the most perfect ever invented, working with almost human intelligence and precision. Few screws are exported, owing to the severe competition of the great screw-manufactories of Birmingham, but the American article is generally regarded as more perfect than any made abroad.

Shovels and spades were manufactured in this country, in Massachusetts, as far back as 1776, in a small way; but since that time the methods of manufacture have improved so rapidly and intelligently that the American product now far outstrips that of the rest of the world. The Ames factory at North Easton, Mass., has a world-wide reputation, and exports its goods in great quantities to almost all parts of the civilized world. There are many other large factories in this country, producing an enormous quantity of these goods annually. The American goods are greatly preferred to the foreign article, because of their being vastly superior in quality and attractiveness, giving far greater satisfaction, and having less weight, whereas the foreign goods are heavy and much more clumsy. There are about fourteen shovel-manufactories in this country, with a total product of about 400,000 dozen shovels and spades.

Horseshoe-nails are prominent among the manufactured articles distributed by the hardware trade. In 1859 Mr. Putnam, of the Putnam Nail Company, undertook to make a black horseshoe-nail the same as the English "Griffin," and was the only manufacturer in this country who succeeded in making one identically the same, unless, perhaps, it was the old Forge Village Nail Company. The progress of horse-nail making in this country was very slow, and it was not until 1872 that much had been done in this line. After that the progress was rapid, and soon thereafter the foreign goods were entirely driven out of the market. Nails in this country are made by what is called the hot forging process, and are hammer-pointed. None are made in this manner abroad, and for that reason the American horse-nail is far superior to those made in other countries. There are twelve horseshoe-nail manufacturers in the United States, employing about 1000 people, with a capital of about $2,000,000, having a total product of, say, 9000 tons, which have a market value of over $2,000,000.

Wire nails, which have so rapidly superseded the cut nails, were not made in this country until 1886, at which time they were first produced and put up in kegs the same as cut nails. The total production that year was 600,000 kegs. In 1887 this output was doubled, and continued increase has been shown each year since until the year 1894, when the product was 5,681,801 kegs, with an estimated product for the year 1895 of from 7,000,000 to 7,500,000 kegs. These goods are made so cheaply in this country that they have been exported to some extent. One single order for American wire nails was taken in London for a lot of 60,000 kegs, in January, 1895, the goods being produced and sold cheaper in this country than anywhere else in the world. At present there are sixteen wire-nail mills in operation in the United States, controlled by ten different companies, with a capital invested of about $8,000,000. The value of the product, based upon present prices, is $15,000,000. There are 5000 people employed in the wire-nail mills.

Barbed wire was first manufactured in the United States in 1874, at De Kalb, Ill. In that year there were not over 500 to 600 tons produced, and the price was twenty cents for painted wire. The next year the product increased to 3000 tons, and five years later (1880) it had made such a great gain that the record was 100,000 tons; while for the year ending March 1, 1895, the total product was 190,000 tons, at which time the average price, which was originally twenty cents, was reduced to about one and one half cents per pound. Of all the barbed wire manufactured in the world fully ninety per cent. is produced in the United States, and there are annually exported from 20,000 to 30,000 tons. Of this amount the Consolidated Steel and Wire Company, with headquarters at Chicago, Ill., are exporting about ninety per cent.

At the present time there are seventeen barbed-wire mills in operation, with a capital invested of $8,350,000, and a total product, based upon present prices (1895), of $14,000,000, and employing 7000 people.

Tin-plate making is among our youngest manufactures, considered in reference to the amount of its product. No industry in the United States has shown such phenomenal growth as has that of the production of tin-plate. It is safe to say that there was substantially none of it prior to 1891. Since that time, or in the brief space of, say, four years, about seventy manufacturers have entered the field, nearly all of them equipped with the most modern plants and with ample funds to do the work in the best and most economical manner possible. The result is that home manufacturers are to-day in position to supply this country with at least one half of its consumption; and when it is realized that the annual consumption is about 6,000,000 boxes, or in the neighborhood of $21,000,000 in value, the importance of this wonderful growth can be appreciated. Prior to 1891 almost all of it was imported from England, whereas now it is a question of only a short time when the home manufacturers will not only control the entire market of the United States, but will be seeking other fields to conquer. The native product is superior to the foreign both as to the quality of steel used for tinning, and again in that advantage which Yankee ingenuity almost invariably brings—labor-saving machinery of every kind. The Welsh tin-plate makers have progressed very little since they began the industry, and the prospects are that a hundred years from this date will find them just where they are now; while the American manufacturers have already made radical changes and introduced a number of marked and valuable improvements.

The American hardware man has often been said to be a philanthropist rather than in the ordinary sense a merchant or shopkeeper, for the reason that he gives better value for the money that is spent with him than is done in any other line of business. An investment of a dollar in his store will last longer, be more useful, do better work, give greater satisfaction, and receive a higher degree of appreciation than will a similar investment in any other article or class of goods that is made. A mechanic will frequently, after using a tool for which he has paid perhaps one dollar, become so attached to it by reason of its excellence that he would decline to sell it for five dollars. It is a fact that many times a barber who has purchased a razor for a single dollar will, after years of use, be offered five or ten dollars for it. In this sense, perhaps, the claim of philanthropy may be defended. Another view of it was presented recently in the case of a distinguished lawyer who was traveling over one of the Northwestern railways, having with him his son, a young man just from college, to whom he was showing the road. The latter asked for what purpose the ax and handsaw which were covered with glass at the end of the car were used, to which the father replied:

"That is for a very peculiar use in this country. The railroad companies have found from experience that when accidents occur and people are killed the surviving heirs usually bring a damage suit for about $5000, that being the customary figure for which suit is brought; whereas if a passenger is wounded, maimed, or mutilated, he brings suit for $25,000, $50,000, or $100,000. Hence these saws are placed at the end of the car, so that in the event of accident, where passengers are wounded, the conductor and brakemen may immediately kill them, saw them up, and thereby reduce the amount of damages that will be asked for."

E. C. Simmons

CHAPTER XCVIII

THE STATIONERY TRADE

IN early days dealers in books were denominated *stationarii*, probably from the open stalls at which they carried on their business; though *statio* is a general term in Low Latin for "shop." They sold, among other things, materials for writing, which have retained the name of stationery, although now embracing thousands of articles then wholly unknown. Indeed, long before the invention of printing there flourished a craft or trade called stationers. D'Israeli, in his "Amenities of Literature," says: "They were scribes and limners, and dealers in manuscript copies, and in parchment and paper and other literary wares." The stationer's stock consisted largely of books or works in manuscript, which were transcribed, loaned, or sold. To these were added parchment, paper of various kinds, ink, quill pens, sealing-wax, etc. But after the introduction of printing, and the commencement of the manufacture of paper in an organized way, he became, as it were, a dealer in all kinds of articles which pertained to the literary vocation. To-day he is not only stationer *per se*, but also, to a greater or lesser degree, designer, printer, engraver, lithographer, photo-engraver, and bookbinder; for in the ramifications of his business he brings into use all of these different callings, in order to satisfy the multiplying wants of his customers. The latter nowadays include merchants, bankers, brokers, railway and steamship men, lawyers, doctors, journalists, and ministers, as well as all classes of the body politic, each of which, in turn, requires something different from the others in the general stationery line. Such being the case, it is difficult to define in the large modern wholesale or retail establishments of this description that part of the stock or business which is strictly stationery and that which belongs to fancy goods or to other kindred branches of trade and manufacture. The tendency of the modern distributing trade in nearly all lines is to return to first principles; that is, to group together under one roof a heterogeneous assortment of articles that bear no direct relationship to one another. This tendency is as manifest in the stationery business as in other departments of merchandise. The crude hand-paper, old inkhorn, and "gray goose-quill" of older days have been supplanted by almost numberless articles of greater beauty and convenience answering like purposes.

The Guild of Stationers in London, England, which was the earliest organization of the kind known in England, was formed in 1403, many years prior to the introduction of the art of printing into that country by Caxton. It was chartered as the Stationers' Company by Philip and Mary in 1556. The charter was renewed by Queen Elizabeth in 1559, exemplified in 1684, and confirmed by King William and Queen Mary in 1690, and as such exists to this day. The guild owns and occupies the building known as Stationers' Hall, in which is kept a book for the registration of the copyrights granted in the United Kingdom.

Toward the close of the seventeenth century, when New York had been under the domination of the English for over a score of years, it was resolved to establish printing here on the same plan as that already in existence at Cambridge, Mass., and at Philadelphia, Pa., where William Bradford, printer, had located. In connection with Rittenhouse, Bradford built the first paper-mill in this country, which was erected on a branch of the Wissahickon, known even to this day as Paper-Mill Run. Conjoined with Bradford and Rittenhouse in this enterprise were Robert Turner, Thomas Tresse, and Samuel Carpenter, also of Philadelphia. The mill was built in 1690, and was composed of rough, unhewn logs put up in the same style as were many of the dwelling-houses of those early days. Some years later Bradford removed his printing-press from Philadelphia to New York, and established himself there; thus depriving the former city for a number of years of a printing-press.

It may be well in this connection to particularize the printing-presses which had been established in this country up to this date. Cambridge, Mass., had one as early as 1639; Boston, one in 1675; Virginia, one in 1682, which was stopped by Lord Effingham in 1683, and no printing again allowed to be done there until 1729; Philadelphia, one in 1685, which was removed to New York in 1693, and none again until some years later; New York, one in 1693; Connecticut, one in 1709; and Maryland, one in 1726. As to paper-mills, with the exception of the one near Philadelphia, none had been established in this country until 1725 or 1726, when Bradford erected one at Elizabethtown, N. J. Up to 1742 Bradford continued in the printing and stationery business in New York, when he was succeeded by James Parker, who carried on the trade successfully for a number of years afterward.

Hugh Gaine was another of the old printers and stationers of New York. He came originally from Belfast, Ireland, and became a journeyman for James Parker. In 1752 he began business for himself, and in that and the succeeding year brought out "Hutchins's Almanac," and a journal entitled the New York "Mercury," which continued to be regularly published until the close of the Revolutionary War. His store was in Hanover Square, where he sold books and stationery, as well as carrying on printing and binding. He occasionally issued books on his own account. When the colonial army took possession of New York he retired to Newark, N. J., and remained there for a time, publishing a loyalist newspaper. At the close of the war he petitioned the legislature of New York for permission to return, which he obtained. He stopped his journal, but continued his printing, book, and stationery business. He died in 1809, leaving a fortune.

Aside from those already mentioned we have very few authentic records of other stationers in New York until about the beginning of the nineteenth century. Printing was then very much improved, as was also the manufacture of paper. In 1812, New York, besides one periodical (a medical quarterly), had seven daily, three triweekly, and two weekly journals, in which the booksellers and stationers especially had the largest advertisements, as they had the greatest number of articles for sale. They had supplies of stationery, including paper, ink, wafers, pumice, pumice-boxes, shining-sand and blossom-blotting paper, not to mention books, pamphlets, and a quantity of quack medicines. Printed forms then were few, as every lawyer engrossed his own matter. There were no printed cards like those which have since come into use. Probably the whole of the job printing then done in the entire United States was not, in amount, equal to that done at the present day in some interior village.

Stationery was not distinct from printing and bookselling until 1810 and even later. It was declared by a stationer who did business shortly after that time that "the stock of the stationer proper usually consisted of a few quarts of ink, a ream or two of writing-paper, and a barrel or two of black sand, the people making their own quill pens." Writing-paper until after 1830 always had a rough surface, and was made only in three or four sizes. Sealing-wax was then an important article; envelopes were not practically in existence, although some few crude hand-made affairs had been shown earlier in Europe.

The early directories of the city of New York give the names of no paper dealers, and but a moderate number of those engaged in the kindred lines of printing, publishing, and bookselling. David Longworth published directories at the Park. The exact location was where Hitchcock's music-store now is, on Park Row.

From 1786 to 1796, Robert Hodges, stationer and bookseller, was located at Maiden Lane, and carried on a very successful trade. Following him, the name of Doubleday appears more or less prominently in the trade, in which it continued for over three quarters of a century. Contemporary with him in the early days was Duyckinck, located at 110 Pearl Street, who continued in business for a long time. He was a very extensive publisher. In 1831 we first hear of David Felt, of Boston, who established himself here, and afterward at Feltville, N. J., where he engaged in the manufacture of stationery, etc. He was a man of strong individuality, with almost revolutionary tendencies in his methods for the advancement of the stationery trade. He was carried down in the panic of 1857, and never was a factor in business afterward. In 1837 the name of Louis I. Cohen first appeared as an importing stationer of prominence. He amassed a competency, and lived to a ripe old age in which to enjoy the fruits of his industry. Among the names that have been continuous in the stationery and kindred trades for the last fifty years, and whose successors are still active in business in New York to-day, are Bowne & Company, established in 1837; E. B. Clayton & Sons, in 1846; Francis & Loutrel, in 1844; and W. A. Wheeler, in 1849.

About 1845 Richard Bainbridge first came to New York, and a change was introduced in the mode of doing business. He began the English and continental method of traveling with samples, and obtained large orders from the start, not only from the few importers on the coast, but from jobbers, who from this time were prominent buyers of foreign goods. About 1850 the house of Richard Bainbridge & Company was established in New York, and began to carry a stock here. After the panic of 1857 Mr. Bainbridge left the stationery business, and the firm was changed to Bainbridge Brothers. In 1861 the firm became Henry Bainbridge & Company, which still continues at 99 and 101 William Street, where it originally was formed, being familiarly known throughout the United States as a legitimate and exclusively wholesale house. Mr. Benjamin Lawrence began the importing of stationery about this time, and afterward, as B. & P. Lawrence, became the largest importers known in the history of the trade. Henry Cohen was established in Philadelphia at this time, and his son, Charles J. Cohen, worthily succeeded his father, more, however, as a manufacturing stationer than as an importer.

In Boston, Benjamin and Josiah Loring, twin brothers, had established themselves in business as bookbinders in 1798, and were located on Water Street, where they continued together until 1805, when they separated, Benjamin remaining at the old place and Josiah being on Devonshire Street. In 1810 the latter was located on School Street as a bookbinder and paper ruler, removing thence in 1813 to 1 South Row or Marlborough Street, opposite School Street, where J. L. Fairbanks has been since his death. Benjamin Loring in 1807 removed to State Street, where he remained until 1810, then changing his place to 50 State Street. About this time Edward Cotton was doing a good business on Marlborough Street, and some ten years later, in 1820, David Felt was also largely engaged in the stationery business at 83 State Street. This was the David Felt who afterward removed to New York, and finally to New Jersey. Charles Himpson, the publisher of the "Boston Directory," Samuel G. Goodrich ("Peter Parley"), Leonard C. Bowles, and Andrew J. Allen, all on State Street, were also among the principal stationers of the same period. Lemuel Gulliver succeeded David Felt, and Thomas Groom, an Englishman, from New York, shortly afterward took the place of the former, especially in the stationery line, in which he had not proved very successful. There were also about this time many stationers in Cornhill, Boston, doing a moderate country trade; but there were few successful ones among the number. Jones & Oakes, Jones & Holman, Oliver Holman, and Aaron R. Gay successively occupied 124 State Street. Mr. Gay is still in business at the old quarters, which are now known numerically as 122.

About the year 1816, John Hooper, a young Englishman, who had been in a newspaper printing-office in New York, came to Benjamin Loring to learn the bookbinding business; but his employer, finding him useful and efficient in the store, kept him there, and finally, in 1826, admitted him to a copartnership interest in the firm, which at that date was known under the style of Benjamin Loring & Company. Thus it will be seen that Thomas Groom & Company and Benjamin Loring & Company were prominent stationers in Boston at this early date; and while the former name still continues the same, the latter was succeeded by Hooper, Lewis & Company, both being favorably known throughout Europe and the United States as extensive importers of and dealers in all counting-house requisites.

Previous to 1845 travelers in this line of business were unknown. At the present day most of the wholesale business is done either by travelers or by mail. The principals in the trade seldom meet one another, except occasionally in an incidental or social way. Formerly it was thought necessary for all the large dealers at a distance to visit New York, Boston, and Philadelphia once or twice a year, as also for the importers to go to Europe. Travelers and samples, through our excellent mail and railway facilities, have changed all this, and the merchants living in remote sections of the Union can now get their supplies as promptly and satisfactorily as if they were on the spot in person to select for themselves.

Chicago fifty years ago was of little importance from a stationer's point of view, but in less than ten years afterward it developed some of the largest buyers of stationery. Among the great Chicago houses the firm of A. H. & C. Burley may be mentioned as large manufacturing stationers and jobbers. When the Illinois Central, Rock Island, and other railroads running out of Chicago were being built, foundations were laid for a progress in that city that makes it to-day the market to which our manufacturers and importers are equally attracted. Chicago can boast of more first-class stationery-stores than any other city in the United States. The farther west we go, attractions increase. St. Louis has many

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large manufacturing and jobbing houses in this line, that are substantial and impressive. The business established by Mr. Loring in that city is now known as the Robert D. Patterson Stationery Company, and has been active in the trade for more than half a century.

San Francisco has several houses worthy of that enterprising and favored land of sunshine and flowers. H. S. Crocker & Company have one of the most complete manufacturing establishments on the Western coast. Payot, Upham & Company, another enterprising house in that city, are favorably known on the Eastern as well as the Western coast. The large firms in San Francisco are probably better equipped for work than most of our Eastern manufacturers, because, being farther from the center of activity, they have naturally become more self-reliant.

The growth of labor-saving office devices has been remarkable during the last twenty-five years. In all modern offices will be found files, clips, and filing-cases of varied and complete manufacture, so carefully and economically arranged that it is no longer necessary to overhaul a lot of old boxes and bundles of former years' accumulation, but one can go directly to his index and in a few minutes examine any records required, each being readily returnable to its proper position in the files, neither defaced nor damaged. Cameron, Amberg & Company, of Chicago, were the first in the market with their cabinets, filing-cases, and indexes, and reaped great benefit from them almost from the beginning. Up to this day this firm is prominent in labor-saving devices, favorably known in mercantile and legal offices. Shannon's files, indexes, and filing-cases have a world-wide reputation, and are second to none in usefulness and popularity. Brower Brothers, of New York, came later in the field, but steadily and surely won their way to public favor. The Globe Company, of Cincinnati, has gained a well-deserved reputation for many novelties in counting-house requisites, and its fame has reached the utmost limits of the United States, and its wares are familiar to many parts also of the outside world.

Turning now from the consideration of the personnel of the stationery trade to its methods, features, and business operations, we find great changes since 1795. Papeteries, pads in all styles, and devices from the cheapest pencil paper to the fine stamped initial have seriously injured the stationer, upon whom we formerly relied for the sale of the monograms and special styles which are so necessary for every well-regulated writing-desk and library. The paper maker may not regret the change this class of manufacture has brought about, but the stationer proper has great cause to do so, as all classes of merchants throughout the country can and do sell a pad or papeterie, with or without envelopes to match, for a nominal profit. No technical knowledge or training is required to sell a package for ten cents that cost nine. The department-stores have been the greatest detriment to this part of the stationer's business.

Envelopes as now made and used are of very recent origin, yet their occasional employment as a covering for letters extends back several hundred years. The first ones were very crude, hand-made affairs, and, aside from the purposes for which they were used, bore but little resemblance to the machine-made article of to-day. In the English state-paper office there is said to be one bearing the date of 1696, which in shape or style resembles some of those in use to-day. In "Gil Blas," published in 1715, allusion is also made to the use of envelopes. But with the exception of the instances noted, envelopes, used as a covering for letters or written communications, made no showing whatever in a commercial way until after the introduction of penny postage in England, in 1840. Then they became common in that country, and in America some four or five years later. Congress made a marked reduction in the cost of postage, and made it uniform for all distances, in 1851 or 1852, leading to increased correspondence between the people of the various sections of the Union. The use of envelopes became still more common soon thereafter, and they were in great request. Up to this time they had been made by hand, and the process was necessarily slow and expensive. They were not self-sealing, but wafers and sealing-wax were then in every household and office, whereas to-day these articles are almost obsolete except for parcels.

The earliest manufacturer of envelopes in New York was an Englishman named Dangerfield, who began about 1846, and was followed by Samuel Raynor, whose successors, the Raynor Envelope Company, are to-day to be found in William Street, where in the manufacture of millions of this article they employ machines which are beautiful examples of perfected mechanism, and which go through with all the varied processes of the making in about one second. The daily consumption of envelopes alone in this country is almost beyond computation, for the reason that the letters which go through the mail form but a part of those used locally and otherwise in an unstamped condition.

The pencil was probably the first instrument used by artists. It consisted of lumps of colored earth or chalk, cut in convenient form for holding in the hand. With such pencils were executed the line-drawings of Aridicies the Corinthian and Telephanes the Sicyonian, and also the early one-colored pictures or *monochromata* of the Egyptians and Greeks. The manufacture of lead-pencils by machinery, however, is of very modern origin. In this country the first lead-pencils were made by Mr. Louis J. Cohen, about 1837, who soon discontinued their manufacture, and the German lead-pencil began to control our markets. The rapid growth of domestic pencil manufacture, fostered by protection in the closing decades of the century, has driven imported pencils almost out of the country, save the higher grades, which cannot as yet be produced here with profit to the makers. The export trade in medium grades of pencils has already reached important proportions in our foreign commerce, and promises to attain to still greater enlargement in the near future.

The earliest pen, we are told, was a kind of reed, split or so fashioned as to retain and give off, as required, colored liquid, or ink, as it is now generally termed. Quill pens came into use about the time of the introduction of modern paper. At the beginning of this century pens began to be made wholly of metal. They consisted of a barrel of very thin steel, and were cut and slit so as to resemble the quill pen as closely as possible. They were, however, but indifferently successful, and, being expensive (the retail price at first being half a crown, and subsequently sixpence), they made but little headway. Their chief fault was hardness, which produced a disagreeable scratching sound on the paper. In England, in 1820, Joseph Gillott, who dealt in the metal pens then made, hit upon an improvement which, by removing this great defect, gave a stimulus to the manufacture which caused it to be developed to an extent truly marvelous. This consisted in making three slits instead of the single one formerly, and by these means much greater softness and flexibility were acquired. He also introduced machinery for the purpose of carrying out his improvements. In this country the old-fashioned quill pen held supreme sway until about 1844 or 1845, when the steel pen began to be more generally used, at least commercially, although the former was employed for many years later to a very large extent in households, schools, and colleges. To-day, however, the rising generation hardly knows what a quill pen is, so rapidly have metal pens of all grades taken its place.

We are told that nothing much was known about ink by the ancients. The use of the stylus, however, indicates the employment by them, as well as by Asiatic peoples in general, of carbon inks. Indeed, Pliny, Dioscorides, and other ancient writers give evidence that carbon in the form of soot was the essential constituent of ancient ink; and in early modern history we know that liquid preparations made from various vegetable and mineral substances were used. But ink corresponding in kind and character to that employed to-day for writing purposes came into use in Europe about the time that paper manufacture and block printing were introduced there. In this country Thaddeus Davids was probably the earliest one to engage in the manufacture of ink on a large scale or in an organized way. He made ink for writing and copying purposes, and he has been followed by several noted manufacturers. In printing-inks especially the business has assumed enormous proportions, and as to writing-fluids of the various descriptions, they have become household and office necessities, the manufacture and sale of which are also of large proportions. Of late years the type-writer, with its prepared self-inking ribbon, for general commercial purposes, has made a serious inroad in the sale of writing-ink proper. Slates and slate-pencils are doomed and are going out of use very rapidly.

In the foregoing but a few of the chief articles made or handled by the stationery trade, wholesale and retail, have been enumerated. Among those most commonly sold by the retail trade of the present may be mentioned the following: arm-rests, albums, rubber bands and rings, backgammon, chess, and checker boards, baskets, alphabet and kindergarten blocks, blotters, pads, book-covers, boxes, tin, bone, wood, and japan paper-cutters, penholders and pens, paints, writing-papers (flat, folded, and boxed), paper-weights, rubbers, rulers, school-bags, school-books, scales, sealing-wax, seals, shears, scissors, twine, slates, sponge-cups, straps, tags, suspension rings, tapes, tape-measures, toothpicks, tracing-cloth, wafers, eyelets, pins, wires, etc.

Many of our retail stationers have also news-rooms, book-stores, small printing outfits, and tobacco and cigars united with their other business, so that it is often difficult to tell what part or parts belong strictly to stationery. In fact, as previously observed, the stationery business, both in the manufacturing and selling departments, in the United States is so closely related to the paper manufacture proper, the printing, bookbinding, and bookselling trades, as well as other industries, that it is hard to get any accurate figures with which to make a numerical exhibit of its progress. The census reports do not afford any very definite idea of its growth or present status. From the imports and exports as reported by the government it is possible to obtain some idea, although there are certain generalizations in the classification of articles under this head that render exactitude impossible.

The importation from abroad of writing and book papers has fallen off materially of late years. Except hand-made papers for drawing and ledger purposes, the American papers are equal to all requirements. Without going into a detailed analysis of the above summary, however, it will be seen that our imports of paper and paper manufactures are still largely in excess of our exports of the same articles, including stationery not made of paper.

IMPORTS AND EXPORTS OF STATIONERY, 1869–1894.

ARTICLES.	1869.	1870.	1875.	ARTICLES.	1880.	1885.	ARTICLES.	1890.	1894.
IMPORTS:				IMPORTS:			IMPORTS:		
Writing-paper........	$259,353	$132,480	$27,170	Paper, and mfrs. of.	$1,671,120	$1,592,892	Paper, and mfrs. of.	$2,816,860	$2,628,351
EXPORTS: (Dom.)				EXPORTS: (Dom.)			EXPORTS: (Dom.)		
Paper and stationery..	[1] 460,268	514,592	740,258	Writing-paper and envelopes	[2] 1,189,498	77,418	Writing-paper and envelopes	125,041	84,305
Writing-paper........	568	981	646	Stationery, except paper	....	395,123	Stationery, except paper	490,673	683,278
				All others	....	793,037	All others..........	1,002,144	1,713,929

[1] Includes paper and manufactures of paper.

[2] Includes stationery, except paper.

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CHAPTER XCIX

OTHER INDUSTRIES

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ALUMINUM

THE aluminum industry in the United States has become of considerable importance, and though still young, it promises to be one of the greatest of American industries. The American manufacture has grown from practically nothing in 1884, until now the value of the annual output amounts to $450,000, one third of the total supply of the world coming from the United States. The manufacture of pure aluminum in this country for industrial purposes was begun by the Pittsburg Reduction Company at Pittsburg in 1888, under what are known as the Hall patents (an electrical process). Three years previous to this the Cowles Company, located at Lockport, N. Y., made aluminum alloys, but the Pittsburg Reduction Company is now the sole American producer. Its founders were Charles M. Hall, inventor of the electrolytic process, Alfred E. Hunt, now president of the company, and George H. Clapp, at present secretary. In 1891 the company's plant was moved to New Kingston, Westmoreland County, Pa., where its works cover ten acres of ground. Within the past year the company has opened works at Niagara Falls, being the first manufacturing plant to receive electric power from the falls. In 1884 the price of aluminum was $16 per pound. The first metal produced by the Pittsburg Reduction Company in 1888 was sold for $8 per pound. In a short time the price was reduced to $4, then to $2; but aluminum is now sold by the Pittsburg Reduction Company in large quantities at prices as low as thirty-five cents a pound. The metal is now able to compete with copper and brass in price, when the relative specific gravities of the two metals are taken into consideration, the specific gravity of aluminum being 2.56, brass about 8.21, and copper 8.93. It is thus seen that from the beginning of the production of aluminum by electricity in the United States, ten years ago, the metal has steadily forged to the front, as one of the most important in the useful arts. The greatest single achievement in the use of aluminum to date was in the use of the metal in the construction of the yacht *Defender*, the American champion in the great international yacht-race for the *America's* cup, off the New Jersey coast, in 1895. The *Defender's* plates above the water-line, her deck-beams, and all of her fittings were entirely of aluminum. By thus using this substance on her topsides, deck-beams, and fittings, the *Defender* was given great lightness above the water-line, and more weight could be put in her keel, which greatly added to her stiffness. Within the next few years it is believed that several American yachts will be constructed wholly or in part of aluminum, and that the metal will also enter into the construction of large ships. Several aluminum torpedo-boats have been constructed abroad during the past year for foreign navies.

One of the most beneficial results of the use of aluminum is to give the country a substitute for wood for many articles. Owing to its lightness it has been substituted for wood in parts of machinery where no other metal has heretofore been found practicable. In marine work, particularly, aluminum, it is said, will replace ordinary timber, as well as other metals, in upper works, rigging, and fitting. There seems to be no limit to the number of uses to which it may be put, owing to its great strength and lightness; and, though the youngest of the metals in practical application, it is apparently destined to be one of the greatest and most useful.

TYPE-SETTING MACHINES

TYPE-SETTING MACHINES have now been in use in the United States more or less since 1850, and have been known through patents since 1840. The first one of the kind, however, which was actually at work for any length of time was the Mitchell, which was employed in New York from 1855 till 1867 or 1868. It dropped types on belts of different lengths, so that the characters standing furthest from the operator reached the line as soon as those nearest. One dozen of these were all that were made, and they were used in only one office. About 1870 the Burr machine came into use, followed by the Thorne and the McMillan. All are constructed with keyboards like a type-writer, and touching a key displaces a type from the end of a line stored much higher than the keyboard. It drops into grooves which are so contrived that the letter cannot turn around while falling, all the grooves converging toward a common center. When the character reaches this place it is stopped in its fall and gently moved forward against the preceding letters by means of a flutter-arm or beater. After sufficient letters have been dropped to complete a line it is spaced and justified by hand. After being used the characters are separated and returned to their grooves by a distributing-machine. A set of these machines requires the labor of about two men and a half, and it is able to perform the work of from four to eight compositors. Another type of machine, entirely distinct from this, is one in which the molds or matrices for the characters are assembled, spaced, and justified, a cast of the line then being made. It requires no thought for the spacing or justification, these operations being automatically performed; nor does it need to distribute, as, when the lines have once been used, they are thrown into the melting-pot. This machine was invented by Ottmar Mergenthaler as early as 1876, but experimenting continued until 1886, minor changes having since been made. In the year just mentioned machines were put into the offices of the Louisville "Courier-Journal" and the New York "Tribune." Until about 1891, however, the expenditures of the company were much greater than the income, and the projectors were frequently in financial straits. The machine has been adopted in nearly all the larger daily newspaper offices of the United States, and in many of those of the second and third rank, between 2000 and 3000 now being employed. This machine does work equivalent to that of four or five men. Factories have been built in Brooklyn, Baltimore, Montreal, and Manchester, England. The capital invested in the company is about $5,000,000, and its annual out-turn at present is about $3,000,000. This machine is a marvel of ingenuity, as are several of the machines which handle movable types. The most largely used of the latter is the Thorne, with an output of about $300,000 a year. Recent notable advances in popular favor must be credited to the Empire machine, which is now being introduced into the office of the New York "Evening Sun." The McMillan machine has been found adaptable for book composition, and is in use at the De Vinne Press. An invention which casts individual types as well as sets them, is known as the Lanston Monotype Machine, and is now in operation in the composing room of the "Philadelphia Inquirer." Immense sums of money have been lost in the invention and exploitation of these machines. It is understood that $600,000 has been sunk in the Paige, probably the most ingenious and complicated machine ever invented by man; while the Mergenthaler is said to have lost $1,300,000 before it reached the paying point. Perhaps 1200 persons are employed in the manufacture of all that at present are for sale.

ATHLETIC AND SPORTING GOODS

ATHLETIC goods are a product chiefly of the last thirty years. Gymnasiums existed before that time, having been begun as early as 1850; and dumb-bells and a few other articles were made in small quantities previous to that year by a few manufacturers, being sold to the general trade as hardware, books, stationery, and toys are now sold. Guns and gun implements, of course, are not included in this statement. Peck & Snyder, of New York, began dealing in base-ball goods in 1865. That game had become common in 1855, but was then always played by boys; and cricket was really introduced into this country by an English team about 1856, although the game had then been played by an

English club in New York for several years. In 1858 there was no special ball employed in base-ball, and no regulation style of club. Other lines of goods were added by Peck & Snyder to their toys, games, and miscellaneous articles. They were the first to inaugurate what might be called the special sporting-goods business. The A. J. Reach Company, of Philadelphia, began business in the same way in base-ball goods about 1867, and Wright & Ditson in Boston in 1871. A. G. Spalding & Brother took up the same line of trade in Chicago in 1876, confining themselves exclusively to sporting-goods, base-ball requirements being the chief part, for that sport at the time was the only one which commanded any very great attention. In 1878 they began at Hastings, Mich., the manufacture, especially for their trade, of base-ball bats, Indian clubs, fishing-rods, and all athletic goods in which wood predominates. This factory burned down, and the goods were subsequently made in Chicago. They have since added several factories in other parts of the country. A number of other houses have embarked in the manufacture of this class of goods, which includes bicycles, the equipment for fishermen, hunters, and canoeists, with their special garments, and everything necessary for games. The total amount of business transacted in the United States, excluding guns and bicycles, is between $3,000,000 and $4,000,000 a year, the number of hands being about 5000, and the amount of capital employed exceeding $3,000,000.

AWNINGS, TENTS, AND SAILS

In the dry and sunny climate of the Orient there is not the imperative necessity for a house which is found in England and the United States. There are particular advantages in a tent in Arabia, the Holy Land, or the Great Desert of Africa, which render it, on the whole, more desirable than a solidly built edifice. One chief advantage is in the ease with which migration can be effected. At night a traveler is in one place; to-morrow he may be fifty miles distant. Tents are chiefly used in Europe and the United States as shelters for soldiers, although the first hunters in this country, following the Indians, made partial use of them. But since 1860 many people who have good houses with every comfort desert them in the summer-time, and pitch their tents on the edges of lakes and streams or upon the mountains. The Adirondacks are filled with them in the summer-time, and they are in great abundance on the shores of the minor lakes of New York, Wisconsin, and Minnesota. Awnings became common here first in the South, and have moved farther North only within forty years. Originally they were introduced into Europe by the way of Spain, when the Mohammedans penetrated that country. Sails also are of great antiquity. The adventurous mariners who left Phenicia and went to the far-distant coast of Britain to obtain tin undoubtedly employed sails on their vessels; and to this day, great as is the number of steam-vessels, they bear no comparison with those which depend upon wind as a motive power. Sails are chiefly made of duck or canvas, as are tents; awnings can be made of a lighter and less substantial cloth. The places of manufacture for all of these are on the seaboard, but none of them are large. Duck manufacturing is carried on in New England. The total value of the product in the last census year was $7,829,003, and the number of establishments was 581.

PRINTING-PRESSES

Printing-presses were not manufactured in the United States before 1795. When needed they were constructed by an ordinary carpenter and joiner. At about that time, Adam Ramage, a native of Scotland, began making wooden hand-presses in Philadelphia, continuing the business through the whole of a long life. A great improvement was made in England in 1802, by which the whole of the apparatus was made of iron instead of wood, as had been the custom previously; and this was imitated in America in 1818, John J. Wells then devising a new iron hand-press. He was followed by Rust, Turney, and others. Peter Smith, a brother-in-law of Robert Hoe, invented another one about 1822, and induced Hoe to embark with him in its manufacture. It proved successful, and Hoe afterward bought out the press of his principal competitor, Rust, which after a time drove out all competitors, then being known as the Washington press. It is still in use, but as the patents have long since expired it is now made by several firms. Both the metal press and the wooden press were, however, very slow, and in 1821 and 1822, Daniel Treadwell, an ingenious Yankee, devised a machine that did twice as much work as the hand-press. This was burned up in a fire which consumed his printing-office in Boston, and he invented another type of machine, which was in successful use in the Bible House in New York in 1828 and 1829. Two mechanics named Tufts and Adams made improvements upon it which led to its being superseded. The Tufts did not continue in use for more than fifteen years, but the Adams, which was largely sold, is not yet entirely laid aside. The great success, however, which had been attained by the machine invented by König in London in the year 1814 led to the importation of an improved form of it for use in New York about 1827. Within two years Hoe was engaged in the manufacture of machines similar to it, which in 1830 were employed in several offices. They were what was known as the Napier press. By 1836 a double cylinder was in use, invented by Colonel Richard M. Hoe, who had succeeded his father. In 1847 he succeeded in producing a rotary press, in which the types were fastened upon a revolving cylinder, each turn of the machine producing four sheets. A little later, Applegarth, an English engineer, produced a machine somewhat similar in idea, but not so well contrived; and this, after twenty years of use, was finally superseded in England by Hoe's machine. The four-cylinder not proving fast enough, six, eight, and ten cylinder presses were made, the latter being of immense size. Up to about 1853 Hoe had really no competitors in his own line of presses except A. B. Taylor, of New York, who had once been a foreman in his establishment and had begun for himself about 1840; and they, with Adams, of Boston, controlled all the press building in the United States for many years. Between 1850 and 1860 appeared, however, a number of persons who contested the market with Hoe and disputed his theories of construction. Each began the building of machines. The successors to them are the Potter, Campbell, Babcock, and Cottrell companies, whose machines have been excellently made and are very popular. At about the same time small presses came into use, although they had been made to some extent for twenty years before. The earliest successful makers in numbers were Ruggles and Gordon; Degener followed during the Civil War; and later came the universal press, now made by Gally and Thomson, but by the latter under another name. A multitude of changes have taken place since 1850. Ink is better distributed, the castings are truer and the jar less, and the extensive introduction of woodcuts has necessitated the employment of workmen of higher skill, who in turn have demanded better presses. It was once the custom to print everything on wet paper, but now almost everything is printed on dry. Just before the beginning of the war, paper stereotyping was introduced, which enabled two or three presses to be employed at the same time upon the same pages of a newspaper. More presses were bought by each establishment, so that they might be available for contingencies. By the use of paper stereotyping, also, smaller cylinders could be employed, and the whole size of the machine could be lessened. Bullock succeeded in making a press in which he availed himself of these advantages and of the use of a roll of paper to feed the press, no hand-feeding being required. This was elaborated still further in England, and reintroduced into America with modifications by R. Hoe & Company about twenty years ago. Printing thus became much cheaper, and a great impetus was given to the manufacture of presses. Instead of a newspaper having only one press, as was the case with the New York "Sun" in 1850, and requiring eight hours to print its edition on one side, newspapers of 50,000 circulation now have half a dozen presses, capable of printing 50,000 copies in half an hour. Other press builders also make these machines, notably Scott and Potter; and, in fact, nearly all the builders pay attention to all lines, except job presses. There are about thirty builders in the United States, Chicago and New York being the chief centers of sale. The figures for this industry are not separated by the census, but the production is about $6,000,000, and the number of men employed about 3000.

UNDERTAKERS' FURNISHINGS

The undertaker's business is now a very much easier one than fifty years ago. Everything he requires he can obtain ready-made. In 1847 there were about twenty coffin warehouses in New York, but they manufactured little else. In small towns throughout the country it was the habit to make the coffin after the decease of the person for whom it was required, this being a regular part of the cabinet-maker's work; and nearly every body was buried in a shroud. In Europe carpenters still make coffins. About 1850 it was seen that as every coffin required a lining, and as there were other fittings needed besides the wooden part, there might be a future for a house in this line dealing chiefly in trimmings and dry-goods. William Fernbacher entered upon the manufacture of robes and linings, and Adolph Tuska, who kept upholstery goods and cabinet-makers' supplies, imported some German-silver plated trunk-handles, which were used for coffins. This trade in handles rapidly increased in its proportions, finally falling into the possession of J. M. Shanahan, who is still in business. The dry-goods part of the trade in New York is in the hands of five firms, who manufacture nothing but the goods required by undertakers. They also import from Europe. These firms are Arnstaedt, Shanahan, Baxter, Tiedman, and Frank & Lambert. The capital now invested is $1,000,000; twenty-five years ago it was $250,000. There are about 75 manufacturers of handles and plates in the country, and 200 manufacturers of coffins and caskets. Approximately, there are about a dozen manufacturers of embalming fluids and implements, half a dozen firms making hearses, and as many making coffin trimmings, such as fringes, cords, and tassels. There are also outside boxes of metal and slate, as well as hinges and springs. Taken altogether, the goods annually manufactured for funerals in the United States are worth $20,000,000. Of this $8,000,000 worth are in dry-goods. If we add to this sum the coffins made in remote districts, the profits and the work of the undertakers, and the hire of horses and carriages, the burial of the dead cannot cost less than $100,000,000 a year. There are over 5000 funerals a day in the United States.

PHOTOGRAPHIC MATERIALS

Photography was discovered by Daguerre at Paris in 1839, and three years later the art was introduced in America. The Scovill Manufacturing Company, which was established at Waterbury, Conn., in 1802, is the pioneer manufacturer of American photographic goods, for in 1842 they made the metal plates for the daguerreotype process. As photography became popular, the department of the Scovill Manufacturing Company devoted to this branch became the Scovill & Adams Company, which has since become one of the largest manufacturers of photographic goods in the world. One of the other founders of American photography was Edward Anthony, who soon after the introduction of daguerreotypes established at New York City the first factory in America devoted exclusively to the manufacture of photographic goods. In 1852 H. T. Anthony became connected with the business, and the firm became E. & H. T. Anthony. Both of the founders are now dead.

The discovery of collodion in 1851 made photography easier and greatly increased the manufacture of photographic supplies. The next notable advance was the commercial production of gelatine dry plates in 1880. Though the use of collodion was an improvement over the daguerreotype process, it had many drawbacks until the advent of dry plates made photography possible among amateurs as well as professionals. John Carbutt, of Philadelphia, is considered the founder of the dry-plate process in America. After dry plates, the most important event in photographic annals was the development of photo-engraving, especially the half-tone process, which, though discovered in Germany, was never successful until improved upon in the United States. An important introduction which may be classed as distinctively American was the substitution of a sensitive paper for albumin-paper. No albumin-paper is made in America, and certain tariff changes increased the price, which resulted in the manufacture of several papers which are now considered superior to albumin. With the introduction of dry plates came amateur photographers in amazing numbers, and it is through the needs of amateurs that some of the best inventions in photographic apparatus have been made.

The manufacture of photographic supplies has grown tremendously within the last few years, and unique apparatus which have produced pictures with wonderful accuracy have been invented. In photographic inventions and in improvements the United States is now far in the lead, and its cameras, lenses, etc., are even exported to the very countries where photography originated. American photographic supplies are now known the world over, and it is estimated that there are at present $10,000,000 of capital invested in the industry, to satisfy the home and foreign demand. There were only $250,000 of capital invested twenty-five years ago, and only $25,000 fifty years ago. One of the old firms to engage in manufacturing photographic apparatus was the American Optical Company, which started in New York in 1858, and subsequently moved to New Haven, where it now turns out a fine grade of cameras, lenses, etc. In late years a number of factories have opened in Rochester, N. Y., devoted mainly to amateur photographic goods. These factories have patented apparatus, and a new style of plate known as the film variety, in which the gelatine is spread on celluloid instead of glass, as in the common dry plates. The pioneer in this line is the Eastman Kodak Company, of Rochester, whose kodak cameras have gained a wide reputation.

UMBRELLAS

The growth of the umbrella industry has been rapid in the United States during the past thirty years. Authorities in the trade agree that the manufacture was commenced here about 1800, at Philadelphia, Pa., by E. J. Pierce, W. A. Drown, and Edmund Wright. It did not progress very rapidly until about 1865. Prior to that date the materials

Albert Clark Stevens.

used in the manufacture were mostly cotton and alpaca. But five years earlier, or about 1860, American manufacturers began to use silk. Previous to that time all or nearly all silk umbrellas used in this country were imported from Europe. At the present time the estimated total amount of capital invested is placed at $3,000,000, as compared with $1,000,000 twenty-five years ago, and $250,000 fifty years ago. The approximate total number of umbrellas manufactured in the United States aggregates 9,000,000 per annum. Among the well-known manufacturers of umbrellas in the United States may be mentioned the following: Follmer, Clogg & Company; Ellis, Knapp & Company; the Excelsior Umbrella Manufacturing Company; and Charles Le Bihan & Company, of New York. In many respects umbrellas manufactured in this country excel those of any other, but particularly as regards finish, neatness, and close roll.

GLUE

Glue is made from the trimmings of hides, bones, and sinews. It can be justly said that Peter Cooper was the founder of the glue industry in the United States, when, in 1827, he established works in Brooklyn, and from this business laid the foundation of his immense fortune. Though the West is now the center of glue manufacture, Peter Cooper's Brooklyn works have grown and are still in active operation, turning out the finer grades of this product. From this beginning in Brooklyn in 1827, and the establishment of another works in Philadelphia by Charles Baeder and William Adamson about the same time, American glue manufacture has progressed until now it is estimated that there are over $10,000,000 of capital invested in the industry, and the yearly sales amount to some $15,000,000. This is more than double the money invested twenty-five years ago, and ten times what it was fifty years ago. Glue is required in all sorts of woodwork, in the manufacture of clothing, in stiffening straw hats, and in a thousand and one industries where a gelatinous material is essential. The greatest quantity of glue is used in what is called the sizing trade. Paper is glazed with it, and oil and turpentine barrels are lined with it.

As the tendency of the times is for manufacturing plants to locate where cheap raw materials abound, so glue makers have opened plants at the chief cattle markets. Of late years the enormous packing-houses of Armour & Company and Swift & Company, of Chicago, and the Cudahy Packing Company, of Omaha, have built big glue plants of their own, thus utilizing the by-products of their own abattoirs. These cities have now become the great glue centers. The glue factories of the East draw their supplies largely from imported hides and from the bone refuse of the big cities. When the Australian rabbit-pest slaughter was at its height quantities of rabbit hides were imported to this country and boiled into glue. Many of the glue factories in the Eastern States are engaged in the manufacture of sand and emery paper as well, which industry is a large one and consumes much glue. Glue is best produced in a dry climate, and consequently the United States is favorable for glue making; though a dry climate is not absolutely necessary, as England, which is noted for its moist weather, has successfully engaged in glue making for years. American glue manufacturers no longer fear their English rivals, however, as considerable American glue is exported to the British Isles and to the world at large, the exportation amounting to about $500,000 annually. France is the only country which now makes a finer grade of glue than can be produced in the United States. The French have a process of their own of turning out the finest glues and gelatines from bones. They are imported and used in America mainly for straw hats. In the United States the finest glues are made from the sinews of cattle, and several factories are now experimenting to produce a glue equal to the best grades of France. In this the trade believe they will ultimately be successful. Among the distinctively American achievements in glue manufacture are methods for artificial drying, by which it is made much more quickly and cheaply. Another improvement is in manufacturing all the year around. It was formerly the custom to close in the summer-time, but now some of the American works have such improved methods that they can run the entire year without annoyance to the surrounding community. As Mr. Armour, of Armour & Company, expresses it, "I make my own weather." There are at the present time about 100 glue factories in the United States, all located north of Mason and Dixon's line.

ELEVATORS

The business of manufacturing elevators in the United States has grown remarkably during the past quarter of a century, as a result of the erection of tall office buildings and other structures in which the machines are used as a convenience. The capital invested has increased from $20,000 in 1850 and $3,000,000 in 1875 to $15,000,000 in 1895.

The output in the United States in money value would, no doubt, amount to $20,000,000 per annum. The manufacture of freight-elevators was commenced in this country as far back as 1849, but it was not until 1859 that the manufacture of passenger-elevators was begun. In the latter year Otis Tufts and Henry Waterman started in the business at Boston, Mass. The business founded by them is now continued by the McAdams & Cartwright Elevator Company, who, with Otis Brothers & Company, the Reedy Elevator Company, the Crane Elevator Company, the Whittier Elevator Company, and Morse, Williams & Company, comprise the more important manufacturers in the United States. Although it is true the United States cannot claim the discovery of any of the broad principles on which either steam, hydraulic, or electric elevators are constructed, it can nevertheless be claimed that the machines have reached a higher stage of perfection in this country than in any other.

HATS

Hat making is one of the most peculiar of all industries, as it is probably the only one in which the maker takes the crude raw material and turns out the completely finished product. In this respect the manufacture of hats has not changed even with the introduction of labor-saving machinery and the general specialization of all branches of industry. The old-time hatter flourished in communities that bought many hats. Wherever there was a city or town, there were hatters to cap and hat the male population. The hatter formerly cut the fur from a felt, felted it, and after making the hat would wait upon the customer as well. The modern hatter has a factory where all this is done by skilled workmen and machinery, and the hats are now turned out by the thousands daily. Some of the first places in America to make hats and start shops were the towns of Danbury, Bethel, and Norwalk, Conn. The records speak of hat making in Danbury as early as 1734. Great hat factories have since been built in these towns, and they form to-day one of the leading hat centers in the United States. Among the other towns that early established hat factories was Albany, N. Y., where Benjamin F. Noahr started one in 1829. A few years later, Andrew Rankin and William Rankin opened shops in Newark, N. J., which city is now one of the important hat centers of the country. The business has grown from the time of these first days in hat making, until there is now estimated to be $30,000,000 capital engaged in the manufacture of all kinds of hats in the United States. We now furnish almost all of our own hats, do some exporting in felt hats to the South American countries, and send straw hats all over the world. There are also $250,000 of certain grades of hats imported annually. The material for making the various kinds of American headgear is nearly all imported. Beaver fur was the main material sixty years ago for fine hats, and at that time America could supply her own fur; but beaver hats have since become silk hats, only retaining the shape somewhat of the old beaver hats, but made with silk plush. This plush comes almost entirely from France, and all attempts to produce it in America have as yet been unavailing. Beaver nowadays is too expensive a fur for hats, and besides it is not considered as desirable as the imported silk plush.

Charles Knox was one of the early specialists in beaver and silk hats in New York City, and his son, E. M. Knox, now has one of the largest hat factories in the world, at Brooklyn, where all kinds of the finest silk and felt hats are manufactured. Robert Dunlap, of New York, has also an eminent name in the hat trade. Nine tenths of the felt hats worn in the United States are made from the fur of the rabbit and the hare. Other furs used are those of the nutria, the muskrat, the otter, the racoon, and the beaver. The rabbit and hare felts are entirely of foreign importation. Much wool is also used in the cheaper grades of felt hats and in the cloth of cloth hats. Felt is the principal material for the great bulk of the hats made in America. Cloth as a hat material has become much in vogue in recent years, owing to the great demand for all sorts of outing and uniform caps and bicycle caps for all seasons of the year. The styles of hats worn in the United States have changed with the freaks of fashion during the past one hundred years. After the three-cornered hat of the Revolutionary period came the regulation beaver, which held sway for many years, and finds its modern descendant in the silk hat. During the middle of the century the white cassimere high hat became popular and had a long run, but it is now out of style. When the Hungarian patriot Kossuth visited America he wore a soft hat trimmed with a black ostrich feather, and the soft hat then became fashionable in America, though never worn with the feather. The soft hat has always been a favorite in the Southern and Western States. Stiff hats, an English fashion, have been more or less in style for some time. A Tyrolean hat that was brought to this country by some American traveler has since been modified and has become the United States army campaign hat. While no style of felt hat has originated in the United States that can be called distinctively American, many of the European shapes have been greatly improved upon and have become so common here as to be considered of American design. In cloth hats a number of new designs have originated in the United States. The finest soft hats are now manufactured in the United States, and are becoming more popular everywhere.

BILLIARD TABLES

THE origin of the game of billiards is lost in antiquity. Some historians believe that the game dates back as far as the time of Cleopatra and Marc Antony, while others state that it originated with the French and Norman-French. Billiards in America came into vogue with some of the early colonists, and at the time of the American Revolution was a popular pastime with many of the noted Americans of the period. George Washington, Alexander Hamilton, Thomas Jefferson, and other patriots enjoyed the game, and Washington and Hamilton had billiard-tables of their own. While Lafayette was in America he played billiards as one of his favorite pastimes, and introduced many French characteristics of the game, which have resulted since in the American game being modeled more after the French than the English. Several inventions have been made in billiard materials during the present century which have greatly improved the game. One is the leather-tip cue, invented by a Frenchman named Mingaud while in prison in 1823, and the same year the cues were imported to the United States. Another improvement was the use of india-rubber cushions for the tables, which originated in England in 1835. In 1854, Michael Phelan, of New York, produced a new style of india-rubber cushion, which with some slight improvements is the cushion in general use to-day. Mr. Phelan's cushion had a sharp edge, while the old-style cushions were round. The first billiard-tables produced in America were made in part of cabinet work, and turned out only as some man of means would order them. About the first tables manufactured as a distinct business were made by Tobias O'Connor and Hugh W. Collender, who formed a partnership in New York in 1850. In 1854 Michael Phelan became interested in the firm, and the title was then changed to Phelan & Collender. Mr. Phelan died in 1871, and Mr. Collender carried on the business under his own name until 1879, when he organized the H. W. Collender Company. With the growing popularity of billiards and the valuable patents held by this company its business rapidly increased, and in order to still further expand, the H. W. Collender Company in 1884 united with the J. M. Brunswick & Balke Company, of Chicago, and the firm has since been the Brunswick-Balke-Collender Company, with factories in New York, Chicago, Cincinnati, St. Louis, and San Francisco, and branch stores in all the principal cities in the United States, and also in Europe and Canada. Of these founders of the billiard-table industry in the United States, Michael Phelan, Hugh W. Collender, J. M. Brunswick, and Julius Balke, all are dead.

The United States now leads other nations of the world in the design and workmanship of its billiard-tables and accessories. American tables are in demand wherever the game of billiards is played, which leads American manufacturers to believe that they will before long supply the world's markets. But while our tables lead, billiard-table cloth used on the tables comes entirely from abroad. The ivory for the balls is, of course, imported. Some of the woods for the tables are imported, but the complete table is manufactured entirely in the United States. There are now $2,000,000 of capital invested in the billiard-table industry. To show the wonders of ivory in its native state the Brunswick-Balke-Collender Company have a fine collection of ivory tusks at their New York salesrooms. There are elephant tusks on exhibition over eight feet long and weighing over 100 pounds each, and also ponderous tusks of mammoths from Mozambique. The finished billiard-balls of ivory have to be carried in a dry room for five to ten years before being fit for use. Nothing has yet been found equal to ivory for billiard balls. The demand for billiard-tables, cues, balls, etc., has increased largely during the past few years with the growing popularity of the game in families.

PIPES AND SMOKERS' ARTICLES

THE manufacture of the more expensive pipes and most other smokers' articles began about 1860. Previous to that time they were imported; but the ordinary clay pipe has been in use for seventy years, if not more. The earliest manufacturer whose name is now recorded was Thomas Smith, tobacco-pipe maker, of the city of New York, in 1847. The high tariff during the war stimulated manufacturing. This was commenced on the smallest possible scale by two or three enterprising German workmen, now dead, with hardly any machinery or experience. The goods could not be compared with the European product, and they were almost as expensive, even with the high tariff paid on the imported articles. Trade itself previous to the war was very small. Edward Hen, who before 1860 was almost the only importer of note, was known as the pipe man of the United States. His pipe business was less than $50,000 per year. William Demuth, a pupil of the celebrated Edward Hen, began the making of pipes in 1861. The prices of goods before and during the war were twice as high as they are now, and American goods in many instances were not up to the standard of European goods. But now the pipe industry in the United States is not only equal to that at the celebrated factories in Vienna, Ruhla, and St. Claude, but surpasses the latter in many respects. Many improvements and inventions were made in America, which were later introduced into Europe; but it was years before Europeans utilized them, thus giving great help to the American industry, as it afforded still more time to improve, and, with the tariff protection during these years, gave ultimately a still better chance to compete.

The capital then invested could not have been over $150,000, but that now used in this business is over $2,000,000, fully seventy-five per cent. of this amount being invested in domestic manufactures and their products. The sales of smokers' articles will not fall short of $3,000,000. At the prices that were paid thirty to forty years ago this would have represented a value of at least $6,000,000. Machinery, study, enterprise, and protection have enabled the manufacturers here from year to year to reduce the cost of production.

STRAW HATS

The first straw hats produced in the United States were of the palm-leaf variety, the material of which was imported from the West Indies and braided in this country, about 1800. Mountain leghorn hats were next worn, made from imported Italian material, and they, in time, became fashionable. Maracaybo hats and Panama hats were next manufactured of imported material, and at one time were highly prized, good Panama hats bringing as high as $120 apiece. By 1840 straw braids brought from Italy were shaped into hats, and the production of straw hats received an impetus in which it has hardly slackened since. Straw braids are now imported from Italy, China, and Japan. The straw-hat factories, through wise tariff laws, have had a very rapid growth. They sprang up so fast that it is difficult to tell who were the founders. The first manufacturers of straw goods in America made millinery goods, and from this took up the manufacture of hats. One of the earliest was J. D. T. Hersey, who had a factory at Monson, Mass. Another was Flagg & Baldwin, at Milford, Conn., which has now become Vanderhoef & Company, with several factories; and another was William Knowlton & Sons, who have a large straw-hat factory at Upton, Mass. Other places leading to-day in the manufacture of straw hats are Brooklyn, N. Y., Newark, N. J., and Amherst, Westboro, and Foxboro, Mass. The American straw-hat industry was never so prosperous as to-day, and no other country equals the United States either in quality or in cheapness of straw hats. America sends straw hats to every civilized country in the world.

CELLULOID

Celluloid has been known since about 1869, having been brought out shortly before by Messrs. John W. Hyatt and I. S. Hyatt, the latter of whom is now dead. It is a compound of guncotton and camphor, which has a high luster, admitting of an excellent finish, and can be used for almost everything for which ivory and horn are employed. Business was begun in Albany in a small way, the inventors characterizing the new product by the name of celluloid. They patented their discoveries and formed the Celluloid Manufacturing Company. Running short of capital, they interested some New York parties with them, among the more prominent of whom were General Marshall Lefferts, Tracy R. Edson,—both of whom are now dead,—Joseph Larocque, and Joseph M. Cook. The business was moved to Newark, N. J., in 1870. The first few years were spent in experimenting and in perfecting the processes, and as soon as this had been accomplished a large business resulted, which has shown constant growth ever since. The original policy of the company was to confine itself to the manufacture of crude material only, and to sell it to sub-companies formed for the purpose of manufacturing special lines of goods under a license from the parent company.

About 1880 a competing company sprang up, which resulted in long and expensive litigation involving the patents owned by the Celluloid Manufacturing Company, the decisions finally being rendered in favor of the latter company. As a result, in 1890, a consolidation of the different interests was brought about by the formation of the Celluloid Company, which purchased the plants and other properties of not only the companies competing in the manufacture of the material, but also of the principal sub-companies. The actual amount of capital invested at that time probably did not exceed $25,000. As the business grew more capital was invested from time to time, until now the company is capitalized at $6,000,000, employing about 1500 hands directly in its manufacture, besides selling the raw material in the form of sheets, rods, etc., to a large number of manufacturers throughout the country, who probably employ some 4000 or 5000 hands in working it up into goods. It is impossible to state the annual out-turn of the goods, owing to the fact that it is scattered among so many manufacturers; but it runs into a number of millions of dollars per annum.

BROOMS AND BRUSHES

"A NEW broom sweeps clean" is a saying which experience has proved true; but the old adage could never have been fully appreciated until the production of American broom-corn brooms. Europeans use to this day a broom made from hickory withes for rough sweeping, and the long-haired brush for housework, and it was not until 1850 that Americans discovered the valuable properties of a variety of the indigenous Indian maize for broom making. An unknown farmer who used a tuft of corn for a brush was, tradition tells us, the unconscious inventor of corn brooms. The first factory established for the manufacture of brooms from corn was in 1859, by Ebenezer Howard, at Fort Hunter, Montgomery County, N. Y. Before that time the industry was carried on in a desultory way. Mr. Howard subsequently took his son in partnership, and the firm became E. Howard & Son, continuing in business for forty years, when it became a part of the American Broom and Brush Company, in November, 1894. Other broom factories were soon started in Fort Hunter by John D. Blood, who formed the firm of Blood & Herrick, and also by Ebenezer Howard, who formed another firm, Howard & Bronson. All of the broom factories established at Fort Hunter have since become absorbed by the American Broom and Brush Company, and are all in operation to-day, with the improved machinery which has come with time. Another old-time factory which was acquired by this company was that of Myers & Parker, at Fultonville, N. Y. Of the pioneers in broom making at Fort Hunter all are dead except Mr. Herrick, who has retired from business and lives at Amsterdam, N. Y. The broom and whisk-broom industry is now carried on in the Eastern States almost entirely by the American Broom and Brush Company, which, besides the factories named, also have works at Buffalo, N. Y., Dallas, Pa., Baltimore, Md., and Richmond, Va. The business in the Western States is in the hands of the Cupples Woodenware Company, of St. Louis, and Roseboom & Company, of Chicago. All of the brooms are now turned out by machinery which is entirely of American invention, and which enables the manufacturers to produce 3,000,000 dozen brooms annually, supplying the home market and exporting $250,000 worth as well. There are now $2,500,000 invested in the industry, while twenty-five years ago there were only $100,000, and fifty years ago none whatever.

Many brooms are made by hand in various penitentiaries throughout the country. There are also many brooms made in blind asylums, as the work is found especially adapted to blind men. The United States is particularly fortunate in having so much territory adapted to the cultivation of broom-corn, which requires a certain quality of soil and climate. The only place where broom-corn has been cultivated to any degree of success outside of the United States is on a narrow strip of land in Upper Italy, but the corn is of an inferior quality. In this country broom-corn flourishes in Kansas, the southern part of Nebraska, a strip of land in Oklahoma, one portion of Illinois, and a narrow strip of land in Tennessee. A little broom-corn was once raised in New York State, but this has given way to other crops.

BUTTONS

BUTTONS are among the small things of daily use the importance of which as industrial factors is out of all proportion to their size. It is now estimated that there are from $8,000,000 to $9,000,000 worth of buttons made in the United States every year, and that there are from $4,000,000 to $5,000,000 invested in the industry. The manufacture of metal buttons was the first branch tried in America, and dates back to 1802, when Abel Porter & Company opened a shop at Waterbury, Conn. The firm has since become, through the successive management of Leavenworth, Hayden, and Scovill, the Scovill Manufacturing Company, and is now a large corporation, manufacturing brass goods and making buttons as well. The second American button factory was established at Waterbury by Aaron

Benedict in 1812, for the manufacture of bone and ivory buttons. In 1823 Mr. Benedict became associated with Bennett Bronson, and they took up the manufacture of gilt buttons also. At this time there was no sheet-brass rolled in America, so the firm erected a brass-rolling mill to supply their button business. In 1849 the button industry was put by itself, and has since become the Waterbury Button Company, the largest firm engaged exclusively in the manufacture of metal, cloth, and ivory buttons in the United States.

The founder of the cloth-covered button industry was Samuel Williston, of Easthampton, Mass., who, with his wife, in 1825, made the first set of cloth buttons ever produced in America. In 1830 Mr. Williston formed a partnership with Joel Hayden, and together they built a button factory at Haydenville, Mass., Mr. Hayden being the mechanic and Mr. Williston the proprietor. In a few years the business was moved to Easthampton, and has since become the Williston & Knight Company. In 1859, A. Critchlow, an Englishman, began to make buttons from vegetable ivory at Leeds, Mass., and subsequently became connected with the Williston & Knight Company, which has continued making a great variety of cloth and ivory buttons ever since. All of the pioneers of the American button industry are now dead.

In the manufacture of pearl buttons, which are a most expensive kind, America has not done much until late years. The Newell Brothers Manufacturing Company, of Springfield, Mass., was one of the first firms to begin it. This company was established at Longmeadow, Mass., in 1848, by Nelson C. Newell, his brother, S. R. Newell, and D. Chandler. The firm has always made a great variety of buttons, including cloth-covered, vegetable-ivory, composition, india-rubber, and pearl buttons. Of the hard buttons, vegetable ivory is one of the principal materials, as it can be dyed any color and makes a hard, durable button. Composition buttons have come into use largely of late years, while cloth-covered and pearl buttons are always in demand for dress-wear.

Button making is an industry in which the cost of production is in large part labor, so that, with the high wages paid in America in the face of foreign competition, it has not reached the proportions of some other industries. Despite this it is estimated that ninety per cent. of the cloth buttons consumed in the United States are of domestic manufacture, and a like percentage of the brass buttons. This showing is made when all of the material of cloth-covered buttons—even the iron backs—is imported, and also the raw material of pearl and vegetable-ivory buttons. It is American machinery and a tariff duty that gives American manufacturers a chance to compete with the cheaper European labor. In brass buttons a vast number of styles and designs have been produced in this country, one firm alone making 5000 varieties of army, navy, railroad, and other uniform buttons. The styles of cloth buttons are mainly taken from France and England and improved upon here. The Eleventh Census reported 106 establishments engaged in making buttons, and turning out an annual product valued at $4,216,795.

OPTICAL GOODS

UNTIL thirty-five years ago America depended on Europe for its eye-glasses and spectacles. Now the United States furnishes its own optical goods and sends some to the rest of the world as well. The first American manufacturer of eye-glasses is said to have been a New-Englander named Salsbury, who ground lenses in a small way at Salsbury, Conn. He was followed by the firm of Brown & Kirby, of New Haven, Conn., in 1850, and then the manufacture was taken up and developed by J. E. Spencer, who established works in the same city. Other optical works have since been built throughout the country, until there are now about $4,000,000 of capital invested in the business, with an annual output equal to this amount. That the industry should have grown to such proportions is natural enough when the number of people wearing spectacles is considered. It is common practice nowadays to have one's eyes examined. Twenty-five years ago there was but one noted oculist in New York City, Dr. C. R. Agnew; to-day there are hundreds. The fine print of newspapers, the custom of reading while on moving trains, and the glaring lights of modern times tend to the benefit of the oculist and the optician.

The mode of making eye-glasses has entirely changed with the requirements of the times. Properly fitting lenses are now ground from an oculist's prescription. In fact, it is seldom now that eye-glasses are made in any other way. This is one of the improvements that has come with American manufacture, for before the home supply, importations were made of assorted lenses, but accurate adjustment to the eyes was not possible as it is to-day. To further illustrate how the industry has advanced it is interesting to note that thirty years ago the Spencer optical people made but one style of nose-piece; to-day they make over 700. French and German goods are the only competitors now with American eye-glasses and spectacles, and even then in but a very moderate degree. In the department of lenses for telescopes and microscopes the United States now manufactures its own. The firm of Bausch & Lomb, of Rochester, N. Y., are noted for microscopes, and Alvan Clark, of Cambridgeport, Mass., is famed for the grinding of mammoth telescope lenses. Opera-glasses still come from across the water, mainly from France.

MATHEMATICAL AND ENGINEERING INSTRUMENTS

As the American optical industry has grown and expanded in the last twenty-five years, so has it been in the manufacture of surveying and mathematical instruments in the United States. The industry first sprang into existence through repairs, and then in making instruments to order, and finally the regular instrument factory came, until it is now estimated that there are over $5,000,000 capital invested in the industry. One of the first to make American instruments was the firm of William Stackpole & Brother, who opened a shop in New York some thirty years ago, and have made all kinds of surveying, navigation, and drawing instruments ever since. Other shops were opened in Boston and Washington, and gradually some of the instrument importers started factories of their own. One of these firms is the Keuffel & Esser Company, of New York, which has built a large factory at Hoboken, N. J., and has salesrooms in nearly all the larger cities of the country. America now manufactures all of its own instruments, and sends many to foreign lands.

SURGICAL INSTRUMENTS

SURGICAL-INSTRUMENT manufacture in America began, so far as learned, in 1826, when George Tiemann, a German, commenced to grind, repair, and make instruments in New York City. Prior to that time all surgical appliances were imported from England and France. Germany is the greatest competitor of the United States in this direction to-day. The industry in the United States has flourished solely on its merits, for skilled labor enters so largely into the cost of surgical instruments that this country has not been able to hold its own with the cheap grade of instruments of foreign makers. It is to quality, not quantity, that American surgical-instrument makers have turned their attention, and in firmness, lightness, and durability of their wares they have no equals. American surgeons are noted as practical men with original ideas who have invented and have required of the instrument makers a great variety of surgical appliances. There are many new designs being brought out continually, and, with constant changes required and keen foreign competition in cheaper but inferior lines of goods, surgical-instrument making has not become a large industry here. The pioneer of the business in this country, Mr. Tiemann, established the firm of George Tiemann & Company, which has been in successful operation for sixty-nine years. Among other large American manufacturers of surgical instruments are Shepard & Dudley, of Brooklyn; John Reynders & Company, of New York; and F. G. Otto & Sons, of Jersey City. Another old-time New York maker is W. F. Ford. A number of American firms have gone out of business of late years, being unable to withstand the cheap goods of foreign manufacturers. Quantities of instruments are now imported from Germany, but for high-grade surgical instruments American surgeons turn to American manufacturers.

SCALES AND BALANCES

THE weighing-scales, which to-day form one of the most useful adjuncts in almost every commercial house, public market-place, and town square in the land, are the product of American genius alone. The first platform-scales ever made were invented and patented by Thaddeus Fairbanks, of St. Johnsbury, Vt., in 1831. Before that time transactions by weight were confined to the even balance and the Roman steelyard. Mr. Fairbanks was associated with his two brothers in a small business in which quantities of hemp were handled. Finding the method of weighing by the steelyard slow and laborious, he conceived the application of the principle upon which modern weighing-machines are made, and from this beginning sprung the use of platform-scales in all parts of the world. The manufacture of these scales was then commenced by E. & T. Fairbanks & Company, who have made them ever since and have introduced them in all parts of the world. At an early date the Fairbanks patents were sold in England, and most foreign platform-scales are made from the earliest patterns manufactured in the United States. Before the introduction of these improved weighing-machines, comparatively few articles were sold by weight, and those only of such a nature that to count or measure them was very difficult, while at present nearly every class of merchandise is sold by weight. This revolution in commercial usage has not been confined to the United States, but has taken place in almost every country of the world; and the Fairbanks scales have in many instances been the pioneer articles of American make to be introduced into foreign countries. In recognition of these services, Thaddeus Fairbanks was knighted and decorated by the Emperor of Austria and other foreign sovereigns.

Among the other pioneers in the scale business was Mr. John Chatillon, who began business in New York in 1835. Mr. Chatillon's business has been confined almost entirely to the making of spring-balances. The industry he built up is still conducted by his sons on a part of the original site of the factory. The manufacturers of scales in the United States successfully compete with foreign makers in the markets of the world. Weighing-machines produced here are the recognized standards of foreign countries. They include every known variety, from the delicate mechanism of the laboratory to determine the weight of infinitesimal objects, to the ponderous levers arranged to weigh a loaded train of cars or a canal-boat with its cargo. There are now $2,500,000 capital invested in the manufacture of scales in the United States, and the annual production, according to the last census report, was about an equal amount.

PENS

It has been declared that each man, woman, and child in the United States uses, on the average, four pens a year. The same authorities also say that three of these four pens are of American make. Some idea of the growth of the pen industry may be obtained, therefore, when it is known that thirty years ago nearly all the pens consumed in this country were of foreign manufacture. The first pens made in the United States were those turned out by a small factory established in New York in 1858 by Harrison & Bradford. At that time America possessed neither the men nor the material for making pens, and both had to be brought from abroad. In 1860, Richard Esterbrook, his son Richard, and James Bromgrove founded a pen factory at Camden, N. J. The business was a success from the start, and in 1866 the firm was incorporated as the Esterbrook Steel-Pen Company.

Steel from which pens can be made has not yet been produced in this country. Manufacturers are unable to say whether the trouble lies in the handling of the steel or in the material itself. The steel must possess a fineness and toughness that has thus far been found in the products of England and Sweden only. Pens, therefore, can be made in England more cheaply than in the United States; but in foreign countries, where a greater amount must necessarily be charged for the American article, the latter finds a ready market, despite the fact that it must be classed as a fancy article. Twenty-five years ago not more than $10,000 were invested in the pen industry, while to-day the combined capital of American manufacturers is more than $1,000,000. Besides the Esterbrook Company, prominent pen manufacturers in the United States are Miller Brothers, Meriden, Conn.; Turner & Harrison and Malpass & Company, Philadelphia; and the Eagle Pencil Company, New York.

PLAYING-CARDS

The origin of playing-cards is shrouded in mystery, and of their manufacture in the United States we have few records prior to 1832. Though history tells us that Columbus carried them with him on his voyage of discovery in 1492, certain sections of the American colonies prohibited the entrance of cards into the country. The Quakers of Pennsylvania were shocked at them, and the Puritans of New England called them "devil's books." But in other parts of the country playing-cards have found favor as simple instruments of amusement, and nowadays they are generally used. In July, 1832, Lewis I. Cohen, of New York, entered into the business of card making, and started the concern which is now known as the New York Consolidated Card Company. Mr. Cohen made the first pack of cards himself, which is still preserved at the company's works in New York. For a long time the Consolidated Company was the principal card producer in the United States, its only competitors being a few small manufacturers.

Another old-time card maker was Andrew Dougherty, of New York, who is still in the business. In 1879 the Russell & Morgan Company was started at Cincinnati, and in 1889 the National Company at Indianapolis, for the manufacture of playing-cards. The Russell & Morgan factory was in 1893 reorganized under the title of the United States Playing-Card Company, which is now the largest producer in the United States, and with the Consolidated Card Company manufactures nine tenths of the total American card output. This now amounts to 25,000,000 packs of cards annually.

Playing-cards are at present nearly all made with enameled paper by improved machinery, and printed by rapid-working presses. The United States exports cards to nearly every country in the world, besides supplying the entire home demand. It is calculated that there is not now over $700 worth of cards imported into this country a year, while the only countries to which America does not send cards are those in which the government controls the business, as in France and Italy. The United States Playing-Card Company has even established an office in London. There is at present an internal revenue tax of two cents on each pack of cards used in the United States. The capital invested in the industry is $5,000,000.

TOYS

DURING the first half of the present century young America's toy supply came entirely from across the water. Germany, which is even to-day the great toy country of the world, supplied the larger part, and Japan also a share. About 1850, however, several toy-shops started in a small way in the United States, and, as in nearly all the industries, Yankee ingenuity has since put this country in the front rank of toy makers. One of the first to devote his attention to the business was John McLaughlin, who with his brother established the firm of McLaughlin Brothers, in 1855, at New York, makers of children's picture-books and games, which are considered a part of the toy business. Another pioneer was Milton Bradley, now treasurer of the Milton Bradley Company, at Springfield, Mass., makers of games and kindergarten supplies. Both firms are successfully carrying on the toy business to-day. America, being a forest country, soon began producing wooden toys of grades which could be turned out by machinery. In the manufacture of these wooden toys the United States had an advantage, as Europe had but little wood and worked mostly by hand, while America had an abundance of wood and her inventors were always perfecting machines to do the work. Then, also, wooden toys were bulky to import. But the principal advantage of the American wooden-toy manufacturers was in the wonderful woodworking machinery, certain patented forms of which even the Germans have found it necessary to buy in order to keep abreast of their American rivals. All the wooden toys used by young America which can be produced by machine-work are now of domestic manufacture, and large quantities are also sent all over the world. The wooden-toy factories are in no particular section of the country, but are found in nearly all of the wood-bearing States.

A branch of toy making which may be classified as distinctively American is that of iron toys. Messrs. J. & E. Stevens, of Cromwell, Conn., were among the first to take up this branch. Iron toys are now made into an amazing variety of forms, and many of the designs have been copied by foreign manufacturers. The making of musical toys is another part of the business which has become prominent in the United States. Schoenhut & Company, of Philadelphia, make nearly all the musical instruments in miniature sizes, even including toy pianos. Mechanical toys, with their clockwork and fascinating movements, have likewise flourished in the United States, but there is not a great demand for this class at present. Toy tools are another of America's chief productions. The toy business is of such a nature that it is continually changing, both in respect to the goods and the firms engaged in it. Novelties and fresh inventions drive out old styles very speedily, and unless a manufacturer keeps well up with the times he will be out of the race. The growth of the toy industry has led to the establishment of several toy emporiums in New York City and elsewhere. Among the oldest toy merchants in New York are the Hinrichs Company and Robert Foulds. The returns of the last census place the number of establishments in the United States engaged in the manufacture of toys and games at 139, employing 3440 hands, and turning out an annual product valued at $3,749,755.

YACHTS—SAILING AND STEAM

THE small speedy vessels which the Dutch called yachts were familiar in the waters around Manhattan Island before they were known in England. But yachts in the modern meaning of the word have been evolved during the last half-century. In no other country are there so many yachts and yachtsmen as in America. There are more than 200 yacht clubs scattered throughout the country, having about 4000 yachts. But of these vessels only about 700 are above 40 feet in length, and only a little over half of these are propelled by steam. The New York Yacht Club, the oldest in the United States, having been organized in 1844, has a membership of over 1000, but there are only about 140 steam yachts and launches on its list. Thus the small sailing yacht is the normal type of American pleasure craft. There are two distinct kinds of yacht, whether propelled by sail or steam—the racing yacht, in which comfort is sacrificed for speed, and the commodious, well-proportioned cruiser yacht; but even in the latter every modern discovery tending to increased speed is incorporated.

Popular interest in yachts may be dated from the victory of the yacht *America* in the international contest around the Isle of Wight in 1851. She represented certain American ideas in the shape of her hull and the fit of her sail, which were immediately copied in England. From that day to this the history of sailing yachts has been a steady improvement in speed through the efforts of such yachtsmen as James Gordon Bennett, General Charles T. Paine, C. O. Iselin, J. Pierpont Morgan, and William K. Vanderbilt, and such designers as the late Edward Burgess, A. Cary Smith, J. Beaver Webb, formerly of England but now of America, and Nat G. Herreshoff. The last-named designer was the author of both the latest international cup-racers, *Vigilant* and *Defender*. The same designers have won golden opinions for their work in the field of steam-yachting, as have also Gustav Hillmann, Lewis Nixon, C. D. Mosher, and Charles M. Seabury; and American yards can now turn out steel steam-yachts equal to the best made in England.

BOATS, CANOES, AND SHELLS

Though America is the home of the famous birch-bark canoe, the modern sailing canoe was developed almost entirely from English and Canadian models. The birch-bark canoe is still used on some of the inland waters, but it has been largely superseded by the modern wooden type, which was introduced in the United States from England about 1863. The first canoes built in this country, following those of Indian manufacture, were constructed by individual boat builders. Among the early canoe builders was James Everson, who began to build them from English models at Greenpoint, N. Y., in 1869. Another was Davis, an Englishman, who built fine canoes at Ithaca, N. Y., in 1871. From these and other early canoe builders regular companies have been formed to build canoes and skiffs. One of the large and successful corporations is the St. Lawrence River Skiff, Canoe, and Steam-Launch Company, founded by Charles G. Emery, John D. Little, and J. G. Fraser, in 1887, at Clayton, Jefferson County, N. Y. Another large builder is J. H. Rushton, of Canton, N. Y.; and among the celebrated builders of sailing canoes for racing are Captain G. W. Ruggles, of Charlotte (Rochester), N. Y., and Stevens, of Lowell, Mass. In the building of row-boats and small sail-boats the United States turns out as fine models as any nation, but no records are obtainable of the early history of the industry. The boat-construction industry is so widely scattered throughout the country that no figures can be given of its annual output, but it must be very large.

One class of boats in which the United States takes undisputed precedence is in the construction of naphtha-launches, first patented in the United States. The Gas-Engine and Power Company, of Morris Heights, New York City, has the American rights for the naphtha-engine, and in 1885 Jabez A. Bostwick, Clement Gould, and John J. Amory established this industry on the Harlem River, New York City. At the World's Fair in Chicago in 1893 the General Electric-Launch Company, of New York, had fifty electric launches running in the waters of the lagoons, and the spectacle was one of the features of the fair. The American electric launches are probably destined to have as brilliant a future as the naphtha-launch has had.

The manufacture of racing shells has rather disappeared as an industry of itself in the United States; the demand is limited and the most of those constructed are made to order by boat builders who are also shell experts.

PINS

Pins were made in Rhode Island during the Revolution by Jeremiah Wilkinson, the heads being made by twisting fine wires firmly at one end. Samuel Slocum at about the same time commenced in Providence in the same line. In 1824 a machine for making solid-headed pins was invented by Lemuel W. Wright, of New Hampshire, which was soon after introduced into England, patents also being granted there. It was, however, crude compared with those of later construction, and did not complete all the operations of pin making. In 1831 the first machine for making perfect solid-headed pins like those now in use was invented by John Ireland Howe, a physician of Bellevue Hospital, New York City, and in the next year a company was started in that city. Six years later the business was removed to Derby, Conn., where it is still carried on. Associated with Dr. Howe was Mr. Fowler, of Seymour, Conn., who was the inventor of several machines for sticking pins on paper. In 1835 another company was formed by Dr. Howe, which continued its operations under his charge till 1865, many improvements being made. Samuel Slocum, an ingenious Connecticut man, also invented a pin-sticking machine, which was used in Howe's factory in 1841, and was improved in 1843, he and Mr. Slocum becoming joint owners of the two patents. The United States takes the lead in the production of superior machines for use in the manufacture of pins. The number of pins made daily is probably about 30,000,000, or nearly 10,000,000,000 per annum—enough to allow 150 pins per year to each man, woman, and child in the United States. The chief place of manufacture is Connecticut.

COOPERAGE

If Africa is the hunter's paradise, America is certainly the joy of the cooper, for no other country has possessed such boundless forests of oak, from which the bulk of the barrels are made, and no other nation has produced such ingenious cooperage machinery. The quantity of timber cut up every year in the United States for barrels, casks, and staves has been such a steady drain on American forests that barrel manufacturers are beginning to apprehend a scarcity of oak and are buying up large tracts of forest land to prepare for the future. The Canadian forests are already depleted of oak, and so are those of some of the Western States, the main supply now coming from the South. The scarcity of timber, however, has not yet made an impression on the barrel market, for barrels and casks of all kinds are as low in price as they have ever been, and the number of barrels manufactured for home and foreign needs is as enormous as ever. Barrel making in the United States is supposed to have begun with the early settlement of the country. Everything was at first done by hand, while now all are made by machinery. One of the first machine barrel manufacturers in the United States was Anson T. Briggs, of New York, who manufactured flour-barrels in quantities along in 1860. Staves were turned out by machinery as early as 1855, but the first manufacturer to use machinery for cooperage was George S. Salter, of Baltimore, in 1869. He was followed a year later by Lowel M. Palmer, of Brooklyn, who is now president of the Brooklyn Cooperage Company, and who began making barrels in 1865.

The introduction of machinery in cooperage met with headstrong opposition from the coopers, and Mr. Palmer had a strike at his works, which lasted for four months before the men could be convinced that they could earn more money by the use of machinery than with the old hand methods. This was proved by Mr. Palmer, who for one year from the time of the introduction of the machinery gave the coopers in his employment fifty cents more a day than they had previously. The Brooklyn Cooperage Company now turns out 35,000 barrels of all kinds a day in its factories at Brooklyn, Jersey City, Boston, New Orleans, and San Francisco; while other manufacturers also produce enormous quantities. The staves are sawed out at the timber-mills and shipped to the cooper-shops in this country if the barrels are for domestic use, while quantities of staves are also shipped to foreign countries to be made up into barrels. No material has been found equal to oak for casks, while for sugar and flour barrels elm is employed. The barrel has always been a popular means for transporting produce and merchandise in America, and its handiness is also appreciated abroad, so that the production is now valued at $38,617,956 annually, which supplies the United States and a large part of the rest of the world with barrels, casks, and staves. The number of establishments is 2652; the number of employees, 24,652; the amount paid out for wages each year, $11,665,366; and the cost of materials used, $20,636,911.

LAMPS

When the Pilgrims landed they had no other lights than those which were afforded by candles and whale-oil. The former required candlesticks, and the latter, lamps. A temporary lamp was made by filling a dish with oil, while on it floated a piece of wood through which passed a wick. Torches and temporary lights were afforded by pine knots. Both candlesticks and lamps were occasionally made in ornamental forms, but the light was always poor. Even theaters could be lighted in no better way than by candles. No radical improvement was shown in the construction of lamps until 1784, when Aimé Argand, a Frenchman, conceived the idea of a circular wick and a double wick-tube, thus obtaining a round flame. Air was admitted both inside and outside, thus insuring a more perfect combustion. Around this wick he placed a glass-chimney. But these lamps were used only in the houses of the rich, and tallow candles remained the ordinary illuminant for all others. In the first quarter of the nineteenth century, at which time whale-oil was very cheap, moderate-priced oil lamps came into use. They were composed of a closed reservoir for holding the oil, and two small, round tubes through which the wicks were passed. On the sides of these tubes were two small slots through which the wicks could be picked up.

In 1845 the camphene or burning-fluid lamp became prominent. These were two different kinds of oil obtained from turpentine and alcohol, but giving a much brighter light than candles. The lamp in which these oils were burned was also much cleaner and neater. This lamp had two round wick-tubes, to which two small caps were attached, to be placed over the tops when the lamp was not in use, in order to prevent the evaporation of the camphene, which went on very rapidly if measures were not adopted to prevent it. About 1856, when petroleum was discovered in Pennsylvania, lamps were made for its use; but there was considerable smoke from them, and the oil had a very pungent odor. There were, consequently, but few lamps made especially adapted to this product; but as soon as the unpleasant odor had been eliminated to some extent and the price of oil became lower, kerosene lamps were introduced everywhere. Many, however, still continued to burn camphene in 1860 and 1861, and did not stop until the war, which, by preventing the receipt of turpentine from North Carolina, raised the price of camphene so high that people turned to petroleum. At that time an ordinary camphene lamp gave twice as much light as a tallow candle, and a kerosene lamp six times as much. Lamps for whale-oil were occasionally used till the same time, but this oil bore no comparison with the mineral product for cheapness, and was also driven out of the market. The light obtained from it was about equal to that from tallow candles.

Since 1862 there has practically been no other lamp used than the one just spoken of. It was fitted with a flat wick, and required a glass chimney, although from time to time since some lamps have been made without chimneys. Many patents have been granted for improved lamps, the most valuable of which have been for a central draft. Duplex burners were a great improvement, and Argand burners and chimneys were also used. The latter were employed in what are known as student lamps. The metal button or flame-spreader was also introduced, and it is still employed in central-draft lamps.

Mr. Leonard Henkel, of Rochester, N. Y., invented a few years ago what may be said to be a distinct improvement in the lamp. The contrivance consists of a small cap placed over the top of the central-draft tube, the sides of the latter being filled with holes, thus permitting the air to pass through the tube up to the flame.

These various improvements have resulted in lamps which are far superior in power and steadiness of light to those formerly known. If the power of an ordinary petroleum light is taken at six times that of a candle in 1858, the larger lights had increased to 20 candle-power in 1868. But the more recent improvements have raised this in ordinary parlor lamps to 60 or 80, and in hall and church lamps to 200 and beyond. They are also less troublesome and give a better kind of light. A large trade is carried on in them. In one city alone the manufacture is carried on to the extent of $400,000, and the value of the annual product of lamps and reflectors, as reported by the census of 1890, was $4,039,359.

LAMP CHIMNEYS

The idea of having a glass tube around the flaming wick of a lamp belongs to Aimé Argand, as has been said. It prevented cold air from directly impinging upon the flame at the sides, it greatly assisted the draft, and it acted as a shield against currents of air. Wherever Argand lamps were afterward used, a chimney was required, but none seems to have been made in this country till 1856, at Pittsburg. At about that time chimneys were required for coal-oil lamps, which smoked very much without them. With the increase in demand for them, other factories began, and new methods of making were introduced. Very few chimneys made in the first ten years of the beginning of the petroleum industry lasted any length of time, the unequal contraction and expansion made by cold and heat breaking them by dozens on the same lamp in one year. The later methods have much improved either the chimneys or the methods of lamp construction, so that each chimney lasts for a considerable time, and occasionally one may be found that has been employed for two or three years. In 1875 there were thirty-one concerns engaged in the manufacture of glass-chimneys, and while at the present time there are but twelve, the price of chimneys has been greatly reduced, and the number manufactured largely increased, the annual output being about 750,000 boxes. Pittsburg is the center of this industry.

BOX MAKING

Box making has now become a considerable industry, particularly in those cities largely engaged in distributing manufactured goods, such as New York and Chicago. In the early part of the century packing-boxes were made by carpenters as they were required, or by any persons possessed of a little mechanical skill. But with the development of the dry-goods industry it was found necessary to have them made regularly, in large numbers, and in the forms and shapes desired. This required special kinds of boards and construction, and it was found they could be more cheaply bought than made. It was about 1840 before there were many firms thus engaged, but the number has been increasing ever since. The introduction of machinery for sawing, assembling, and nailing the boxes has much increased the facility of manufacture, as mechanical gauges determine the length of each piece, and saws divide a dozen or twenty boards at once. The total amount of business done in this line is about $20,000,000 a year, New York and Chicago each producing about $3,000,000 worth of packing boxes. The capital required is about $4,000,000, and the number of hands employed is 8000 or 9000.

FIREARMS

THE rifle, originally invented in Leipsic in 1498, was first brought into general military use in America during the Revolutionary War. The riflemen in Kentucky, Tennessee, and the other wildernesses of the United States had long been accustomed to the use of this firearm, and so far as they could be procured, rifles were the arms of the American soldiers in that struggle. In 1813 G. H. Hall proposed a new idea. He suggested that the rifle be loaded at the breech, so that the ball and powder, united in one cartridge, might be inserted without delay, and the piece loaded and fired as rapidly as the muzzle-loading smooth-bore. Hall's idea did not attract much attention in the United States. The army, for the most part, was supplied with flint-locks, and it would have involved considerable expense to change them all over. He also proposed to manufacture the locks and other pieces of the guns by machinery, so as to make the parts of the different guns interchangeable. He was employed at the government armory at Harper's Ferry to introduce the latter idea and experiment with the former. In this he was successful, and the interchangeable system was soon introduced into all the armories of the United States. In 1827 100 of Hall's guns which had been sent to Springfield in 1824 were brought back to Harper's Ferry and placed with 100 guns of current make. The 200 were taken apart, the pieces thoroughly mingled, and the guns then remounted from pieces picked up at random. The whole 200 fitted perfectly. They attracted much attention abroad, and England afterward obtained machinery in the United States, so that she might introduce the system in her factory at Enfield. Prior to 1853 every gun made in England was manufactured by hand. The percussion-cap was proposed by Shaw, of Bordentown, in 1817, and was really an indispensable part of any improved system of firearms.

The principal weapon of a new type brought out a little before the Mexican War was a purely American invention, namely, the repeater. Samuel Colt, a seaman, while on a voyage to Calcutta, devised a six-barreled revolver to be used with percussion-caps. In 1835 he improved upon this and perfected a six-barrel rotating breech. Prior to this there were two common types of pistol: one the small pistol, suitable for use on a small object at thirty yards; and the other the large horse-pistol, which was almost equal to a gun. Patents were issued to Colt for his revolver, and the manufacture commenced in 1835 at Paterson, N. J. He later built a factory at Hartford, Conn., and turned out 60,000 weapons a year. The large sales brought many competitors into the field, including the manufacturers of the Allen, Derringer, Volcano, Pettinger, Whitney, Smith & Wesson, and Lowell. The pistol was very much employed during the war, and many are even yet sold. Hall's idea of a breech-loading rifle was never put into general use, but in 1852, Stark, of Philadelphia, invented a breech-loading rifle that met with great success. He built a factory at Bridgeport, Conn. The first of a new class of rifles to come into notice was the Spencer, the chief idea of which was applied to other American guns. This was a repeating rifle, but was almost too heavy to be successful. It was too great a burden for the men to bear in addition to their other accoutrements. The Remington, which has acquired great success, is produced at a factory at Ilion, N. Y., founded in 1825 by Eliphalet Remington. One great cause of the growth of the industry was the War of the Rebellion. The capital invested in 1840 did not exceed $200,000; in 1870 it was over $3,000,000, while at the present time it is about $10,000,000. The annual output of rifles is 1,000,000, and the same number each of shot-guns and revolvers. The United States takes precedence in the manufacture of sporting rifles, metallic ammunition, and revolvers.

FIRE EXTINGUISHERS

FIRE EXTINGUISHERS have now been regularly manufactured since 1867, but attempts were made years before that time to devise something which, on its receptacle being broken or the contents poured out, would prevent combustion. Those who were associated at its inception as a regular business were Dawson Miles (now dead), B. F. Jacobs, F. W. Farwell, and S. F. Hayward. The places where factories were earliest established were in Boston and Chicago. Small hand-extinguishers were first made, but now the size has so much increased that the production includes large engines drawn by horses. The total of manufacture is about $150,000.

GLOVES AND MITTENS

The glover's art is centuries old in Europe, but its beginnings in this country are almost or quite within the memory of men now living. Mittens were not unknown to the Indians, and the earliest settlers in the country made for themselves rude hand-covers from the skins of wild animals; but glove manufacture as an American industry is only about sixty years old. A Vermonter named Burr was among the earliest to establish it, at what is now the city of Gloversville, N. Y. Deer were plenty in the neighboring forests, and their skins were the chief material used. The early products were no doubt quite crude, but they sold and their sale was profitable.

For many years deerskin, usually called buckskin, was the only leather thought to be suitable for a driving or working glove. Sheepskin was used, but it was weak and pulpy. Two or three towns in New Hampshire attained a good reputation for buck gloves, and in later years factories have been established in various parts of the country, notably in Illinois, the Northwest, and California; but the chief seat of the industry is at Gloversville and Johnstown, Fulton County, N. Y.

Buckskin remains the preferred material for heavy gloves, and varies much, from the thick "jack" hide of the torrid zone to the thin, tough cuticle of the Rocky Mountain deer. Other leathers are approved. Sheepskin is now so dressed as to make it durable in all weathers, and the equine, bovine, and porcine hides are all valuable for hand-wear purposes of the rougher sort. Genuine dogskin is made up by a few firms, the stouter skins entering the above category, while the finer ones may do for street wear.

For the purpose last named many skins are utilized. Among them are the goat, kid, lamb, antelope, calf, colt, Egyptian sheep (mocha), and cabrita or South American kid. Chamois is sometimes used. The best castor gloves are made from antelope. Coltskin has a fine surface and wonderful durability. Mocha and cabrita resemble castor, having a velvety finish. The former has the grain-side outward, while the latter reverses that order. Goat, lamb, and kid are the staple leathers for street and dress purposes. Reindeer has been added in recent years, and makes a good street glove.

Kid and lamb skins dressed are extensively imported to be made up here; but these and all the other kinds are also brought in a raw state from all over the earth, to be made into glove-leather in the scores of tanneries in Fulton County, New York.

The manufacture of the finer classes of gloves—kid, castor, etc.—in the United States is hardly twenty years old, but within that time great progress has been made. In fact, the last five years have been a period of rapid growth. Formerly it was thought necessary to label domestic gloves with foreign brands, but it is not so now. The importations of gloves of European make are still large, owing to the excellent reputation of some lines and the extreme cheapness of others; but probably four fifths of all the leather gloves used in this country are of home manufacture.

Considerable development has taken place of late years in knit gloves of wool and silk. What are known as Scotch-wool gloves have become popular, and our manufacturers have shown much ability in matching the foreign product, excellent as it is, with creditable goods at low prices. Silk gloves of high merit are made here, and several new factories for this purpose have recently been started. The total value of the American glove manufacture is probably well above $10,000,000.

ENVELOPES

Envelopes were not in general use in any country prior to 1840, when, after the passage of the penny postage bill, they became common in England. Until about 1845 nearly all letters in this country were folded so that an unwritten portion came on the outside, and the address was placed there. By that time envelopes were well known, and by 1850 all letters were inclosed in them. The first maker of envelopes in New York was an Englishman named Dangerfield, who began about 1846; and by 1850 Alderton and several others were in the field. Only 2000 or 3000 could be made in a day, as machinery had not yet been employed. The blanks were cut out by chisels and pasted and folded by hand. Machines were invented in England in 1845 by Warren de la Rue and Edwin Hill, but these were never employed in America. Our machinery was invented here, but not until just before the outbreak of the Civil War. Many improvements have been made, and the speed is now so great that on some of the machines the output will reach 55,000 a day. It is supposed that the consumption of envelopes in this country is from 8,000,000 to 10,000,000 a day, or not far from 3,000,000,000 a year, of which 600,000,000 are stamped envelopes. The latter are all supplied by the Morgan Envelope Company, of Springfield, Mass., and the Plimpton Manufacturing Company, of Hartford, Conn. There are about thirty large firms engaged in the business, besides a number of smaller manufacturers. The principal towns thus employed are New York, Philadelphia, Hartford, Rockville, Holyoke, Worcester, and Springfield.

AMMUNITION

Ammunition may loosely be defined to be the articles which are required in firearms to render the mechanism effective. It includes shot, bullets, powder, cartridges, caps, and wads. The last are chiefly used by hunters, and are supplied by them from anything that is convenient, which is generally something of no particular value. They therefore do not enter into commerce. From the earliest period of settlement shot and bullets have been made by Americans. Lead was brought with them from England and Holland, and cast in molds, many of which are still preserved in old houses in New England, Pennsylvania, and Virginia. They differed only in size, so whether each projectile weighed an ounce or the twentieth of an ounce, the same plan was adopted. It will readily occur to any one that these molds left a seam where the two points joined together, and that the operation of casting must necessarily have been very slow. Shot-towers, therefore, were invented at an early date, and for the sizes required for shot-guns are still necessary. The metal, a compound of lead and arsenic, the latter forming one one hundredth, is melted at the top of a high tower and poured into a colander. The lead passes through in drops instead of streams, each assuming a perfectly spherical form, and falling into a basin of cold water, there being instantly chilled in the globular form. After this the shot are rolled down an inclined plane, those which are not truly spherical falling off at the sides, while the perfect ones continue in a direct course. The holes through which the liquid metal passes are from one thirtieth to one three hundred and sixtieth of an inch in diameter. Shot is much used for killing small game, which would be torn in pieces by a heavy bullet; and a shot-gun also requires less accurate marksmanship than a rifle. Bullets are still cast in molds, but in the factories this operation is performed with great celerity. The ridge caused by the meeting of the two parts is automatically removed by a knife. Swaging of bullets is also practised. The total quantity of shot made in New York annually is valued at $400,000, there being three shot-towers. Baltimore also makes shot. Early in the last century no method was commonly known of getting accurate results from a gun, but it was noticed that a bullet was nearly always flattened or smashed at the end nearest the powder. If the ball was large for the bore of the gun it reached its mark more certainly than if the bore was large. It was therefore the common practice for hunters to put a patch or wad around their bullet, which prevented the powder from falling out, and also kept the bullet straight till it had left the muzzle; and it was also discovered that if there were grooves inside the barrel which twisted more or less, a rotary motion was imparted to the bullet, which added much to its range and its power of reaching its aim. This constituted the rifle, and after its method of construction became generally known no other weapon was used for hunting large game. They were used to some degree in armies even fifty years ago. Gradually the smoothbore musket was driven out and soldiers were supplied alone with rifles. But another article was necessary before this could be completely accomplished. Until the second quarter of the century the fire which was required to be communicated to the powder came from a blow of the hammer of the gun upon a piece of flint. Frequently there was a miss. Percussion-caps were introduced about this time. They depended for their value upon the quality of igniting with a blow, their shape, like that of a cup, being only requisite in order to keep them on the nipple of the gun. They were much more certain in action than the flint had been, and soon drove it out everywhere. A later improvement in ammunition was by the introduction of cartridges, the powder and bullet being together. The metallic cartridge is an invention made in France about 1831 and introduced here shortly after. A great improvement was also made in France in 1845 in the shape of the bullet, which did not become known here till the time of the Crimean War. It was the Minié bullet, having for its peculiarity an elongation of the projectile. Hitherto all others had been round. The part which was foremost tapered to a point, but the rear was flat, as if the bullet had been cut from a round rod of lead. A heavier bullet was thus attained, a more thorough rotation was imparted, and little resistance was experienced from the air. The new projectile would carry twice the distance of the one it superseded, and would even at that point be more destructive. The total production of ammunition in the United States in the year 1890 was valued at $6,538,482; business was carried on in 35 establishments, which had 2267 workmen, paid $1,110,482 in wages, and used materials valued at $4,645,850.

COLLARS AND CUFFS

Detached collars and cuffs of plain linen or cotton are, like the shirt-bosom now in use, of modern development, if not strictly of recent origin. The men of the Revolution and the first presidency wore no visible collar, but only a voluminous white cravat, wound about the neck and tied in front, the soft ends mingling with the bosom-frill of the shirt. With the new century came the high collar and extension of the shirt. Much of it was hidden by the large neck-cloth or stock; but its fashion closely resembled the cut long known to the trade as the "bishop," the upper edge rising gradually toward the front and terminating abruptly at the sides of the chin, the corners forming a slightly acute angle. This style was not uncommon thirty years ago, and a few old gentlemen still wear it. Sometimes the upper edge was turned over the cravat. Lord Byron wore his high collar in that negligée manner, and when the turned-down article was introduced as a fashion it was named after the poet, and was so designated for many years.

The plain, deep wristband, or cuff, as it is now called, came into being later than the collar. Long after the linen band had been adopted for the neck gentlemen wore lace at the wrists; but the advent of the steam-engine seems to have banished all such marks of effeminacy from the apparel of men. The deep wristband was, like the collar, an extension of the shirt, and, in further resemblance, it was sometimes turned up out of the way.

Just when the first detached collars and cuffs were made and offered for sale may not be ascertainable, but it could not have been far from a half-century ago. No doubt they were considered to be a cheap shift to avoid changing one's shirt when its exposed portions became soiled—a vulgar expedient, not in keeping with true gentility. Dickies, or false shirt-bosoms, were also used for the same reason. However that may be, they found a market; but their manufacture was small until after the invention of the sewing-machine. With the perfection of that instrument collar and cuff making on a large scale became possible and profitable.

The collar industry was started in a modest way at Troy, N. Y., by one or two men. Their success incited emulation, and several other firms entered the field. Some of the concerns now prominent in the business date back to quite near the beginning. The convenience of detachable pieces of linen was so easily apparent that the demand for them outran even the rapidly increased production. This, however, continued to enlarge, until it seemed that the limit of consumption must have been fully reached. Competition gave birth to many new fashions, and there have been several periods which might be called freakish and fantastic; but reaction to less radical forms invariably supervened.

Some English collars had long been imported, and about twelve years ago German collars were introduced. Both classes have their admirers, but there seems to be room enough for all. With occasional pauses, the development of the domestic manufacture has proceeded with great strides. Singularly enough, the business is almost confined to the city of Troy, where it started. Several of the twenty-odd firms engaged in it there have very large establishments, employ many hundred persons, and maintain warerooms in a half-dozen cities. There is no trust or combination, but the freest competition. Many grades, from fine linen to all cotton, are produced, and the workmanship in all classes has been brought to a high degree of excellence. Good wages are paid, and the industry as a whole is a fine illustration of American skill, integrity, and persistent enterprise. The value of the annual production of collars and cuffs at Troy exceeds $5,000,000, and there are one or two thriving concerns at Glens Falls, N. Y. Paper collars and cuffs, which were at one time very greatly used, now turn out an annual product valued at only $301,093, while in 1880 the production was valued at $1,582,571. Celluloid, at one time also employed, is now little used. The total production of linen collars and cuffs is not given separately in the last census report.

PRECIOUS STONES AND GEMS

The mineral wealth of the United States so far as the so-called precious stones are concerned is only at the threshold of its development. Discoveries embracing almost the entire list of gems have been made in this country from time to time, but with few exceptions the production up to the present year has been simply incidental to other mining operations. Among the few precious stones for which regular mines are worked the turquoise probably stands at the head in point of commercial importance, the American turquoise selling readily in the market both here and abroad. Mines in the Southwest which have been worked for some time have yielded nearly $200,000 worth of these stones in a single year. Tourmaline is another mineral which is found in sufficient crystalline purity and excellence of color to warrant its being mined systematically, although in a small way. The most important mine for this gem is in Maine, and a single crystal from these workings has brought as much as $1000. The diamond has never been found in sufficient quantity in this country to give it commercial importance, although crystals of more or less value have been discovered in Wisconsin, North Carolina, California, and Michigan. In North Carolina many important discoveries of precious stones have been made, and emeralds have been found in some quantity in Mitchell County, while certain other sections of the State are being very carefully searched, with more or less successful result, by expert miners and mineralogists. Important discoveries of rubies have also been made in this same State in Macon County, and valuable workings in the not distant future are highly probable. The sapphire has been found in Montana, of a very pure blue color, and both there and in one or two of the adjacent States crystals have been found of sufficient fineness and variety of color to cut into gems inferior only to the Oriental rubies, sapphires, and topaz. The beryl, from which the gem called aquamarine is cut, has also been found in this country to some extent. The most valuable discoveries of this crystal have been in Maine, where not only the green and blue varieties of the aquamarine have been obtained, but also the golden beryl and the clear white, both of which cut into gems of great brilliancy. Beryl has also been found in Connecticut and North Carolina. Amethystine quartz, false topaz, and cairngorm-stone are also found in considerable quantities, and garnets of more or less value may be added to the list. Opals of fine quality have been mined to some extent in Idaho. Besides these many minerals that might be classed as precious are brought to light from time to time. What the total annual production of precious stones in this country has been for the last few years is impossible to say. Specimen hunters, enthusiastic mineral collectors, and professional prospectors annually gather thousands of dollars' worth, which find their way into cabinets all over the country. In the commercial phase of the matter both producers and dealers show a marked disinclination to give figures. The report of the census of 1890 gives the total production of precious stones in the country during the ten years preceding as $851,238, which is probably far below the true amount. The United States Geological Survey gives the figures for the year 1893 as $264,041, which shows that even in that year of financial depression a marked increase took place over the average annual production of the preceding decade.

BAGS AND BAGGING

Bags, as a separate industry, have not been made for more than half a century. Originally they were put together by hand, one piece of cloth making the sides and another the bottom, if the bag was to contain much, or simply by sewing the length of the side and then across the bottom, if it was not to be of large capacity compared with its height. Various contrivances were made for the mouth. An immense number, however, are needed throughout the country, and as soon as the sewing-machine was perfected factories were fitted up to prepare them faster than had theretofore been possible. Later the bags were woven, both bottom and sides being completed, but the top hemmed by hand. The first large factory where this was done was the Stark Mills, at Manchester, N. H. Since that time many other firms and companies have engaged in this business, and it has extended to the West. There are six large manufacturers in New York, who at times turn out 100,000 bushel-bags a day, and small bags for salt and other substances amounting to twice that number. The importations from Europe average 10,000 bags daily. There are a large number made by small dealers owning a single machine, and many are made by the families of farmers residing in the vicinity of great cities. The burlaps for making bags are imported in large quantities. One of the curious subdivisions of this industry is a bag-loaning company. Shippers of goods from this country can borrow as many bags as they like, paying for the use a certain specified sum, and returning them after they are emptied. The number of establishments engaged in bag making in the United States is 64; the number of employees is 3769; the wages paid are $1,462,011; the cost of materials is $12,657,270, and the value of products is $16,355,365, very nearly twice the amount in 1880.

Bagging, which is a very important article in the South, where it is employed as a covering for cotton-bales, is also used more or less in many other industries. The number of firms employed in its manufacture is 16; the number of hands is 3149; the wages paid are $905,213; the cost of materials used—flax, hemp, and jute—is $2,520,995; and the total out-turn is valued at $3,852,440.

Paper bags have now become very common. They are used in a thousand industries, from heavy packages like those of flour to light and graceful forms utilized in the dry-goods trade. In 1890 there were 56 paper-bag factories, employing 1382 hands, paying out $580,092 in wages, using materials valued at $3,167,717, which produced goods worth $5,023,-793. The bags are made either wholly or partially by machinery. In the latter instance the cost for apparatus is a great deal less, and the labor of children and women is utilized to complete the work of the machines. Every sheet is of exactly the size needed, so there is no waste, and the pasting is done mechanically.

PAVING MATERIALS

Until a hundred or a hundred and fifty years after the first American colonies were settled there were few paved streets in our cities. Stone Street, in New York, was thus called because it was the first thoroughfare which had a pavement. This was about two hundred years ago, and the stones were probably cobbles. When the Revolution came, most of the streets in our cities were muddy from side to side in winter, including the footpaths, and in summer were mountains of dust. The first paving material largely employed in our towns was brick, which is still considerably used in Philadelphia and some other cities. This was only needed for sidewalks. The center of the street was macadamized or Telforded as long ago as sixty or eighty years, and smooth flagstones were employed in sidewalks even before that period. As time passed plank roads were laid down in many localities throughout the United States, and at one time it seemed as if all good country roads would be constructed of wood. They were much in vogue between 1840 and 1860, but have almost disappeared since. Central Park, of New York, probably furnished the first instance of the use of an asphalt roadway on a large scale. This has since been much employed, but in this climate it sometimes becomes hard in winter and cracks, and in summer becomes soft. Blocks of wood, end up, and blocks of stone, have been employed largely during the last thirty years, and have proved valuable. In Western cities artificial stone has been much used for sidewalks, being made of a beauty and evenness not found in any other material. Chicago has many miles of these sidewalks. By the last census paving and paving materials were handled by 704 firms, employing 22,730 men, and paying $10,450,970 in wages. The cost of materials used was $11,030,-916, and the total output was valued at $30,644,072.

TRUNKS AND VALISES

In few industries have there been greater changes than in this occupation. Every taste may now be suited. Modern materials have been added, and frames are made of both metal and wood. In 1795 few trunks or valises were needed, as there was little traveling. The business of manufacture was then generally conducted by those who were saddlery and harness makers. In the "Business Directory" of New York in 1841 eleven names appear as trunk makers, one or two of them still being remembered. Later improvements in machinery and traveling now diminished the cost of some portions of the work materially, but not enough, on the whole, to lessen the prices of goods generally. There are five large manufactories having their offices in New York and their shops either here or near by, whose sales amount to $2,000,000 a year. In the United States there were 395 firms engaged in the manufacture of trunks and valises in 1890. They employed 6785 men, paid out $3,513,749 in wages, used $4,703,-982 in the purchase of materials, and produced goods valued at $10,821,621.

LEAD-PENCILS

Lead-pencil manufacture in the United States did not begin until 1860, but there is now estimated to be $4,000,000 capital invested in the industry, and American lead-pencils are sold all over the world. This country is particularly adapted to the production of lead-pencils, for it has rich graphite mines, and extraordinary facilities, also, for obtaining this substance from elsewhere; it also has the only great forests of cedar in the world, from which the stock of the pencil is made, and even sends quantities of cedar to foreign pencil makers. Above all, it has had numbers of ingenious mechanics to originate labor-saving machinery. Germany is the pioneer country in lead-pencil manufacture, and from that nation came many of the founders of the industry in the United States. Among the first in this country were Eberhard Faber, Joseph Reckendorfer,—both of whom are dead,—and Henry Baulzheimer, who returned to Europe after opening a factory here. New York City and vicinity have always been the seat of lead-pencil manufacture in this country, and among the prominent manufacturing firms now located there are the American Lead-Pencil Company, the Eagle Pencil Company, and the works and office of Eberhard Faber; while just across the Hudson River, in Jersey City, is the big plant of the Joseph Dixon Crucible Company, with its office and salesroom in New York. The Dixon Company was founded by Joseph Dixon at Salem, Mass., as early as 1826, and moved to Jersey City in 1840, but the company did not begin to make lead-pencils until 1872. It is the pioneer graphite company in the United States, if not in the world. The plumbago crucibles (which are identical with graphite) were invented by Joseph Dixon. Graphite now enters largely into every department of the mechanical arts. The American output of pencils is calculated to be 5000 gross per day. American lead-pencils now supply nearly all the home demand and are sold everywhere. Many novelties in pencils have originated in the United States.

ARTIFICIAL FEATHERS AND FLOWERS

Artificial feathers and flowers have long been made in the United States. It is probable that the industry was brought here by French immigrants, who had fled from their own country. The number of French people here was soon increased by those who had come hither from the island of Hayti. It was necessary that these strangers should live, and one of the first industries they took up was artificial flower making. We had at that time few green-houses, and those which existed contributed very little to the daily supply of the citizens. But artificial flowers are permanent, lasting a year or two if required; and they serve as cheap decorations for ladies' hats and bonnets. For the same purpose feathers were used, and it became the custom to unite the two industries in the same shop. As long ago as 1840 there were ten manufacturers in this line in New York, T. Chagot apparently being the chief. He was an importer as well as a manufacturer, his place being at 24 Maiden Lane. The others were nearly all in William Street. In 1847 the number had increased to twenty-four. No separate enumeration of these products appears in the early census returns, but the quantity demanded increased greatly. Within the past few years a great change has taken place: the flowers are of a much finer quality than formerly. The importations have, usually speaking, been of a higher grade in flowers than are made here; but this is now changed, except for a few very expensive kinds, and America ranks with the world. Feathers are used on ladies' hats and bonnets, as trimming on ladies' dresses, and as boas and collars. New York is the principal seat of the industry. The amount of goods produced in the United States, including receipts from custom-work and repairing, was valued in 1880 at $4,879,324, and in 1890 at $9,078,683. There are now 251 establishments in this line, having 6835 employees, and paying out annually $2,681,185 in wages.

DYESTUFFS AND DYEING

Almost the first industries established in the American colonies, after they were settled, and after they had taken measures to establish a food supply, were spinning and weaving, and dyeing came soon after. New dyestuffs were found here, and permanent dye-houses were established sooner than woolen factories. Butternut was a very common dye, but logwood and other substances prevented it from being used in any other than the most common work. Indigo, cochineal, annotto, quercitron, and brazil-wood were among those introduced from abroad shortly afterward, and have stayed in use up to the present time. Mordants afterward became known, and later mineral dyes. Within the lifetime of the present generation a new and exceedingly brilliant series of colors for dyeing has been evolved from coal-tar. The industry of dyeing is now very widely spread. Nearly every mill devoted to textiles has a dye-house, and there are many independent works throughout the country. In dyeing and finishing textiles there were, in 1890, 248 establishments, employing 20,267 hands, paying them $9,717,011 in wages, using materials worth $12,385,220, and turning out a total product valued at $28,900,560. Dyestuffs and extracts were made in 62 factories, employing 2302 hands, whose wages were $1,289,987, and using $6,500,928 worth of materials. The total value of the product was $9,292,514.

CORUNDUM

Corundum has been known for only a few years, and has come into popularity on account of its being harder than emery. It is used for polishing, and although it is very hard and jagged, it serves well the purpose for which it is used. The article to be polished is acted on by one wheel after another, less and less rough, until the surface becomes of a glassy smoothness. An emery-wheel is an ordinary wheel in shape, around the circumference of which emery is impressed, glued, or pasted. Corundum is intermingled with emery, with which it is closely allied. Both are together on the same wheel. In hardness corundum is next to the diamond. Some specimens of it are the well-known gems, topaz, sapphire, and ruby. Common corundum comes from North and South Carolina and New Jersey, but some is imported. The total product is $105,000 a year.

WINDOW-SHADES

THE manufacture of window-shades is a large industry in many of the cities of the Union. The extremely bright days we have in this country, together with the heat, necessitate a protection from the sun. Practically, shades are curtains, but are rolled up instead of being divided and looped up. Curtains have been known from remote times. In the "Arabian Nights" there are constant references to curtains, and in the description of the Israelite tabernacle are elaborate instructions of the way in which the curtains are to be made and looped up. In modern communities dwellings are required having windows from which light can be excluded, although admitting air. This is afforded by outside or inside shutters, or by curtains of rushes or reeds. But some forty years ago it was found that the shades or curtains then made could be rolled up on a stick, held to the right height, or pulled down when required, the power being furnished by a spring. So common has this contrivance become that almost every house is now supplied with shades moving in this way, and the manufacture of them has become a great industry. Some are moved by weights, and there are various minor contrivances. The cloths used generally imitate a brown holland. The total production is $5,812,428, the number of factories is 48, and the number of employees is 1307.

CHOCOLATE AND COCOA

THE chocolate and cocoa trades of the United States have assumed vast proportions during recent years. There are 11 establishments engaged in the manufacture of various preparations from these commodities, the capital representing about $3,000,000, and furnishing employment to 963 hands. The entire product is valued at $4,221,075.

Chocolate as a beverage was introduced into Europe by the Spaniards in 1520. It is prepared from a West Indian bean. The ancient Aztecs were very skilful in making this drink, and by them it was regarded as a necessity and a delicacy. In the West Indies the product is gathered, dried, and packed for this and other markets. In the manufacture of chocolate the beans are generally roasted, and the development of a peculiar aroma indicates the completion of the process. Subsequently the beans are reduced to a paste, mixed with one half to equal parts of sugar, and a small quantity of vanilla-bean is generally used for flavoring. Chocolate is easy of adulteration, and is often diluted with farinaceous substances such as arrowroot, sago, wheaten flour, and animal fats, although the standard brands on the market are guaranteed to be chemically pure. No record is preserved of the time when the first chocolate was made in America; but in 1794 a chocolate-mill in the North End of Boston turned out twenty-five hundredweight daily. In 1829 a factory in Lynn annually made sixty tons.

Cocoa, or, more correctly, cacao, is produced by the same plant from which we get chocolate. The latter is from the kernels of the fruit of the chocolate-tree, while the former is from the nibs. Cocoa has much less fatty matter than chocolate, and is consequently preferred by many persons. In the preparation of cocoa as an article of food the aid of science has been invoked, and in the form in which it is placed on the market it is regarded as one of the most valuable food products. The statistics of this industry are included with those of chocolate.

BLACKING AND STOVE-POLISH

SHOE-BLACKING has long been made in this country. Fifty or seventy-five years ago gentlemen blacked their shoes as they do now, but at the earlier period it is not probable that any polishing preparation was known. Two and three centuries ago shoes were worn of the natural color, but for a couple of centuries shoemakers and tanners have made a compound containing some coloring matter which is applied to the surface of the leather handled by them. Polishing shoes probably originated either in London or Paris, and the production of blacking for this purpose has become a very extensive business in the former city. It was in a blacking factory that Dickens was employed as a boy, as he has recorded for us in the pages of "David Copperfield," although he does not there state the identity of himself with his hero. This must have been about 1821. As far back as 1841 there were seven manufacturers of blacking in New York, and there were doubtless others in Boston and Philadelphia. For fifty years a bootblack has been a necessity for every hotel in America, and there are many boys and some men employed in this calling in the streets. Although five or ten cents is the usual price for a box of blacking, there are so many boxes sold that the business in the aggregate is a large one. The number of manufactories was, in 1890, 71. They had 1039 employees, paid out $561,644 in wages, used $1,484,203 in material, and sold $2,900,402 worth of products.

Stove-polish is plumbago, in a comminuted form, applied to stoves, and rubbed on them with a brush till they shine. Other articles are mixed with black-lead, so called, by some manufacturers, but simply for the purpose of cheapening it. Plumbago alone will accomplish the desired end. In its present form stove-polish has been known for a little over fifty years. No statistics are available on this industry, but its output probably exceeds $1,000,000 a year.

BOTTLING AND BOTTLERS' SUPPLIES

A GREAT demand exists in all the brewing districts, and in those producing wine, for bottles, and to put up these beverages with quickness and economy requires specially trained workmen and modern appliances. Beer, wine, and spirituous liquors demand nearly all the strong, heavy bottles made in the glass factories sixty years ago, but with the temperance agitation, the inquiry for wine and beer lessened very much, and new beverages, in the shape of soda-water and root-beer, became popular. They had been known before, but those who were temperance advocates then began drinking the non-intoxicating liquids freely. An apparatus was contrived about that time by which the right quantity of fluid could be injected into bottles, the cork driven in, and the top wired; but it took many years before the invention was perfected. Much of the progress made was owing to the great springs at Saratoga, the water from which was beginning to be called for throughout the United States. Bottling was continually going on, and there were many contrivances perfected. Later mineral waters and ginger-ale were produced in quantities, each requiring separate bottles and to some extent separate devices. Much capital is invested in this business, and there is a national association composed of manufacturers. Returns are made by nearly all these firms and companies to the association, from which it appears that this industry employs nearly 30,000 persons; it serves 4,489,038 customers, owns 22,940 horses, employs a capital of nearly $51,000,000, and owns bottles to the value of $12,747,633. Its loss of bottles annually is $3,522,804. In this line are consumed annually, besides bottles, corks in great number, wire, patented arrangements for closing bottles, paper boxes for holding bottles, sealing wax, and labels. The cost of these materials is given at $7,937,001.

SCHOOL FURNITURE

VERY little was made in the way of school furniture before 1850. What answered for grown people was suitable for children, so that small seats and desks were constructed by the local carpenters when needed; blackboards were prepared when used, or were dispensed with; and all the little accessories which are now a necessity in the school-room were then unknown. Threescore years ago, through a large part of the United States, the children sat upon rough planks or even upon slabs; the desks were simply boards, with a little ledge on the lower side, and there were no steel pens and very little paper. In the United States now there are over 100,000 school districts, and each school-house and each child must be supplied with facilities which were then not dreamed of. In high schools globes, orreries, and cabinets of specimens must be provided, and in all there must be a great number of contrivances to lessen labor, to make the results more uniform, and to impress more certainly the lessons to be inculcated. Much school furniture is made by those whose names are not known in that line, but the regular trade is carried on separately from that of other dealers, the estimated annual value of the business being about $15,000,000.

CORK

CORK is not a product of the United States, but is imported, chiefly from Spain. It is the bark of a species of oak. When it arrives here it is cut into smaller pieces by specially devised machinery, and is thus prepared for many uses. The chief one is for bottling. Nothing has ever been discovered that is equal to cork for this purpose, as it is very elastic, can be driven in easily, and cannot be removed without special effort. It is also employed for cork jackets, life-preservers, and buoys for nets, for which its extreme lightness makes it advantageous. The factories where these articles are produced are in the four large seaboard cities, which are chiefly engaged in the Mediterranean trade. Cork cutting is carried on in 65 factories, employing 2138 persons, to whom wages amounting to $762,518 are paid. The raw materials cost $1,501,962, and the value of the annual product is $2,840,359.

FLAGS AND BANNERS

Flags have long been produced in this country. In the early days of flag making here these emblems were made of almost any stout woven material, the stars and stripes on the national colors being sewed on separately in order to complete the design adopted. Subsequently a cloth of a homogeneous character was manufactured for the purpose, that part comprising the stripes being in one piece and the stars in another. During the war a stimulus was given to flag making, many patriotic persons being anxious to make a display of their loyalty by publicly exhibiting the national colors. There was also a large demand for flags by the armies in the field. In the early colonial days there was no standard emblem for the Americans; but with the beginning of the War of the Revolution the design of the present national colors, then composed of thirteen stars and stripes, representing the thirteen original States, was adopted. As each State was added to the Union, one star was added, until the present design, comprising forty-five stars, was completed. Thus the flags change for every decade.

At the present time New York is the center of the flag-manufacturing industry of the United States. The large quantity of bunting consumed in flag making is chiefly produced in Massachusetts. There are some concerns in New York City and Brooklyn which hire or lend flags for special occasions, and there are artists connected with the industry who decorate doorways, public and private buildings, highways, and arches.

The manufacture of banners—many of them very elaborate in design and finish, for indoor ornamentation—is also being developed. According to the census reports there were 29 firms engaged in the flag and banner business, having 364 employees, and turning out an annual product valued at $455,849.

FELT

It is probable that the making of felt preceded weaving, as many substances can be made into cloth or its equivalent simply by rubbing or shaking them together. They are interlaced by being agitated and tossed in the air, then falling upon a table with the utmost irregularity, and finally forming a thin sheet. Layer after layer is added till the required thickness is attained. Felt is used most largely for hats, but is also required for shoes and a variety of other purposes. Many improvements have been made in felt-making machinery, and the business is now very extensive. It is impossible to tell exactly the quantity of goods manufactured, as the proportion of hats made of felt cannot be ascertained. But felt goods are reported in the census as being made in 34 establishments, the value of the product being $4,654,768.

BASKETS, RATAN AND WILLOW WARE

One of the earliest industries in the East was that of basket making. No countries, except the most degraded, are without this calling, and since the settlement of America it has been carried on in all sections. Many persons are employed at it who cannot exert much physical force, and a considerable quantity of goods is manufactured in asylums and homes. Any species of willow can be used, but there are some particularly adapted to this business, as they are tougher and more flexible than others, or the trees are more accessible. The twigs are also used for many other purposes, such as baby-carriages, basket phaëtons, and seats in railway-cars. The trade does not appear so large as it really is, for much is sold by the maker direct to the consumer, and a great deal is also placed in the hands of retail men, and all this remains unclassified. There is a wider extent of usefulness for ratan goods. The raw material is obtained from the ratan palm, found in the island of Borneo and elsewhere in the East, which is imported here in vast quantities. It can be employed for nearly everything that willow can be used for, and in addition for walking-canes, hats, and many other things. There are 403 establishments now engaged in the manufacture of baskets, ratan and willow ware, employing 3732 men, and paying them $1,269,135 in wages. The raw material cost $1,398,483, and the annual value of the product was $3,633,634.

Albert C. Stevens

CHAPTER C

THE NEXT ONE HUNDRED YEARS

IT has been a labor of love as well as instruction to edit the articles which appear in this volume. Such a review of our remarkable century can be found nowhere else. Assistance has been sought, not among literary men and professional writers, but from the experts in each department of industry. The encyclopedia is largely professional work. This is purely practical. Gentlemen absorbed in the management of the enterprises which are the growth of the century have stepped aside from their engrossing duties and cares to put into enduring form, each for himself, a plain, clear, and lucid statement of the section of the material world with which he is familiar, and in which he has won his position, fortune, or fame. No one can rise from a perusal of these papers without having an increased admiration for the nineteenth century and unbounded hopes for the twentieth. The stories of battle and conquest, of the founding of dynasties and the dissolving of empires, of the sieges of cities and the subduing of peoples, which constitute the body of written history from the beginning of recorded time, are in ghastly contrast to this glorious, beneficent, and humanitarian picture of the achievements of the nineteenth century.

A philosopher has said that he is a benefactor of mankind who makes two blades of grass to grow where only one grew before. We celebrate harvests in inventions and discoveries where existed only Saharas. We find that the nineteenth century has not only added enormously to the productive power of the earth, but, in the happiness which has attended its creative genius, it has made the sunlight penetrate where the sunbeam was before unknown.

Our own country is peculiarly the pride of this century. It is the most complete example ever presented of the working out under favorable conditions of the principles and opportunities of civil and religious liberty. The marvelous development of the United States cannot be attributed solely or mainly to climate, to soil, to the virgin forests, or to unlimited and unoccupied territory. South America, Central America, and Mexico were as well, if not better, equipped in these respects. The garden of Eden, that fertile and fruitful portion of Asia, which for ages was the seat of empire, civilization, art, and letters, and for centuries the hive from which swarmed the conquerors of Europe, has returned to aboriginal conditions of desert and wilderness. Every industry whose birth and growth are features of this volume is the expression and witness of the beneficent principles of the freedom and liberty of individual action.

One hundred years ago the first cotton-mill was running with 250 spindles. Whitney discovered the cotton-gin, which created the wealth of the Gulf States and made the cotton industry over all the world tributary to them. Other inventors improved the machinery, and the single mill of one hundred years ago has expanded into 1000, and the 250 spindles have increased to nearly 18,000,000. One hundred and one years ago the first wool-carding machine was put in operation, under the impulse mainly of American invention. There were in 1895 2500 wool manufactories. The production of textile fabrics in this country supports 512,000 employees, paying to them in wages $176,000,000 yearly, and receives from the product $722,000,000. At the beginning of the century a few thousand tons of iron were manufactured. In 1890 the United States produced over 9,000,000 tons of pig-iron, being more than any other country; while in the manufactured products of iron and steel we are also in the advance of nations.

These astonishing figures give only the basic results of production, for from them collaterally flow car building, the miracles of the sewing-machine, of the vast employment and earnings of machinery manufacturing, of building and building materials, of the manipulation and composition of other metals, as silver and gold and copper and brass, of the singularly rapid rise of American glass interests, of the incalculable demands made upon furnace and mill and shop for railway appliances, of the immense production of utensils useful in domestic life and in agriculture, of the great supplies of material comprehended under the name of dry-goods, and of the machinery required for the telegraph, the telephone, and the creation of electrical energy.

The twentieth century will be a truth-seeking century. The nineteenth has been one of experiment. Invention and discovery have made the last fifty years of the nineteenth century the most remarkable of recorded time. Nature has been forced to reveal her secrets, and they have been utilized for the service of man. Lightning drawn from the clouds, through the experiments of Franklin, has become the medium of instantaneous globe-circling communication through the genius of Morse, of telephonic conversation by the discoveries of Bell, and the element of illumination and motive power by the marvelous gifts of Edison. Steam, which Fulton utilized upon the water and Stephenson upon the land, has created the vast system of transportation which has given the stimulus to agricultural and manufacturing products by which millions of people have been enabled to live in comfort where thousands formerly dwelt in misery and poverty. The forces of destruction, or rather the powers of destruction, have been so developed that while the nations of the earth are prepared for war as never before, the knowledge of its possibilities for the annihilation of life and property is so great that peace generally prevails. Physical progress and material prosperity have led to better living, broader education, higher thinking, more humane principles, larger liberty, and a better appreciation in preaching and in practice of the brotherhood of man over all the globe.

The nineteenth century closes with civilization more advanced in the arts and in letters than in the best days of Greece or Rome or the Renaissance; with a development in mechanical arts, in chemistry and in its appliances, in agriculture and in manufactures, beyond the experience of all preceding centuries put together. The political, social, and productive revolutions and evolutions of the period mark it as unique, beneficent, and glorious in the story of the ages. It has been the era of emancipation from bigotry and prejudice, from class distinctions and from inequalities in law, from shackles upon the limbs and padlocks upon the lips of mankind. It has been conspicuously the century of civilization, humanity, and liberty. As its presiding and inspiring genius looks proudly over the results, he may well say to the angel of the twentieth century, "You can admire, you can follow, but whither can you lead?"

The imaginary line drawn on the thirty-first day of December, 1899, between the past and the future cannot stop the wheels of progress nor curb the steeds, instinct with the life of steam and electricity, which are to leap over this boundary in their resistless course. The twentieth century will be preëminently the period for the equitable adjustment of the mighty forces called into existence by the spirit of the nineteenth century, and which have so deranged the relations of capital and labor, of trades and occupations, of markets and commercial highways. There will come about a oneness of races and nationalities by which the moral sense of civilization will overcome the timidity of diplomacy to prevent or to punish such atrocities as are now being perpetrated in Armenia. The Turk will either adopt the laws and recognize the rights of life, liberty, and property commonly recognized among Christian nations, or his empire will be dismembered and distributed among the great powers of Europe. Militarism, which is crushing the life out of the great nations of the Continent, will break down through the burdens it imposes and the conditions it exacts. The peoples of those countries, groaning under this ever-increasing and eventually intolerable load, will revolt. They will teach their rulers that that peace is not worth the price which can only be maintained by armaments which are increased on the one side as rapidly as on the other, so that peace depends upon an equilibrium of trained soldiers and modern implements of war. They will discover closer ties of international friendship, which will strengthen year by year, and in the camaraderie of international commerce they will come to maintain amicable relations with one another before tribunals of arbitration and under the principles of justice. The world will discover, as we found in our own country in our Civil War, that a free people quickly respond to the call of patriotism to meet every requirement of war in defense of their nation, and that armies of citizen soldiers, when the danger is passed, resume at once their places in the industries of the land. The twentieth century will realize the prophecy, "They shall beat their swords into plowshares, and their spears into pruning-hooks."

The pessimist has proved with startling accuracy that with the exhaustion of fuel-supplies in the forests and in the coal-mines, the earth can no longer sup-

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port its teeming populations, and that we are rushing headlong into anarchy and chaos. The twentieth century will find in the methods of the production of electrical power an economy of fuel and an increase of force which will accelerate progress and conserve our storage of supplies. Transportation both by land and by sea will be done solely by electricity. The same power will run the mills, the furnaces, and the factories. It will revolutionize and economize the processes of domestic life. It will shift and alter centers of production to places where electrical power can be more cheaply evolved, and that power will be utilized at long distances from its sources.

The hospitals of the world have reached their highest and best conditions in the nineteenth century for the care and cure of the sick and the injured. The hospitals of the twentieth century will perform this work as well, if not better, but they will also be schools of investigation and experiment. It is the peculiarity of each generation that it accepts as a matter of course that which was the astonishment and wonder of its predecessor. The antiseptic principle, which has made possible modern surgery, —the discovery of a surgeon still living,—is the commonplace of our day. So are the wonderful revelations which came through the trained brains and skilled hands of Pasteur and of Koch. Systematic and scientific research under liberal and favorable conditions will make the hospitals of the twentieth century the very sources of life. As the Gatling gun and the mitrailleuse enable the explorer in central Africa to disperse hordes of savages and open up unlimited territories for settlement and civilization, so will the leaders of the hospital laboratory produce the germicides which will destroy the living principles of consumption, of tuberculosis, of cancer, of heart, nerve, brain, and muscular troubles, and of all the now unknown and incalculable enemies which give misery and destroy life.

Continuing concentration and centralization of capital in great enterprises and in every field of production will be compelled by small margins of profit and the competition of instantaneous and world-wide communication. At the same time labor, more skilled, better educated, more thoroughly organized, finding a larger purchasing power in wages, and intelligently commanding its recognition by international compacts, will improve its condition, will find the means of quick and peaceable settlement with capital, and the relations of these two great forces will be much more beneficent and friendly.

Artists, whether with brush or chisel, or upon the lyric or dramatic stage, will require for success profounder study, broader experience, and more universal masters; but they will secure these essentials in schools at convenient centers, not only of countries, but of territorial divisions of countries. The great artist who can produce a picture which will rank with the works of Raphael or Titian and of the best exponents of modern schools will receive as adequate reward as ever for his masterpieces, and at the same time the processes of copying by the assistance of nature and chemistry will be so accurate that, with a copyright, his revenues will be increased, and his picture, perfect in every detail and expression, as well as in its general effect, and cheaply reduplicated, can be the delight, the inspiration, and the instruction of millions of homes.

Then there will be an increase in socialistic ideas and tendencies. The aim will be for a full and complete experiment of the principles of State paternalism and municipal communism. As we face the future we have no doubts as to the result, nor do we doubt that the inherent vigor of nations is greater as their institutions rest upon the liberty of the individual; yet, like the French Revolution and the theories and experiments which carried away the best thought and the highest aspirations of our own country fifty years ago, the popular tendency is for the trial of these methods of escape from ever-present poverty and misery and old-age disability. Human nature, however, has in all ages manifested itself in the social organization according to its lights and its education. Light and intelligence both accompany opportunity and experiment, and control them; and the twentieth century will close with the world better housed and better clothed, its brain and moral nature better developed, and on better lines of health and longevity. It will also exhibit increased and more general happiness, and the relations of all classes and conditions with one another will be on more humane and brotherly lines than we find them as we look back.

Let us reckon American manufactures from the infancy of the cotton and wool production in 1794 at practically zero on the one side, and on the other Europe, with the accumulated capital of over a thousand years and the accretion of the skill of all the centuries. The race-course of progress was open to the Old World and the New. Father Time kept the score, and Liberty said, "Go." To-day, after one hundred years, the American farm has become the granary of the world; the American loom and spindle and furnace and factory and mill supply the wants of 70,000,000 people in our land, and send annually $200,000,000 in value of product abroad for other countries. Europe, pushing forward on a parallel course, finds herself outstripped at the close of the century by this infant of its beginning in agricultural production, in manufactured products, in miles of telegraph and of railway, and in every element of industrial and material production and wealth. She finds one after another of her industries leaving her to be transplanted to this country, even with the conditions of labor, which makes up ninety per cent. of the cost of all manufactures, nearly fifty per cent. in her favor. American inventive genius has cheapened the cost of production on this side of the Atlantic to the advantage of American wages, and the principles of the Declaration of Independence have done the rest. Our population has grown from 3,000,000 to 70,000,000; our accumulated wealth from less than $100,000,000 to about $70,000,000,000; the number of our farms from probably about 100,000 to nearly 5,000,000; our agricultural products from just sufficient for the support of 3,000,000 people to an annual commercial value of $4,000,000,000. The workers upon our farms have increased from about 400,000 to 9,000,000; the operatives in our factories from a handful to 5,000,000; and their earnings from a few thousand dollars to $2,300,000,000. The increase in wages has been correspondingly great. Even since 1870, it has been sixty per cent. and the purchasing power of money has enhanced about the same. Our public-school system was very crude at the beginning of the century, and the contribution of the States for its support very small. Now we spend for education annually $156,000,000, as against $124,000,000 for Great Britain, France, Germany, Austria, and Italy combined.

It is easy to see that Europe, with its overcrowded populations, its more difficult and almost insoluble problems, and with the limitations imposed upon development and opportunity by its closely peopled territories, must advance in wealth and material prosperity and the bettering of the condition of the masses by destructive revolutions or by processes which are painfully slow. The United States, with a country capable of supporting a population ten times in excess of that with which this century closes, with its transportation so perfected that it can be quickly extended as necessity may require, with its institutions so elastic that expansion strengthens instead of weakens the powers of the government and the cohesion of its States, will advance by leaps and bounds to the first place among the nations of the world, and to the leadership of that humanitarian civilization which is to be perfected by people speaking the English tongue.

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