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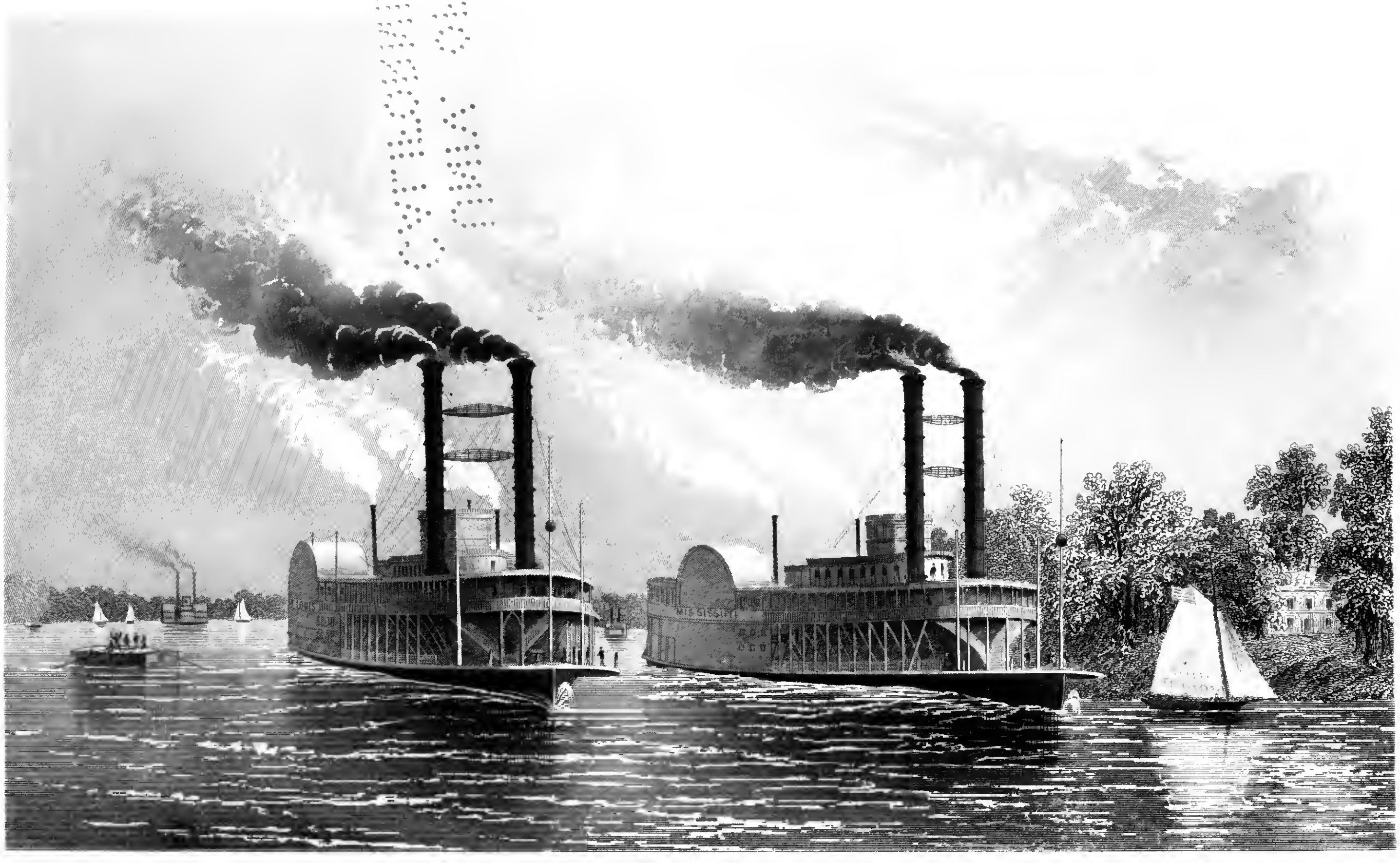
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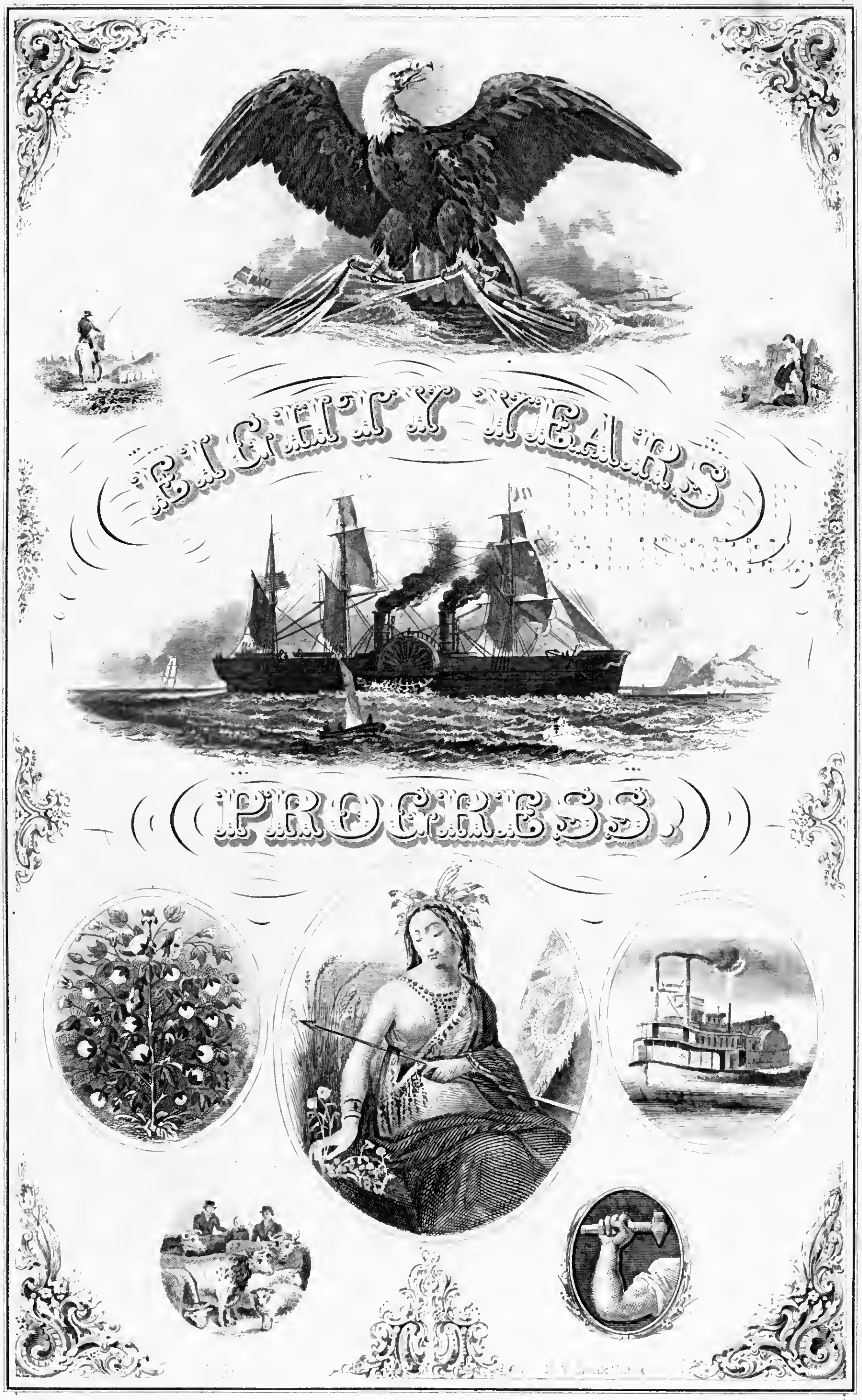
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EIGHTY YEARS' PROGRESS

OF

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A FAMILY RECORD

OF AMERICAN INDUSTRY, ENERGY AND ENTERPRISE:

SHOWING

THE VARIOUS CHANNELS OF INDUSTRY AND EDUCATION THROUGH WHICH THE PEOPLE OF THE UNITED STATES HAVE ARISEN FROM A BRITISH COLONY TO THEIR PRESENT NATIONAL IMPORTANCE;

GIVING, IN AN HISTORICAL FORM,

THE VAST IMPROVEMENTS MADE IN AGRICULTURE, CULTIVATION OF COTTON, SUGAR, COMMERCE, TRAVEL AND TRANSPORTATION, STEAM ENGINE, MANUFACTURE OF COTTON, WOOLEN, SILK, PAPER, FIRE-ARMS, CUTLERY, HATS, CARRIAGES AND COACHES, PLATED WARE, LEATHER, BOOTS AND SHOES, CLOCKS AND WATCHES, PINS, REFINED SUGAR, GLASS, INDIA RUBBER, FISHING BUSINESS, FUR AND FUR TRADE, HUMANITARIAN INSTITUTIONS, ETC., ETC.

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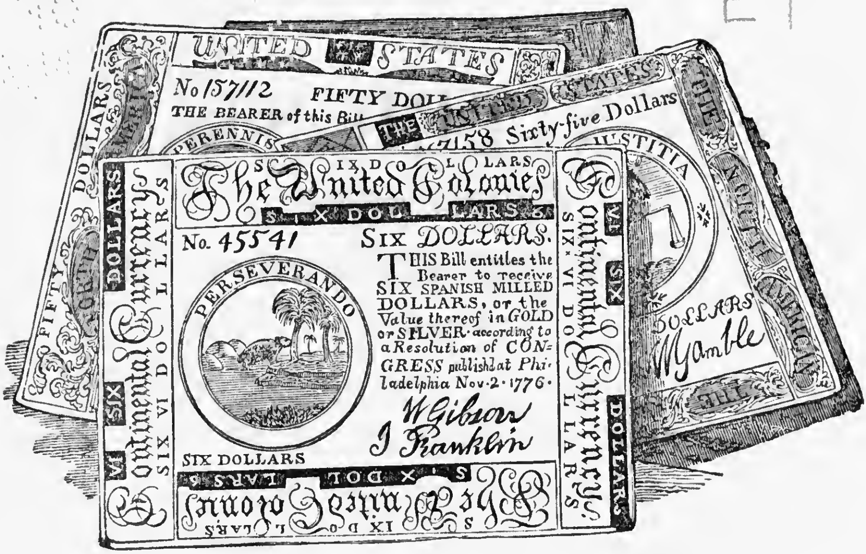

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Secretary Massachusetts Board of Agriculture; Author of "Grasses," "Forage Plants," "Milch Cows and Dairy Farming," &c., &c.

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MANUFACTURES

Of Cotton, Woollen, Paper, Leather; Boots and Shoes, Fire-Arms, Cutlery, Carriages and Coaches, Clocks and Watches, Electro-plated Ware, Pins, Refined Sugars, Silk, Fire-Proof Safes, Bank-Locks, Glass, India-Rubber, Sewing Machines, Musical Instruments: showing the various improvements made by machinery and other means of manufacture, the extent of operations and value of productions, &c., &c.

BUILDING, BUILDING MATERIALS, FISHING INTERESTS, AND FLOUR MILLS.

By THOMAS P. KETTELL,

For many years Editor of Hunt's "Merchants' Magazine," and Author of various Statistical Works, "History of the Great Rebellion," &c.

PREFACE

It has been said that history, as generally written, is but an account of the wars and contentions by which dynasties have striven for the mastery of nations. It imparts little or no information in respect to the social condition or material progress of the people themselves. It is true that the means of preserving such information have never before existed in the shape of those printing facilities which at this day place every variety of intelligence within the reach of the poorest classes. These facilities are themselves among the wonders that have attended the progress of the American people during the past eighty years. In that period a nation has been born, and grown to unexampled power and place among the nations of the earth.

Inasmuch, however, as that the nature, the institutions, and the administration of the American nation are different from all others, so must its history be in an entirely different style. If there are no regal intrigues to chronicle or military exploits to recount, there are more lasting triumphs in every useful science to record. If we have no Alexander, or Cæsar, or Bonaparte, or Wellington, to shine on the stormy pages of our history, we have such names as Franklin, Whitney, Morse, and a host of others, to shed a more beneficent lustre on the story of our rise. The means by which a few poor colonists have come to excel all nations in the arts of peace, and to astonish the people of Europe with their achievements through the development of their inventive genius, are true subjects for a history of the United States. Such a history is now for the first time presented to the American people. In its preparation no pains or expense has been spared in the view of making it perfectly reliable, and it is believed that a work has been produced which will be standard on the subject.

When the War of Independence was finished, the American people, free on their own soil, turned their quick intellect and undivided attention to the great object of improvement, material and mental, and they have wrought out results that have become not only the admiration but the exemplar of all nations. The great genius of the people manifested itself in the invention of labor-saving machines, because labor was scarce and dear. The steam engine was adopted, improved, and applied to every branch of labor. It was applied to navigation, to locomotion, and to manufacturing in all its branches, great and small. Inventions were introduced in all possible branches of manufacturing by which labor was saved. It is probable that one man now produces as much by the aid of machines as one hundred did formerly. In other words, that inventive genius has increased manufacturing production a hundredfold. At the same time a vast continent has been settled; and here again has inventive genius supplied machinery as a substitute for farm laborers, and one man may, by their aid, harvest a large surplus above his family wants. These machines have become the models for Europe. This vigor of production has enabled the construction of as many miles of railroads as all Europe put together.

The telegraph has been invented for transmission of intelligence, and more miles of it used than in all Europe.

In ship-building, the American improvements have outstripped the boasted wooden walls of old England, and given the model to the world. Their active enterprise has won the foremost rank in foreign commerce, and covered the inland waters with more steam tonnage than all other nations possess.

The cities of America have sprung up with magic growth, and increased with marvellous vigor. There is no example in history where so many large cities have been built in a similar period.

In producing a carefully written history of all these events, a vast amount of labor and research has been gone through to collate reliable statistical matter. Every effort has been used to place the results in a clear and attractive view, so as to make the reader master of every branch of the subject, and enable him to speak understandingly of his country's triumphs. To this end a great expense has been incurred for engravings illustrative of the various industries.

It is believed that the work now offered to the public is the most complete history of a nation's progress ever written.

The reader should ever bear in mind that the work does not come down later than 1860, except in a few cases, it may cover a portion of 1861. There is also a brief description of the Iron-clads and Monitors of a later date.

CONTENTS.

PAGE

AGRICULTURE.

INTRODUCTORY REMARKS.................... 19
First Settlers.......................... 19
James River Settlement, Virginia.......... 19
Plymouth Colony......................... 19
Stock of early Settlers.................... 20
Introduction of Clover in England, 1633.... 20
Beef and Mutton, same date............. 20
Early Agricultural Implements........... 20
Customs of the Indians.................. 21
Indians' method of clearing Forests........ 21
Indians instruct the English how to cultivate Corn.............................. 21
Indians' mode of storing Corn............ 21
First sight of Ships...... 22
Low condition of Agriculture before the Revolution.......................... 22
Raisings and Huskings of early times....... 22
Early Settlers manufacture their Garments.. 22
Courtship and Marriage.................. 23
Number of Newspapers................. 23
Prejudice against housing and milking Cows in Winter........................ 23
Emigrating West meaning Western New York.............................. 24
ASSOCIATED AND LEGISLATIVE EFFORT........ 24
Letter of Washington to Sir John Sinclair.. 24
South Carolina Agricultural Society........ 25
Massachusetts do do 25
First Agricultural Exhibition in 1809....... 25
Effects of Agricultural Societies............ 26
FARM IMPLEMENTS......................... 26
Jack at all Trades...................... 27
Ploughs in Virginia in 1617............... 27
Thirty-seven Ploughs in Massachusetts in 1637.............................. 27

PAGE

Wooden Forks........................... 27
Description of Ploughs 30
Modern Improvements in Ploughs......... 30
Ten Millions saved in Ploughing............ 30
First Patent for Cast Iron Ploughs......... 31
Thomas Jefferson on Ploughs............. 31
Massachusetts Plough Manufactories....... 31
The Harrow, Cultivator, Grubbers, &c...... 32
Sickle and Cradle....................... 32
Reapers and Mowers.................... 33
Horse Rake........................... 36
Malthus on Population.................. 36
Trial of American, English, and French Threshing Machines.................. 36
RAISING OF STOCK......................... 37
First Stock imported.................... 37
Crossing of different Breeds of Cattle...... 38
Fodder for Cattle in Virginia.............. 38
Cattle in Illinois in 1682.................. 39
Stock Raising in England................. 39
Large Prices for Improved Stock.......... 40
Hereford and Devon Breeds............... 40
Methods of improving the Breeds of Cattle.. 41
Milch Cows........................... 42
Kentucky, Ohio, Indiana and Illinois Cattle. 47
18,378,907 head of Cattle in 1850.......... 47
Animals slaughtered in 1850 worth $111,703-142.................................. 47
Importing Choice Stock.................. 48
Ohio Company for importing, Capital $9,200. 48
Short Horns, Jerseys, Ayrshires........... 49
Value of Cattle in Ohio in 1857, $11,315,560 50
Average number lbs. Butter per Cow in different states............................ 51
Average number lbs. Cheese.............. 51
Number of Cows per inhabitant........... 51
Stock Raising in Southern States.......... 52

	PAGE
HORSES	52
Roads, Mails at four miles per hour	52
Speed desired in Horses	52
First Horses imported by Columbus	53
Wild Horses Descendants of Spanish Breeds	53
Demand for Fast Horses	53
The Morgan and Black Hawk	54
Horseback Riding in the South	54
Number of Horses in 1850, 4,336,719, not including Cities and Large Towns	54
SHEEP	59
First Imported Sheep	59
Wool Two Dollars per pound	59
The Dog Law	60
Tennessee Wool takes the Premium at the World's Fair	60
Great Britain produces 275,000,000 lbs. Wool annually	60
Wool of the South, West and North	63
SWINE AND PORK	63
First Swine imported	63
Improvement in Breeds of Swine	64
Native Hogs of the West	64
Swine of the South, West and North	65
Manner of killing Hogs	65
Pork Packing	66
Lard Oil	67
Quantity of Pork packed in Cincinnati for twenty-seven years	67
Number of Hogs killed in Western States	67
PRODUCTS OF THE SOIL	68
Indian Corn	68
Indian Mythology	68
Early Exports of Corn	69
Increased Exports of Corn since 1820	70
Corn produced in France and Russia	70
1,000,000,000 bushels Corn in 1855	70
Corn exported from 1851 to 1858	71
England imports $225,000,000 worth of Grain	71
WHEAT	72
Samples of Wheat sent to Holland in 1626	72
Damage to Wheat by Blast, Insects, &c.	73
Raising Wheat in New England	73
Exports of Wheat and Flour	74
French Settlements in the West	74
Soldiers of the Revolution settle in Illinois	75
Chicago Grain Depot	75
Grain Store-houses of Illinois Central Railroad	76
Agricultural Products Sixteen Hundred Millions annually	76
Agricultural Interests four-fifths of Taxes in New York State	77
Wheat produced South, West and North	77
Wheat in California	77
PRODUCTION OF OTHER GRAINS	77
Rye, Oats, Buckwheat	78
Buckwheat raised South, West and North	78
Clover and Grass seed	79
POTATOES	79
PEAS AND BEANS	79
GRASS AND HAY CROP	79
Timothy found by Mr. Herd in a Swamp, taken to Maryland and Virginia by Timothy Hanson	80
Value of Hay Crop	80
Hay consumed per head of Cattle in different States	80
CULTURE OF FRUIT	81
First Apples in this Country	81
First Horticultural Society	81
The Nurseries of Western New York	82
Orchards in the South	82
Peaches in the South	82
Fruit in California	83
Wine in do	83
Imports of Fruits which may be grown in California	83
Thousand Dollars worth of Pears on one acre	84
Orchard Products of 1850	84
Fruit Books	84
Pears imported from France in 1851	84
CULTURE OF TOBACCO	85
Columbus presented with a Cigar	85
French Revenue from Tobacco	85
Tobacco at Forty Cents per pound	86
Exports of Tobacco	86
Tobacco raised South, West and North	87
Manufacture of Cigars	87
CULTURE OF HOPS	88
Hops introduced as early as 1828	88
Hops Raised South, West and North	89
FLAX AND HEMP	89
Quantity raised South, West and North	90
CULTURE OF SILK	90
BEE CULTURE	90
POULTRY	90
LUMBER BUSINESS	91
Great Variety of Trees	91
New Settlers	91
The Lumbermen in the Forest	92
Rafting Business	93
Lumbering in Maine	94
Kinds of Lumber	94
The way Lumber is sold	95
Lumbering at Green Bay	95
Chicago Lumber Market	95
AGRICULTURAL LITERATURE	97

PAGE

Essays by Jared Elliot.................... 97
The American Farmer.................... 97
Various Agricultural Papers.............. 98
Agricultural Books........................ 98
Agricultural Colleges...................... 99
Chemistry in aid of Agriculture............ 99
Guano as a Fertilizer..................... 100
Two Million Tons Guano from Chincha Islands 100
THE PROSPECT OF AGRICULTURE IN THE COUNTRY 101
Comparison with other Countries........... 101
Number of Farms in the United States...... 102
Remarks of Daniel Webster.............. 102

COTTON CULTURE.

Capital and Labor......................... 103
Early Exports of Produce................. 104
Labor in Comparison with Europe.......... 105
Cotton great Export Article................ 106
Trade with Brazil......................... 107
Cotton, Rice and Tobacco South........... 107
PRODUCTION AND PRICES OF COTTON.......... 108
Machinery for Spinning Cotton............ 108
Steam Engine Important in Cotton Manufacturing........................ 109
Early Manufactures in England........... 109
Cotton Trade of France.................. 109
Comparative Consumption of Cotton....... 110
Cotton found by Columbus................ 110
Sea Island Cotton......................... 111
Whitney Cotton Gin...................... 111
Vexatious Law Suits..................... 113
Increase of Cotton from 1820 to 1830....... 114
Prices of Cotton decline.................. 114
Decline in Shipping Tonnage of Charleston.. 114
Rice Culture.............................. 115
Railroads in the South................... 115
Cotton Factories in the South............. 115
MONOPOLY OF THE MARKET—SLAVE LABOR.... 116
Limit of Sea Island Cotton................ 116
Cotton in various Countries.............. 117
Paper read before the Society of Arts....... 118
Experiment with American Cotton in India. 118
Picking Cotton........................... 119
Slave Labor.............................. 119
Humanity of the Master.................. 119
Maine Liquor Law among Slaves.......... 120
Ploughing in February.................... 120
Cultivating Cotton....................... 121
Distribution of Labor among Whites and Blacks.............................. 121
Slaves Marry and are given in Marriage.... 121
Cotton and Gold support high Tariff........ 122
Northern Furniture in Southern Houses.... 122
Northern Books do do ... 123

PAGE

SUGAR CULTIVATION AND CONSUMPTION.

Cane first introduced in Louisiana......... 127
Five kinds of Cane....................... 127
Mode of Cultivating.................... ... 128
Sugar Mills.............................. 128
Quantity Sugar produced per acre.......... 129
Consumption of Sugar in the United States. . 129
MAPLE SUGAR............................ 130

COMMERCE OF THE UNITED STATES.

COLONIAL TRADE, &c....................... 132
Rapid Development...................... 132
Early Settlers and Imperial Government.... 133
Colonists forbidden to Coin Money.......... 133
Early Manufactures....................... 133
The Colonies forbidden to Manufacture.... 133
Report of Parliamentary Committee on Colonial Manufactures and Trade......... 133
West India and American Rum............ 135
Imports and Exports of 1770............. 136
Burdens of the Colonies.................. 137
The Revolutionary War.................. 137
Paper Currency.......................... 138
Trade with Great Britain from 1784 to 1790. 138
Insurrection in St. Domingo............. 139
Stephen Girard.......................... 139
Jay's Treaty............................ 139
Table Imports and Exports from 1790 to 1807 140
Mr. Hamilton, Secretary of Treasury, Report 141
Table of Exports........................ 141
American Manufactures.................. 142
Table of Tonnage, Exports and Imports, from 1808 to 1820.................... 142
The Embargo........................... 143
National Debt at close of the War of 1812.. 143
Increase of Population, Wealth, &c., from 1791 to 1820............................ 144
CHANGED INTERESTS, MANUFACTURES, &c..... 144
Table of Imports and Exports from 1821 to 1839............................. 145
Capital employed in Cotton Manufacture in 1830.............................. 147
Table Imports and Exports from 1831 to 1840 147
Large Fire in New York in 1835.......... 148
Two Hundred Millions sent West to start Banks.............................. 151
The Panic of 1837....................... 151
United States Bank...................... 151
United States Bankrupt Law............. 152
Table of Imports and Exports from 1841 to 1850.............................. 153
Famine in Ireland....................... 153
French Silks in Tricolors................. 154

	PAGE
Gold discovered at Capt. Sutter's Fort....	154
Nine millions Gold received from California in 1850....	154
Exportation of Gold depreciating....	154
Six hundred million dollars of Gold received from California from 1850 to 1860....	155
Emigrants bring in $251,805,400 Gold from 1850 to 1860....	155
Five hundred million dollars expended in land operations from 1850 to 1860....	155
Failure of Corn crops in Europe....	155
Table of Exports and Imports from 1851 to 1860....	156
Wheat crop of 1850 equal to 22,000,000 barrels flour....	156
Exports of Agriculture from 1850 to 1856....	156
Table of Exports for periods of ten years..	157
The area of Great Britain....	157
Lands sold and given for public works....	157
Quantities of Corn and Pork exported to Great Britain from 1840 to 1858....	158
Imports of Cotton from India....	158
Internal production of wares....	159
Value of Manufactures and Agricultural productions....	159
The firms in business in 1857....	159
Exchanges at the Clearing House, New York	160
Growth of the U. S....	160
Ships—Tonnage—Navigation Laws....	161
Two ships to do the work of one....	161
Vessels built in the several Provinces in 1771....	163
Bounties on Fisheries....	162
Tables showing tonnage of Shipping from 1789 to 1858....	163
Cotton as Freighting....	163
Measure of tonnage....	163
Effect of Mexican and English wars in China on trade....	163
Favorable treaty between the United States and China....	164
Caleb Cushing robbed of his Baggage on his way home from China *via* Mexico...	164
British and French Expedition from Varna to the Crimea....	164
First arrival of a Steamer from England..	164
Table showing the different Lines of Steamers between Europe and U. S....	164
Table showing the number and names of Ocean Steamers lost....	165
Growth of Steam service in the interior..	165
Keel-boats on the Ohio River....	165
First sea-going Brig built on the Ohio River	165
First Steamboat built for the Ohio River...	165
Territory drained by the Ohio....	166
Opening of Erie Canal in 1825....	166
Table showing the number, kinds, &c., of Vessels navigating the Lakes in 1858...	166
Losses of Screw Propellers from 1848 to 1856....	166
Lake Cities, their rapid growth....	166
Lopez Propeller....	167
Ship-building at the Lake ports for Liverpool....	167
Ship-building, Clipper model....	167
Tonnage owned in U. S. in 1860....	168
Table of National Exports from 1800 to 1860....	168

TRAVEL AND TRANSPORTATION.

EARLY ROADS, POST ROADS, &c....	171
Gen. Washington as an Engineer....	173
Stock of Dismal Swamp Canal....	173
Statistics of Mail Service from 1791 to 1859.	174
Country Roads....	175
Charcoal do....	176
Plank do....	176
Turnpike do....	176
Macadam do....	176
Roads in Ohio....	177
Cumberland Road....	177
COASTERS, STEAMBOATS, CANALS....	178
Sloop experiment....	178
Fulton's Steamer Clermont....	179
The first Steamer Hell Gate....	179
Progressive speed of Steamers from 1811 to 1860....	180
Flat Boats on the Mississippi....	181
First Steamboat on the Ohio....	181
Time of passage from New Orleans to St. Louis reduced from 120 to 3 days....	183
Increase of Steam Tonnage on the Western Rivers from 1842 to 1860....	183
Ground broken for the Erie Canal....	184
Early Canal Projects....	185
Loss of Water in Canals by leakage....	186
Transportation from Buffalo to New York, $100 per Tun....	186
Increase of Steam Tonnage on the Lakes from 1841 to 1860....	187
Opening of Lumber Trade of Western New York....	188
List of Ohio Canals....	188
John Q. Adams and Charles Carroll turn first earth for Canals....	189
List of Important Canals....	190

PAGE

Total receipts from New York Canals...... 190

EARLY RAILROADS, LAND GRANTS, &C........ 191

First Railroad in the United States........ 192

Massachusetts Western Railroad.......... 193

Process of Railroad Building.............. 195

Cost per mile of Running Locomotives...... 196

Earnings of New York Central Railroad from 1853 to 1859.......................... 198

Erie Railroad chartered.................. 201

Receipts and Expenditures of Erie Railroad. 202

Pennsylvania, Baltimore and Ohio Railroads. 203

Georgia Railroads...................... 205

Illinois Central Railroad.................. 205

Land Department of Illinois Central Railroad 207

Table showing the Land Grants to the several States........................... 207

Railroads from Maine to Louisiana, with the names of different Corporations.......... 208

Michigan Railroads...................... 208

Missouri Railroads...................... 209

RAILROADS OF THE UNITED STATES PROJECTED. 209

Length and miles completed, with the Capital paid in and Funded Debt............... 209

Miles of Canals and Railroads for transportation of Coal.......................... 220

Miles of Railroad in use for transportation of Cotton, with number Bales of Cotton..... 220

Railroads entering Chicago.............. 221

Tonnage of the five great East and West Transportation Lines.................. 221

New York and Philadelphia Stages........ 222

City Railroads.......................... 223

Number miles of Railroads in the world, with the cost per mile in each country........ 224

STEAM.

HISTORY OF THE STEAM ENGINE............. 227

First Steam Engines in America........... 227

Robert Fulton, Oliver Evans, Watt........ 228

Horse Power of Steam Engines........... 228

High and Low Pressure.................. 229

First adoption of the Crank for the Steam Engine 229

English and American Steamers.......... 232

Description of the Steam Engine.......... 233

STEAMBOATS............................ 234

John Fitch............................ 234

Steamboats on the Ohio River............ 239

Steamboats on the Lakes................ 239

The Propeller.......................... 240

The Adriatic........................... 241

First use of Coal for Steamers............ 241

Explosion of the Boiler of Steamboat Washington............................... 242

PAGE

Tonnage of Steam Vessels of United States.. 243

LOCOMOTIVES............................ 243

First experiments....................... 244

First Locomotive built in America......... 245

Export of Locomotives................... 246

Cost of Locomotives..................... 247

Great speed of a Locomotive.............. 249

Time saved in England by Railroad Travelling in comparison with Stages..... 250

Dummy Engines....................... 250

STATIONARY ENGINE...................... 252

Rotary Engine.................... 253

Corliss Engine......................... 254

Portable Engine........................ 255

Steam Saw Mills....................... 256

Description of Steam.... 256

Brooklyn Water Works Engine........... 258

STEAM PUMPS.......... 258

Fire Engines.... 259

MISCELLANEOUS.......................... 263

Use of Steam in Farming................ 264

Steam in Manufacturing................. 266

CONCLUSION............................. 268

Caloric Engines........................ 270

Experiments of United States Government on the Expansion of Steam............. 272

COTTON MANUFACTURES.

ORIGIN—HAND-WORK—INVENTIONS......... 274

Hand Carding.......................... 275

The first Spinning Jenny................ 275

First Carding Machine.................. 276

First Power Loom...................... 276

First Calico Printing in England 276

The American Invention of Mr. Perkins.... 277

Early Importations of Cotton into Great Britain 277

Dates of Important Inventions in Cotton Machinery............................. 277

MANUFACTURE IN AMERICA................. 280

First Cotton Mills in Rhode Island......... 280

The number of Cotton Mills in 1809........ 281

The first Mill in the world combining all branches of Cotton Manufacture, established in Waltham, Mass................... 282

The beginning of Lowell................ 282

Statistical Table of Cotton Mills in 1831..... 283

do do do 1850..... 285

INVENTIONS, MODE OF MANUFACTURE, PRINTING, &C.................................. 286

The meaning of Staple as applied to Cotton.. 286

Description of Calico Printing............ 288

Statistics of Cotton Manufacture in the United States, from 1809 to 1860.............. 290

PAGE

PAPER: ITS MANUFACTURE.

MATERIALS—PROGRESS.......... 291
First Paper Mill in Massachusetts.......... 292
Importations of Rags into the United States from 1846 to 1857.......... 292
Rags consumed in the United States, Great Britain and France.......... 293
Mummy Wrappers used for Paper.......... 293
Water Mark.......... 294
INVENTIONS—MANUFACTURE.......... 295
Fourdrinier Machine.......... 295
Names and Dimensions of Paper.......... 296
Description of Manufacture.......... 296
Statistics of Manufacture.......... 298

WOOLLEN MANUFACTURES.

CARDING—WEAVING—FELTING.......... 300
Value of Manufactures from 1810 to 1850.. 300
Machines for making Cards.......... 301
Manufacture of Worsted.......... 301
Dyeing Cloths.......... 304
Felting.......... 305
Carpets.......... 306
Quantity of Carpeting made in Massachusetts and New York in 1855.......... 308
CLOTHING TRADE.......... 309
Statistics for 1850.......... 309
Large Manufactories.......... 310
Statistics of Woollen Manufactures in 1850 ..311
Manufactures of Massachusetts, New York and Maine.......... 312
Imports of Cloths.......... 312
Imports of Wool, total consumption.......... 313
Shoddy, description of.......... 313

LEATHER.

TANNING—BOOTS AND SHOES.......... 316
Leather Manufacture in 1850.......... 316
Different kinds of Hides.......... 317
Disposition of Hides brought into New York. 318
Description of Tanning.......... 319
Time required for Tanning different Hides... 322
Number and value of Boots and Shoes manufactured in Massachusetts.......... 324
Pegging Machines.......... 325
Statistics of Leather Trade of New York for 1855.......... 326

FIRE-ARMS.

COLT'S REVOLVERS.......... 328
The Match-lock and Flint-lock.......... 328
Colt's Inventions.......... 331

PAGE

Colt's Fire-Arms at the World's Fair.......... 331
Colt's Manufactory.......... 332
Sharpe's Rifle and Pistol.......... 332
Stafford and Whitney Arms.......... 333
United States Armories.......... 334
Dahlgren Gun.......... 335
Comparative Strength of Iron and Bronze... 335
Process of Casting.......... 335
Method of Proving.......... 336
Naval Warfare.......... 337
Large Gun for Harbor Defence.......... 337
The Floyd Gun.......... 337
Powder used.......... 338

CUTLERY.

UNITED STATES INDUSTRY—AXES.......... 339
European System.......... 339
Shears at Seven Cents per dozen.......... 340
Table Cutlery manufactured in the United States by Machinery.......... 340
Grinding and Polishing.......... 340
Butcher and Shoe Knives, Forks.......... 341
Axe Manufacture.......... 341
Statistics of Cutlery and Edge Tools for 1850. 342

FURS AND FUR TRADE.

Trade with the Indians.......... 343
Hudson's Bay Company.......... 343
John Jacob Astor in Fur trade.......... 344
Exports of Fur for 1850.......... 345
List of Prices of various Furs.......... 346
Prices of different kinds per set.......... 347
Felting of Fur.......... 347

HATS.

EARLY HISTORY—IMPROVEMENTS.......... 348
The London Hatters.......... 348
Early Fashions.......... 348
Hat Business in New York.......... 349
Monopoly of Machinery.......... 349
Silk Hats.......... 350
Finishing.......... 350

INDIVIDUAL INDUSTRIES.

Introductory Remarks.......... 353
BUILDINGS AND BUILDING MATERIALS.......... 353
Number and value of Dwellings in the United States in 1798 and 1850.......... 354
Dwellings as per population.......... 354
Supposed value of Buildings in 1870.......... 355
Improvements, Fixtures.......... 355

PAGE
Lumber Business........................ 356
Machinery used in Building.................. 357
Lumber Trade East, West and South....... 357
Brick Making.......................... 358
Lime................................ 358
Stone................................ 359
Ship Building.......................... 359
Statistics of House and Ship Building...... 360
CARRIAGES AND COACHES.................. 360
New York Omnibus..................... 360
Kinds of Timber used.................. 361
Description of Messrs. G. & D. Cook & Co.'s Manufactory......................... 361
Carriage and Car Manufactories in New York 362
Express Wagons....................... 367
Statistics for 1850...................... 368
CLOCKS AND WATCHES..................... 368
Alfred the Great uses Candles as Time-pieces 368
Connecticut Clocks..................... 369
Terry, Thomas, Jerome, and others........ 369
Barnum in the Clock Business............ 370
Exportation of Clocks.................. 370
Roxbury Watch Factory................. 370
Watches made by Machinery at Waltham... 371
ELECTRO-PLATING........................ 372
Description of the Process................ 372
FISHERIES.............................. 377
Venice founded by Fishermen............ 378
Holland and England, do................ 378
Yankee Fishermen...................... 378
Fishing Bounties....................... 378
Cod, Mackerel, Herring and Halibut Fishing 378
Oyster Trade.......................... 384
Whale Fishery......................... 385
Seal Fishery.......................... 385
Statistics of Fishing Trade............... 386
ICE................................... 386
Use of Ice by the Ancients.............. 386
General uses of Ice.................... 387
Massachusetts in the Ice Trade............ 387
Exports of Ice 388
Gathering Ice in Houses................ 388
Use of Ice in the East Indies—Incident related by Edward Everett............... 389
PINS.................................. 389
Pin Manufacture in State Prisons.......... 390
Pin Machines......................... 390
Manufactory at Waterbury.............. 390
REFINED SUGAR......................... 391
Consumption of Sugar per head of population in United States, Great Britain, France, and Germany....................... 391
Beet Sugar in France................... 392
Introduction of Machinery............... 392
Annual Value of Candies 392
SILK.................................. 393
Early Culture of Silk in America.......... 393
Morus Multicaulis Speculation............ 394
Imports of Raw Silk.................... 395
FIRE-PROOF SAFES AND SAFE LOCKS.......... 395
First Imports of Safes.................. 396
Spontaneous Combustion of a Safe......... 396
Wilder's, Marvin's, and other Safes......... 397
Bank Locks at the World's Fair........... 398
GLASS MANUFACTURE..................... 398
Various uses of Glass................... 398
Glass of remote antiquity................ 399
Early manufacturing in England........... 399
First Glass Works in America............ 399
Materials for Glass 400
Description of Manufacture.............. 401
American Inventions for Grinding Glass.... 403
Silvering Glass........................ 404
Enamelled Glass....................... 405
INDIA-RUBBER AND ITS MANUFACTURE........ 406
Countries producing it, gathering, &c....... 406
Goodyear's experiments................. 410
Belting and Hose Manufacture............ 411
Rubber Car Springs.................... 411
Statistics of the Trade.................. 412
SEWING MACHINES........................ 413
Elias Howe, Jun., Lock-stitch............ 413
Three classes of Machines............... 414
Mr. Wilson's improvement............... 419
Description of Wheeler and Wilson's Machine 419
Singer & Co.'s Machines, description of their Manufactory......................... 421
Grover & Baker Machines............... 424
Finkle & Lyon's Machines............... 425
Number Machines made under Howe's patent 426
Comparison between Hand and Machine Sewing........................... 426
Various uses of Machines, Statistics, &c..... 428
Comparative Statistics of Great Britain and the United States.................... 430
MILLS................................. 431
Product of Flour and Grist Mills.......... 431
Number of Flour Mills in 1840 and 1850... 432
Descriptions of Mills.................... 432
MUSICAL INSTRUMENTS.................... 434

HUMANITARIAN AND CORRECTIVE INSTITUTIONS.

Prisons and Prison Discipline............. 435
Auburn Prisons.......................... 436
The Silent System...................... 437
Great Britain and Germany, Prisons in ... 438

PAGE

Massachusetts, Prisons in 438
Hospitals for the Insane 440
Efforts of the Friends in Pennsylvania..... 441
Statistics of Hospitals in the United States . 444
RELIEF OF THE POOR...................... 445
Statistical Tables 447
Hospitals 449
Statistical Table 450
Pauperism in the City and County of New York—Statistical Table................ 451
Dispensaries 452
Statistical Table........................ 453
Nurseries and Foundling Hospitals........ 454
Homes and Asylums for the Aged and Infirm 454

LIST OF ILLUSTRATIONS.

	PAGE.
1, On the Mississippi, ... (*Steel plate.*)	
2, Fancy Title, ... (*Steel plate.*)	
3, Continental Bills, ...	2
4, The Beginning, ...	17
5, The Aborigines, ...	18
6, Farming Tools of 1790, ...	28
7, Farming Tools of 1860, ...	29
8, Excelsior Mower, ...	33
9, Wheeler's Patent Reaper, ...	34
10, Landing at Jamestown, . (*Steel plate,*)	37
11, Milch Cow, ...	43
12, Short-horn Bull, ...	43
13, Jenny, Devon Cow, ...	44
14, Devon Bull, Tecumseh, ...	45
15, Ayrshire Bull, ...	46
16, Petersham Morgan, ...	55
17, Trotting Childers, ...	56
18, Cotswold Sheep, ...	57
19, Improved Kentucky South Downs, ..	58
20, Southern Pine-woods Hog, ...	61
21, Western Beech-nut Hog, ...	61
22, Improved Suffolk, ...	61
23, Improved Essex, ...	62
24, Berkshire Hog, ...	62
25, The Pasture, ...(*Steel plate,*)	83
26, Cotton cleaning by hand, ...	112
27, Cotton Gin, ...	112
28, Picking Cotton, ...	125
29, Gathering Sugar Cane, ...	126
30, Commerce, ...	131
31, Clipper Ship, ...	149
32, Wall street, ... (*Steel Plate,*)	159
33, Bridle Path, ...	171
34, Stage Coach, ...	171
35, Canal, ...	171
36, Railroad, ...	171
37, Captain Bunker's Sloop, (*Steel plate,*)	180
38, Flat Boat on the Mississippi, ...	182
39, Mississippi River Steamer, ...	182
40, First Locomotive on Mohawk Valley Road, ...	194
41, Hudson River Steamboat, ...	194
42, Emigrating at the present time, ...	198
43, Emigrating in 1805, ...	199
44, Second experimental Boat of J. Fitch,	226
45, The first Steamboat ever built to carry passengers, ...	226
46, The first Propeller ever built, ...	235
47, Oliver Evans' Orkuter Amphibolus, ..	235
48, The machinery of Fulton's first boat,	236
49, The North River, off Claremont, ...	236
50, The Adriatic, ...	237
51, Amoskeag Locomotive works, ...	247
52, Silsby's Fire Engine, ...	261
53, Caloric Engine, ...	262
54, Hand Loom, ...	278
55, Power Loom, ...	278
56, Spinning by hand.	279
57, Mule Spinner, ...	279
58, Hand Carding, ...	299
59, Colt's Sporting Rifle, ...	329
60, Colt's Military Rifle, ...	329
61, Colt's new Model Revolver, ...	329
62, Colt's Revolving Pistol with Carbine Breech attached, ...	329
63, Colt's Holster Pistol, ...	329
64, Colt's Revolving Shot Gun, ...	330
65, Colt's Military or Revolving Rifle, ...	330
66, Iron-clads and Monitors, ... (*Steel plate,*)	338

PAGE.
67, View of Chickering & Sons' Piano Forte Manufactory, ... 352
68, Wagons of 1810, ... 363
69, Wagons of 1820, ... 363
70, Wagons of 1825, ... 363
71, First Elliptic Spring Wagon, ... 363
72, Jagger, ... 363
73, Gazelle, ... 363
74, English Pheaton, ... 364
75, Box Jump Seat, ... 364
76, World's Fair Buggy, ... 364
77, Eureka Jump Seat, ... 364
78, Child's Seat Drop Front, ... 364
79, Crescent City, ... 364
80, Lawrence Brett, ... 364
81, Loop Calash, ... 364
82, Doctor's Phaeton, ... 365
83, Full Top Cabriolet, ... 365
84, Champion, ... 365
85, Prince of Wales, ... 365
86, Dayton Brett, ... 365
87, City Coupe, ... 365
88, Brewster Calash Coach, ... 365
89, Coup Rockaway, ... 365
90, Premium Top, ... 366
91, View of G. & D. Cook, & Co's Works, 366
92, Castors, ... 373
93, Cake Dish, ... 373
94, Oyster Dish, ... 373
95, Toast Fork, ... 373
96, Meat Dish, ... 374
97, Cups, ... 374
98, Goblets, ... 374
99, Tea Set, ... 375
100, Dish Covers, ... 375
101, Coffee Pot, ... 375
102, Urn, ... 375

PAGE.
103, Tea Set and Tray, ... 376
104, Spoon and Fork Case, ... 376
105, Whale Fishery, ... 379
106, Cod Fishery, ... 380
107, The Great Callender Machine, ... 407
108, Ficus Elastica,—Rubber Plant, ... 407
109, Cutting Rubber, ... 407
110, Machine for Washing Rubber, ... 408
111, India Rubber Grinding Mill, ... 408
112, Past, ... 413
113, Present, ... 413
114, Lock Stitch, ... 413
115, Wheeler & Wilson's Sewing Machine ready for work, ... 415
116, Front View, ... 415
117, View with Cloth Plate removed, ... 415
118, Section IV, showing Lock Stitch, ... 416
119, Section V, ... 416
120, Section VI, ... 416
121, Cloth Plate reversed, ... 416
122, Feed Bar, ... 416
123, Hemmer, ... 416
124, Singer's Sewing Machine No. 2, ... 417
125, Family Machine, ... 417
126, Transverse Shuttle Machine, ... 417
127, Machine in Cabinet Case, ... 417
128, Hand Sewing by Candle Light, ... 418
129, Finkle & Lyon's Family Sewing Machine, ... 418
130, Large Manufacturing Machine, ... 418
131, Medium Machine, ... 418
132, The Chain Stitch, ... 424
133, The Shuttle and Lock Stitch, ... 424
134, View of Grover & Baker's Warehouse, 427

THE BEGINNING.

EIGHTY YEARS' PROGRESS.

AGRICULTURE IN THE UNITED STATES.

I SUPPOSE it will be conceded that agriculture is the largest and most important interest of this country. It is my purpose to trace its progress from the time of the establishment of the first settlements upon these shores, but more especially during the last hundred years. If I mistake not, a sketch of its history will be found to possess much that is interesting, useful, and instructive.

It is not necessary to dwell upon the condition of America at the time when it was first settled by Europeans. The character and the objects of the men who proposed to establish a home here, are already familiar to the mind of every intelligent person. They left countries which were considerably advanced in civilization, and better cultivated, probably, than any others, at that time, on the globe, with the exception, possibly, of the Chinese empire. They came to settle down in circumstances wholly new to them, with a climate and soil unlike any which they had known before. They were to begin life anew, as it were, where their previous experience could afford them little or no aid, in a wilderness which was to be subdued by their own hands, in the midst of a thousand obstacles.

With the exception of some extensive tracts of prairie, chiefly confined to the great west, then wholly unknown and inaccessible, there was no large extent of territory which was not covered with the primeval forest, though here and there a partially cultivated opening occurred, which was, or had been, occupied by the Indians. They were, therefore, to start anew; to acquire, painfully and laboriously, that practical knowledge of their new situation, for the details of which no previous training could have fitted them. When we consider the hardships they had to encounter, especially that portion of them who had to endure, year after year, the rigor of a northern winter, we cannot wonder that their progress in farming was slow.

It is true, the different colonies, as they were originally established, had a somewhat different experience. The winters of Virginia were less severe than those of New England. The settlers on the James river suffered less, probably, than those further north, but all had to undergo many privations which are unknown to an old and improved country. All were surrounded by a howling wilderness, by savage men, by wild beasts ready to prey upon their live stock, or destroy their crops. In these respects the circumstances of the settlers in all parts of the country were nearly the same.

Let us look, for a moment, at the condition of things in the Plymouth colony, and we can gather therefrom a pretty correct idea of that in the other settlements. For many months after the arrival of the pilgrims at Plymouth, they had no beasts of burden, and when at last a few cows were brought over, they were poorly fed on the coarse wild grasses, and they often died from exposure and want of proper food, or fell a prey to the wolves or the Indians. Owing to the difficulties and expense of importation, the price was so high as to put them beyond the reach of many, even in moderate circumstances. In the colony of the Massachusetts Bay, a red calf soon came to be cheaper than a black one, on account of the greater liability to be mistaken for a deer and killed by the wolves. When cows were so high as to sell, in 1636, at from twenty-five to thirty pounds sterling, and oxen at forty pounds a pair, a quart of new milk could be bought for a penny, and four eggs at the same price.

It is important to bear in mind that the cattle of that day, even in England, were not to be compared with the beautiful animals now to be seen there. The ox of that day was small, ill-shaped, and in every way inferior to the ox of the present time. The sheep has, since then, been improved to an equal, or even greater extent, both in form and size, and in the fineness and value of its wool. The draught-horse, so serviceable on the farm, long the pride of London, and now, to an almost equal extent, of most of our large cities, was not then known. It is difficult to appreciate fully the changes which the increased attention to agriculture has effected in our domestic animals, even within the last half century.

But when we consider that no attention whatever was paid to the culture of the grasses; that very few, if any, of the vegetables, now extensively cultivated as food for stock, were then introduced there; that the introduction of red clover into England did not take place till 1633; of sainfoin, not till 1651; of yellow clover, not till 1659; and of white, or Dutch clover, not till the year 1700; and that the form, size, and perfection of animals depend largely upon a full supply of food and good care when young, we shall cease to wonder, when we are told by the highest authority, that during the early part of the last century the average gross weight of the neat cattle brought for sale to the Smithfield market was not over three hundred and seventy pounds, and that of sheep, twenty-eight pounds; while the average weight of the former is now over eight hundred pounds, and of the latter, over eighty pounds.

It is a fact worthy of note in this connection, as it throws much light upon the early farming in this country, that the extensive and practical cultivation of the natural grasses originated here; or, at least, was introduced here long before it was into England. The necessities of our rigorous climate, indeed, compelled attention to this branch of husbandry very soon after the settlement, while the climate of England admitted a greater degree of reliance on the wild luxuriance of nature.

The cattle that first arrived, in 1624, were kept through the long winters on poor and miserable swale hay, or more frequently on the salt hay cut from the marshes, and death from starvation and exposure was no uncommon occurrence, the farmer sometimes losing his entire herd. The treatment of animals now as they were treated during the whole, or nearly the whole, of the first century of the colony, would subject the owner to prosecution for cruelty. This treatment was, in part, no doubt, owing to the poverty of the settlers, but more, probably, to the ideas and practices in which they had been early trained in a different climate.

Besides, on account of the high price of cattle at that period, and the risks to which they were exposed, it is not probable that the settlers selected the best specimens then to be found in England. There is no evidence that they were at all particular in this respect. Nor was the difficulty of procuring agricultural implements the least of the obstacles to the successful pursuit of farming. A few, no doubt, were brought over, from time to time, from the mother country, but all could not obtain them in this way; while the only metal to be had was made of bog ore, very brittle, and liable to break and put a stop to a day's work. Most were made of wood, and those imported were extremely rude in construction, being very heavy and unwieldy, and having comparatively little fitness for the purpose for which they were designed. The process of casting steel was not discovered till the middle of the last century, and then it was kept a secret in Sheffield for some years. The number and variety of implements have been infinitely increased, as we shall see, even within the last half century, to meet the wants of a more advanced state of agriculture, to which, indeed, these mechanical improvements have, in their turn, largely contributed.

Indian corn, pumpkins, squashes, potatoes, and tobacco, were plants which few of the early colonists had ever seen previous to their arrival here, but necessity taught them their value, and they were not slow in adopting the Indian methods of cultivating them. As the general cultivation among the colonies continued much the same for many years, with slight modifications, on the introduction of the European implements, it may not be inappropriate to turn our attention, for a moment, to the agriculture of the natives.

Most of the hard work among the Indians, it is well known, fell to the lot of the women, with the assistance, sometimes, of the old men and little boys. Among their thankless tasks was that of farming, which they carried on to an extent quite remarkable, when we consider the rudeness of the implements with which they had to work, and the circumstances in which they were placed. They had no art of manufacturing metal, and, of course, could have no suitable contrivances for tilling the ground. Their cultivation was not so rude, however, as one would naturally suppose. They made a kind of hoe by tying the shoulder-blade of a moose, bear, or deer, to a stick or pole, and managed to do much of the work with that.

The land, when selected, was cleared by keeping up a fire around the foot of each tree till its bark was so burned that it would die. Then they planted their corn. When a tree fell, it was burned into pieces of such length that they could be rolled into a heap and burned to ashes. In this way, by degrees, a piece covered with wood was wholly cleared. An industrious woman could burn off as many dry, fallen logs in a day as a strong man could, at that time, cut with an axe in two or three. They used a stone axe, made much in the same manner as the hoe above described, to scrape the charred surface of the logs and hasten the burning. This mode of clearing was pretty common among the natives in different parts of the country. Sometimes the tree was first girdled with the axe and thus killed, allowed to become dry, and then burned by kindling a fire around it, as above described. Several of these stone axes, of different sizes, are now in my possession.

The Indians taught the settlers to select the finest ears of corn for seed, to plant it at a proper time, to weed it, and to hill it. They were accustomed to dig small holes four feet apart, with a clumsy instrument resembling the one described, which was made, not unfrequently, of a large clam-shell. Those living in the vicinity of the sea-shore put into each hole a horse-shoe crab or two, or a fish, upon which they dropped four, and sometimes six kernels of corn, and covered it with the implement with which they had dug the hole. The use of fish in the hill as a fertilizer was common, also, in the interior. Beans were planted with the corn after it had come up, and grew up supported by it.

Great attention was paid to the protection of their crops from weeds, while the corn was carefully guarded from destruction by insects and birds. To prevent loss by the latter, a small watch-house was erected in the midst of a field of corn, in which one of the family, often the eldest child, slept, and early in the morning rose to watch the birds. It was their universal custom to hill the corn, often from one to two feet high, for its support, and spots are often seen at the present day which were evidently cultivated by them. The colonists very generally imitated this custom, and it has been continued down to our own times in many parts of the country. The men planted and cured their tobacco, which was, ordinarily, the only plant they worked upon, the women managing all the rest.

This brief sketch of the farming of the Indians would not be complete without an allusion to their mode of storing grain for their winter supply. Large holes were dug in the earth, and the sides carefully lined with bark; this was also the work of the women. The corn and the beans, after being dried in the sun, or on rocks or flakes over a fire, were thrown into these holes, and then they were covered up level with the surface of the ground. They were thus preserved, if necessary, through the winter. These excavated barns were carefully concealed by the women from their lazy husbands and sons, lest they should discover and eat up their contents; yet, with all the care they could take, the hogs of the colonists often unhinged their barn-doors, and helped themselves to the golden treasure. History says that one of these Indian barns was discovered by the pilgrims at Truro, at a time when their store of provisions was so reduced as to contain but five kernels of corn to each individual.

They sometimes made additional provision for winter by means of large boxes of wicker-work, or bags or sacks of hemp, which were filled and kept in the wigwam for the more immediate wants of the family. They had, of course, little or no occasion to cut grass, though it grew in abundance along the marshes and the rivers, and in places which had been cleared for cultivation. It was of a coarse quality, and served the colonists a good turn till they resorted to the cultivation of better.

We may imagine the surprise of the natives at the first sight of a plough. They could not understand so complicated a machine. They wanted to see it work; and when it tore up more ground in a day than they, with their clam-shells, could scrape up in a month, and they saw the colter and the share to be of iron, they told the ploughman if he was not the devil himself, he was very much like him.

The first sight of a ship, it is recorded, had excited their wonder even to a greater extent. To them it was a floating island; its masts were nothing but trees; its sails were clouds; its discharge of guns was thunder and lightning; but as soon as the thunder and lightning ceased, they pushed off their canoes to go and pick strawberries on the island!

This cursory glance at the early surroundings of the settlers of the country, will enable us the better to comprehend the difficulties in the way of making rapid progress. When poor and miserable cattle, poor and miserable implements, poor and miserable ideas of farming were the best of every thing they had, we can well imagine that little was done which was not forced upon them by the pressure of necessity. Their wants were too many, and required too vigorous exertions to provide what was indispensable, to admit of their spending time to experiment or seek out new principles to be applied to practical farming. As long as new lands could be had almost for the asking, it was not to be expected that they would till them very thoroughly. The soil was rich in mould—the accumulation of ages—and did not require very careful cultivation to secure an abundant return. But years of constant cropping exhausted its productiveness, when other lands were taken to subject to the same process. The farmer raised wheat year after year on the same land, till the soil became too poor, and then he planted corn; and when it would no longer grow corn, he sowed barley, or rye, and so on to beans.

Agriculture, so far as any real improvement was concerned, was, therefore, naturally enough, in a state of extreme depression for more than a century and a half after the establishment of colonies in various parts of the country. There were few intelligent cultivators previous to the Revolution, and there was no spirit of inquiry to give a charm to farm labor. It was performed as an evil which must be endured from stern necessity. Hard work was the order of the day. The forests were to be cleared, the buildings for shelter erected, the stone walls to be laid, and little time or inclination was left for the "humanities" of life.

The inhabitants of country towns, a hundred years ago, most of whom were, of course, engaged in tilling the soil, seldom visited even their neighboring towns, and many a farmer and farmer's son did not leave his own township from one year's end to another. The liberalizing influence of social intercourse was unknown and unappreciated, unless the village tavern and the frequent glass might be considered as forming an exception, while it afforded an opportunity, of which most men availed themselves, of forming new acquaintances and talking over the stale gossip of the neighborhood, or indulging in the ribald jest.

People for some miles around turned out to a "raising," as the erection of a frame building was termed, and a merry time it was, where the flip and the cider flowed like water. On a more limited scale, the "huskings" brought together, also, a pretty large neighborhood, when the same favorite drinks did much to enliven a long autumn evening, the whole being followed by a sumptuous repast of pumpkin pies, etc., continued into the small hours of the night. Then the "spinning bees" afforded a time for talk, and song, and riddle. Election day often, however, brought the people from a greater distance.

No butcher drove up to the farmer's door, with his ever fresh supply of meats, to give variety to the daily and homely fare; no baker, with his jingling bells, travelled his rounds on stated days to relieve the monotony of the housewife's toil. Salted meats were the almost universal food from autumn till spring, and often from spring till autumn, though now and then a sheep or a lamb fell a victim to the necessity for change. No cottons, no calicoes, no ginghams, no linens, no flannels loaded the counters of the village store, to be had at a sixpence, or a ninepence, or a quarter a yard. The farmer, and the farmer's family, wore homespun, and the spinning-wheel and the huge timber loom were a part of nearly every household furniture, and their noise was rarely silenced. If linens were wanted, the flax was sown, and weeded, and pulled, and rotted, and broken, and swingled—for all of which processes nearly a year was required before the fibre was ready for spinning, and bleaching on the grass, and making and wearing. If woollens, the sheep were sheared, and the wool dyed and got in readiness, and months were often required before it could be got into shape for wearing. Courtships were, therefore, of longer duration than many of them now-a-days, and two years was about as soon as the betrothed farmer's daughter could get ready to go to keeping house. Not unfrequently the flax had to be sown as the preliminary step, and to pass through all its forms of transition into cloth and garments. With our present facilities for manufacturing by machinery every conceivable variety of fabric, and that, too, in the shortest space of time, it is impossible to appreciate fully the state of things among all classes of society a century ago. Even the old processes of curing and preparing flax, and the variety of fabrics made from it, have undergone an entire change. Processes which then required many months to complete, are now wholly avoided by the more perfect and economical ones at present known and in constant use.

Owing to the imperfect provision for schools for the great body of the people, the boy was trained up to a narrow routine of labor, as his fathers had been for a century before. He often affected to despise all intelligent cultivation of the soil, and not only scrupulously followed the beaten track, but was intolerant of all innovation, simply because it was innovation. Very few of the rural population of that day saw a newspaper or a journal of any kind. There were not, probably, a dozen published in the whole country a century ago. There was not one in New England at the beginning of the last century, and but four in 1750, and these had an extremely small circulation beyond the limits of the metropolis.

Obstinate adherence to prejudice of any kind is now generally regarded as a mark of ignorance or stupidity. A century ago, the reverse was the case. In many a small country town a greater degree of intelligence—except on the part of the parson and the doctor—than was possessed by his neighbors, brought down upon the possessor the ridicule of the whole community. If he ventured to make experiments, to strike out new paths of practice and adopt new modes of culture; or if he did not plant just as many acres of corn as his fathers did, and that, too, in "the old of the moon;" if he did not sow just as much rye to the acre, use the same number of oxen to plough, and get in his crops on the same day; or if he did not hoe as many times as his father and his grandfather did—if, in fine, he did not wear the same kind of homespun dress and adopt the same religious views and prejudices, he was shunned in company by the old and young, and looked upon as a visionary. He knew nothing of a rotation of crops. The use and value of manures were little regarded. Even so late as within the memory of men still living, the barn was sometimes removed to get it out of the way of heaps of manure by which it was surrounded, because the owner would not go to the expense of removing these accumulations and put them upon his fields. The swine were generally allowed to run at large; the cattle were seldom or never housed at night during the summer and fall months; the potato patch often came up to the very door, and the litter of the yard seldom left much to admire in the general appearance of things about the barn or the house. Farmers thought it necessary to let their cattle run at large very late in the fall, and to stand exposed to the severest colds of a winter's day, "to toughen." It was the common opinion in the Virginia colony, that housing and milking cows in the winter would kill them. Orchards had been planted in many parts of the country, but the fruit was, as a general thing, of an inferior quality, and used chiefly for the purpose of making cider.

This is no picture drawn from the imagination. It is strictly and literally true of the farming of the country as a whole, a century ago, though it should be remarked that a slightly modified state of things existed in localities widely distant. But with some differences in detail, it will be found to be consonant with historical facts.

It would be extremely interesting, were it in our power, to support, by accurate statistics, this general view of the condition of farming during the last century, but, unfortunately, no reliable statistics were taken till the year 1790, and then, chiefly to ascertain the number of the population, with special reference to the distribution of the representation, or the political power of the several states. We are, therefore, wholly destitute of statistical information of the products of farming industry during the last century;

nor was it till the fourth decennial census, in 1820, that the population was divided according to industrial pursuits, so that we have no means of ascertaining even the number engaged in the occupation of farming. We only know that the general estimate of the population at the time of the Revolution, which fixed it at three millions, was considerably too high.

The occurrence of the Revolution, and the period immediately succeeding, very naturally brought men of all pursuits and from all parts of the country more frequently and closely together, and gave all classes, and farmers among the rest, a more general knowledge of what was passing in the world around them. Intercommunication became more easy and frequent, and had its influence upon the masses of the people. In the latter part of the last century many left the seaboard and removed to the interior to avoid the inconvenience arising from the difficulties between this and the mother country, and for other reasons; more attention began to be paid to agriculture. Emigration from the east began to set toward the so-called inexhaustible west, which at that time meant central or western New York.

Up to this point our survey of the condition of agriculture has necessarily been general. No one branch of farming had made any marked and perceptible progress. It has been said that a good strong man could have carried all the implements in use on the farm, except the cart and old clumsy harrow, upon his shoulders, fifty years ago, and we know that many a year occurred when grain, and even hay, had to be imported from England to keep the people and the cattle from starvation. Hereafter, it will be more convenient to trace the progress of the different branches of farm industry, and the means brought to bear in the development and improvement of agriculture, in a more distinct and separate manner, in order that we may get a clearer idea of the relative progress and influence of each. And first, of the origin and growth of

ASSOCIATED AND LEGISLATIVE EFFORT.

One of the characteristic features of the farming of the present day, is the extent to which associated effort is brought to bear upon all its details, by way of exhibitions, premiums, clubs for discussion, and the publication of reports for wide and gratuitous distribution. This enormous power of mind upon mind, by means of association or social intercourse, is of comparatively recent origin in this country. It can scarcely date back to the beginning of the present century, though the necessity of it had, even then, become impressed upon the minds of patriotic and public-spirited men.

On the 20th of July, 1794, Washington, then president of the United States, addressed a letter to Sir John Sinclair, in which he says: "It will be some time, I fear, before an agricultural society, with congressional aid, will be established in this country. We must walk, as other countries have, before we can run; smaller societies must prepare the way for greater; but, with the lights before us, I hope we shall not be so slow in maturation as older nations have been. An attempt, as you will perceive by the enclosed outlines of a plan, is making to establish a state society in Pennsylvania for agricultural improvements. If it succeeds, it will be a step in the ladder; at present, it is too much in embryo to decide upon the result." And again, in his annual address on the 7th December, 1796, when he met for the last time the two houses of Congress, he said: "It will not be doubted that, with reference to either individual or national welfare, agriculture is of primary importance. In proportion as nations advance in population, and other circumstances of maturity, this truth becomes more apparent, and renders the cultivation of the soil more and more an object of public patronage. Institutions for promoting it grow up, supported by the public purse; and to what object can it be dedicated with greater propriety? Among the means which have been employed to this end, none have been attended with greater success than the establishment of boards, composed of proper characters, charged with collecting and diffusing information, and enabled, by premiums and small pecuniary aids, to encourage and assist a spirit of discovery and improvement.

"This species of establishment contributes doubly to the increase of improvement, by stimulating to enterprise and experiment, and by drawing to a common centre the results, everywhere, of individual skill and observation, and spreading them thence over the whole nation. Experience, accordingly, has shown that they are very cheap instruments of immense national benefit."

Some few individuals, even before this date, had felt the necessity for some such action as would lead to the development of the agricultural resources of the country, and as the result, the South Carolina Agricultural Society had been established in 1784, and still exists. The Philadelphia Society for the Improvement of Agriculture was formed in the same year, or the year after, followed by a similar association in New York in 1791, which was incorporated in 1793. The Massachusetts Society for Promoting Agriculture was incorporated in 1792, and soon after commenced the publication of a series of papers known as the *Agricultural Repository*, which, for sound good sense and judicious suggestion, challenges comparison with any similar series ever published. It should be stated, however, that the prime movers in the formation of these societies were not men actually engaged in farming, though many of them were owners of fine estates. The mass of farmers were not, as yet, fully prepared for this progressive effort, and all the agricultural teachings of educated and scientific men prove unavailing, unless the people themselves, the actual tillers of the soil, are prepared to receive and profit by their teachings. Many years elapsed after these early efforts were made, before the habit of reading became sufficiently common among the masses of practical farmers to justify the expectation that any general benefit would arise from the annual publication of the transactions of these societies.

There was little or no disposition in the community to examine the subject, and they failed to excite any spirit of emulation in the public mind. The improvements proposed fell almost dead upon the people, who rejected "book farming" as impertinent and useless, and knew as little of the chemistry of agriculture as of the problems of astronomy. A quarter of a century, however, effected some change, and in 1816 the Massachusetts society held its first exhibition, at Brighton, at which a list of premiums was offered, and a ploughing match instituted, not so much with the object of improving the plough as to try the strength and docility of the oxen. But the plough-maker happened to be there, and to have his eyes open; and since that day, an amount of knowledge has been brought to bear upon this implement sufficient to bring it very near perfection.

The first national society established with this specific object in view, is believed to have been the Columbian Agricultural Society for the Promotion of Rural and Domestic Economy, organized at a convention held in Georgetown, D. C., on the 28th November, 1809; and the first agricultural exhibition in this country was, probably, one held by that society in Georgetown, on the 10th of May, 1810, when large premiums were offered for the encouragement of sheep raising, etc. In the October following, in the same year, Elkanah Watson exhibited three merino sheep under the great elm tree in Pittsfield, Mass., which was the germ of the Berkshire County Agricultural Society, whose regular exhibitions began the year following, and are believed to have been the first county exhibitions ever instituted in this country. To show the feeling with regard to what was, at that time, considered an innovation, in a strictly farming community, the projector of that society encountered the opposition and ridicule of all classes of society, from the moment the proposition was made. It was viewed by many with contempt. Gradually, however, the feelings of the people were enlisted in its favor, premiums were offered and awarded, and a large concourse, from all parts of the county, increasing rapidly from year to year, showed clearly that something had reached the heart of the community.

But though this was the first county exhibition, so far as I am informed, it was not the first county society that was formed. The Kennebec Agricultural Society was instituted at Augusta in 1800 and incorporated in 1801, being the second society incorporated within the limits of Massachusetts, to which Maine, at that time, belonged. A voluntary association of the Middlesex husbandmen had also been formed in 1794, and incorporated in 1803, under the name of the Western Society of Middlesex Husbandmen.

These were some of the early efforts in this direction, and though they, like other similar attempts, met with some opposition on the part of the very class they were intended to benefit, the increasing intelligence of the people very soon enabled them to live it down. Now we have more than a thousand similar associations, all striving, by the offer of premiums, and by bringing together the best products of the farm and the garden, to encourage improvement and stimulate enterprise. Almost every state in the Union has its state society, and almost every county, and, in some of the states, every county, has its county organization. And what is the result? It is well known that by far the largest and most valuable part of our practical knowledge is that which is got in our intercourse with our fellow men, with those who are engaged in the same pursuits and have the same interests as ourselves. The farmer has, therefore, gained, and is gaining a vast amount of information, much of which he can apply to advantage on his farm. Emerging from his naturally isolated position, he has become a more social being. More frequent contact with others, by way of competition, has stimulated mental activity. Contrast him now with his father on the same farm half a century ago, and see if there is not some improvement that can be traced to the social influences of the agricultural clubs and societies.

In addition to these societies, most, if not all of which are encouraged by the several states in a substantial manner, there exist, in some of the states, boards of agriculture, organized as departments of the state government, and having a general supervision of the societies, receiving their official returns, and publishing an abstract of the most valuable papers presented, for general distribution.

I do not think it is claiming too much for the agricultural societies throughout the country, to say that the general spirit of inquiry in relation to farm improvements, and much of the enterprise manifested by farmers of the present day, is due to their efforts. The most impartial judgment would, in fact, go much further than this, and say that a large proportion of the actual improvement that has been made in farm stock, farm implements, and farm products, may be traced, directly or indirectly, to the influence of the agricultural associations of the country.

To appreciate this influence it is only necessary to consider the immense facilities which a well-conducted exhibition gives, not only to the agricultural mechanic for making known the nature and value of his improvements, but to the farmer for becoming acquainted with them. Many an invention would have slumbered in oblivion, or enjoyed only a limited and local fame, had it not been for the multitudes brought together at the state, county, and town fairs, which, it will thus be seen, furnish a most admirable medium of communication, both to the mechanic and the farmer, making it for the interest of both to attend and avail themselves of the facilities offered them. Thus a great public interest is served, notwithstanding the individual mechanic or inventor may have his own interest chiefly at heart.

And what is true with regard to agricultural implements, is true to nearly an equal extent of every thing else brought for exhibition to the fairs of the societies. A farmer sees fruits that he knew nothing of, and could not obtain otherwise. He knows who presented them, secures the same for his own farm, and within five years can present as good samples himself. He sees animals brought to a degree of perfection of which he had never, perhaps, conceived. Thought is excited. He asks himself whether they are more profitable than his own; procures them, perhaps, and thus an improved stock is disseminated over the country to take the place of that which is inferior, but which costs the individual nearly or quite as much to keep as that more valuable and profitable.

I need not enlarge upon this point. Enough has been said, I think, to show that the modern system of associated effort is a most decided progressive movement; but let us trace out more in detail some of its results. And first, in the multiplication and improvement of

FARM IMPLEMENTS.

There is, perhaps, no branch of farm economy in which the progress of improvement has been so apparent and unquestionable, as that made in the implements of agriculture during the last half century. It might almost be said that progress in agriculture itself may be measured by an increased demand for new and better implements, as the advance in civilization is shown by a greater demand for comforts and luxuries by the people.

There was a time, as we have seen, in the history of American farming, when labor was cheap, when strong limbs and the power of endurance were the requisites chiefly sought for in the hired man, and when his labor was paid for as so much brute, physical force. Intelligent labor, skill, and thought found higher rewards in other callings, and the practical farmer was thought to be sufficiently well informed if he was able to hold plough, to mow, to sow, and to reap. The labor—the physical force necessary to carry on the operations of the farm—could be obtained very easily in those days, and it was natural that farmers should be satisfied with the limited variety of implements then in use. The isolated position in which they were placed, their limited opportunities for travel and observation, the difficulties, in fact, of getting about among people engaged in the same pursuits, all helped to strengthen prejudice and foster a repugnance to try new and unused implements, or to strike out into new fields of experiments. Besides these obstacles in the way of improvement, the progress then made in the various branches of mechanics was extremely limited, and the adoption of new and improved implements must follow, of course, in the wake of mechanical invention. The few rude and imperfect implements in use at an early day were, for the most part, of home manufacture, or made by the neighboring blacksmith, who had a thousand other things to make at the same time. There was little idea of a division of labor. Jack at all trades was good at none.

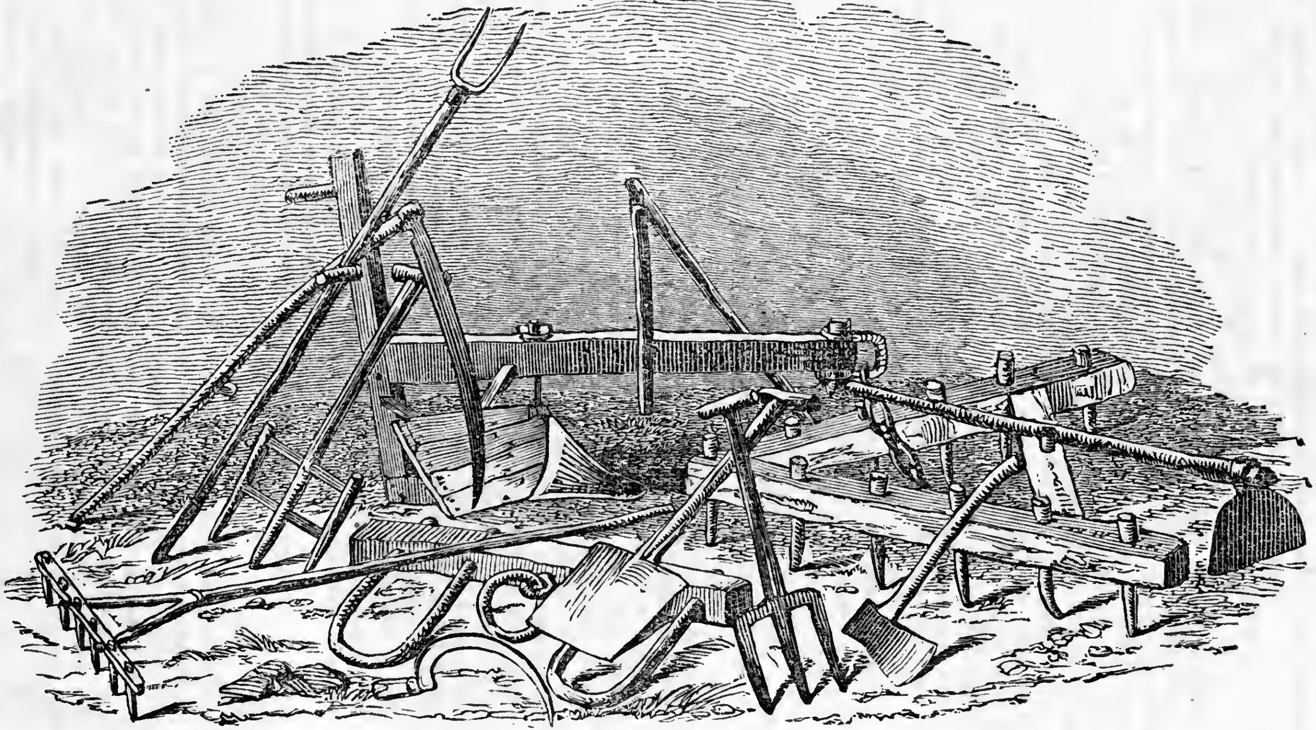
As early as 1617, some ploughs were set to work in the Virginia plantation, but in that year the governor complained to the company that the colony "did suffer for want of skilful husbandmen, and means to set their ploughs on work; having as good ground as any man can desire, and about forty bulls and oxen, but they wanted men to bring them to labor, and iron for the ploughs, and harness for the cattle. Some thirty or forty acres we had sown with one *plough*, but it stood so long on the ground before it was reaped, it was most shaken, and the rest spoiled with the cattle and rats in the barn." This complaint had some effect, for, in 1648, a cotemporary resident says: "We have now going near upon a hundred and fifty ploughs," and they were drawn by oxen.

It is recorded that in 1637 there were but thirty-seven ploughs in the colony of Massachusetts Bay. Twelve years after the landing of the pilgrims, the farmers about Boston had no ploughs, and were compelled to break up the bushes and prepare for cultivation with their hands, and with rude and clumsy hoes or mattocks. It was the custom, in that part of the country, even to a much later period, for any one owning a plough to go about and do the ploughing for the inhabitants over a considerable extent of territory. A town often paid a bounty to any one who would buy and keep a plough in repair for the purpose of going about to work in this way. The massive old wooden plough required a strong and well-fed team to move it through the soil, a heavy, muscular man to press it into the ground, another to hold, and another to drive. We may judge, therefore, of the economy of the work it performed. What was true of the early period of the settlement, was true, to nearly an equal extent, for a hundred and fifty years, so far as the implements and the processes of farming are concerned. All these last were traditional, handed down from sire to son, and adhered to in the strictest manner. The implements consisted almost wholly of the plough, the spade, a clumsy wooden fork, and now and then a harrow. I have in my possession two of these wooden forks, made, and in use, at least a hundred and fifty years ago, in the Massachusetts colony. They were regarded as curious for their antiquity in the youth of the grandfather of the donor, who died some years ago, upward of ninety years of age. That would date them back nearly two centuries, perhaps.

At this time, the ploughs used among the French settlers in Illinois were made of wood, with a small point of iron tied upon the wood with straps of raw-hide. The beams rested on an axle and small wooden wheels, the whole drawn by oxen yoked to the ploughs by the horns, by means of a straight yoke attached by raw leather straps, with a pole extended from the yoke back to the axle. The plough was very large and clumsy, and no small one was used by them to plough among the corn till after the war of 1812. The carts they used had not a particle of iron about them.

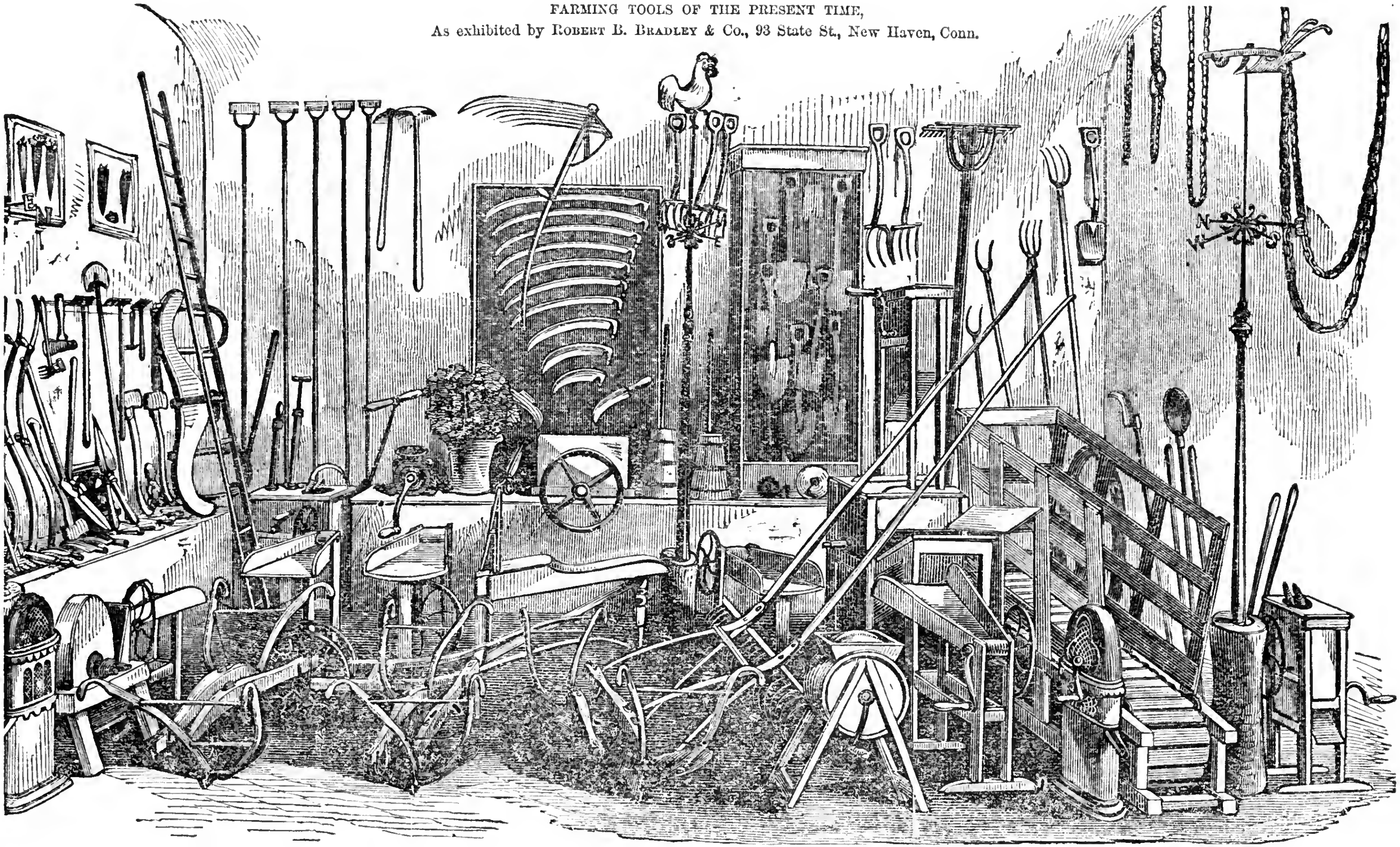
During the last century, the old "Carey plough" was more extensively used in the Atlantic states than any other pattern, though the particular form of this instrument varied almost as much as the number of small manufacturers or blacksmiths who made it. The Carey plough had a clumsy wrought iron share, a land-side and standard made of wood, a wooden mould-board, often plated over, in a rough manner, with pieces of old saw-plates, tin, or sheet iron. The handles were upright, and were held by two pins; a powerful man was required to hold it, and double the strength of team now commonly used in doing the same kind of work.

The "bar-side plough," or the "bull plough," was also used to some extent. A flat bar formed the land-side, and a big



FARMING TOOLS IN USE IN 1790.

FARMING TOOLS OF THE PRESENT TIME,
As exhibited by Robert B. Bradley & Co., 93 State St., New Haven, Conn.



clump of iron, shaped a little like the half of a lance head, served as a point, into the upper part of which a kind of colter was fastened. The mould-board was wooden, and fitted to the irons in the most bungling manner. The action might be illustrated by holding a sharp-pointed shovel back up, and thrusting it through the ground.

In the southern states, the "shovel plough" was in general use down to a very recent date, and is, indeed, to some extent, at the present day. It was made of a rough-hewn stick for a beam, with another stick framed in, upon the end of which a piece of iron, shaped somewhat like a shovel, sharp-pointed, was fastened. The two rough handles were nailed or pinned on to the sides of the beam, having a wooden prop, with a draft iron, or a raw-hide loop, at the forward end of the beam

Generally speaking, it might be said that the ploughs used in this country a century ago, were not very unlike those used by the old Romans before the Christian era, and by some of the people of southern Europe even at the present day. They were not unfrequently nor inaptly termed the "hog plough," on account, probably, of their propensity to root into and out of the ground. And in describing the plough, an adequate idea of all other kinds of farm implements—the variety, as we have seen, being extremely small—is clearly enough conveyed. These old-fashioned wooden ploughs continued, with little or no improvement, till after the beginning of the present century.

By far the greater part of the draught of the plough, or strength of team required, is due to friction in the soil. The cutting, raising, and turning over of the turf add comparatively little to the draught, though, it is true, the friction itself is somewhat increased by the weight of the plough, and this weight is, of course, increased by the weight of the furrow-slice as it is lifted from its bed. Hence, the draught of the plough is but slightly increased by an increase of speed, since the friction is not increased, but remains nearly the same on the bottom of the furrow, on the land-side, and between the furrow-slice and the mould-board, whether the motion be fast or slow. Modern improvements have aimed, therefore, to overcome the friction and resistance by an improved construction of the mould-board and by the use of better materials, for it is now well established, by practical experiment, that the draught depends less on the weight of the plough itself, than on its construction. The draught does not increase in proportion to an increase of weight, and hence, though some still object to the modern plough, as compared with the models in use fifty years ago, on account of their being heavier, yet it is a common remark that the draught is easier, and they require much less strength of team to do the same, or a far better work.

The excessive friction of the old-fashioned bull plough was the great objection to it. It was constructed awkwardly enough, in the first place, but the form of the mould-board was especially defective, and this it was that required such great strength of team. It did pretty fair work, no doubt, on light and easy soils, but the share and the mould-board were so attached, as to make the wedge too blunt, which, of course, made the friction excessive. It broke and crumbled the furrow-slice, in places, and was not calculated to turn a flat furrow. But the action of the old plough was not uniform, some furrows being set too much on the edge, while others were laid quite flat. It was not its weight so much as its form that needed improvement. Its construction not being based on such principles as to make it of easy draught, it was more difficult to hold, more easily thrown out of the ground, and required constant watchfulness on the part of the ploughman. It was difficult to cultivate to any depth without the help of one or two men to ride on the beam to "hold down." The mould-board was frequently shod with iron, as we have seen, to diminish the friction and prevent wear; but it was in strips, and uneven, and the desired effect was not always produced.

It is not too much to say that the changes and modifications made in the mould-board within the last forty years, have effected such improvements as to enable the farmer to do a much greater amount of better work, with far less expenditure of strength, and to reap larger crops as the result, while the original cost of the implement is less than it formerly was. The saving to the country from these improvements alone, within the last twenty-five years, has been estimated at no less than $10,000,000 a year in the work of teams, and $1,000,000 in the cost of ploughs, while the aggregate of the crops has been increased by many millions of bushels.

These improvements in the form of the

mould-board will be understood, when we consider that one side of the furrow-slice, as soon as it is cut, begins to rise gradually, till, as the plough advances, it is turned entirely over. The mould-board should be so constructed as to offer the least possible resistance as it moves along, and to run as far as possible without clogging, to which the old plough was especially liable, the lines of its mould-board being concave, instead of convex or straight, according to the rules more recently laid down requiring the "board to be composed of straight lines in the direction of its length, with continually increasing angles to the line of the furrow; and these last lines are severally straight, convex, and concave." Ransome, after the most mature study of this implement, says: "Although no one form of mould-board will, or can be applicable to every variety of soil and circumstance, there is no description of soil for which a perfect mould-board may not be made by this rule in some of its modifications."

Such was the condition of things with regard to this, and most other farm implements, at the close of the last and beginning of the present century, or till within the last forty or fifty years.

The first patent for a cast iron plough in this country, is believed to have been that of Charles Newbold, of Burlington, N. J., in 1797. This patent combined the mould-board, share, and land-side, all cast together. It was so great and manifest an improvement on the old wooden plough, that Peacock, in his patent of 1807, paid the original inventor of the plough of 1797 the sum of $500 for the privilege of copying some parts of it.

A cast iron mould-board had been invented in Scotland, it is proper to remark, as early as 1740, by James Small, but he still continued to use the wrought iron share, cast iron not being used in its construction till 1785. Small established a plough manufactory in 1763, and becoming familiar with the manufacture of cast iron, not long afterward, he conceived the idea of making patterns of the principal parts of the plough. But whether the American inventor had a knowledge of the existence of these ploughs is not known.

Such was the extreme importance of this implement, as to command the attention of scientific men in studying to improve its form and construction, and, in 1798, Thomas Jefferson applied himself to the task, and wrote a treatise on the form of the mould-board, discussing it on scientific principles, calculating mathematically its exact form and size, and especially its curvature, with a view to lessen its friction. I have seen his original manuscript of this essay, containing his drawings, etc., now in the possession of a gentleman of Boston. Since his time, such an amount of scientific and practical skill has been brought to bear upon this implement, as to leave little to suggest. But it should be stated that the successive improvements were not readily adopted by the mass of farmers. Their introduction was far slower than that of an improved implement would be at the present time, though the prejudice against the use of new inventions has not yet wholly disappeared. Many a farmer, clinging to the old wooden plough, asserted that cast iron poisoned the ground, and spoilt the crops. Still, the modern styles gradually gained ground, as real improvements always will. In one respect we have especially improved, and that is the adaptation of our ploughs to the different kinds of soil on which they are to be used. When attention was first directed to the improvement of this implement during the latter part of the last century, the principles of ploughing were not so well understood as at the present day. The work was neither so carefully done nor so critically examined, and, consequently, the want of different forms of the plough adapted to the varieties of surface and of soil was not so much felt as now, when nearly every farmer sees that he cannot produce directly opposite effects with the same implement. In another respect, also, custom has changed as much as the forms of the plough itself, for while a half century ago it was made by the blacksmith in nearly every small town in the country, it is now made in large establishments by those who devote themselves exclusively to the business, and these establishments have gradually diminished in number, while the aggregate number of ploughs has largely increased. In the single state of Massachusetts, for example, there were, in 1845, no less than seventy-three plough manufactories, making annually 61,334 ploughs and other agricultural implements, while in 1855 there were but twenty-two plough manufactories, making 152,686 ploughs, valued at $707,175.86. Up to the year 1855 there had been no less than three hundred and seventy-two patents issued from the Patent

Office at Washington, for changes and improvements on this implement.

I need not dwell upon the wonderful performances of the steam plough, the practical and successful operation of which is one of the proudest triumphs of modern agricultural mechanics and engineering. I need not dwell on the vastly increased facilities it will give for developing the resources of the west, through whose almost boundless prairies it will run unobstructed, like a thing of life.

The harrow naturally follows the plough, and is equally indispensable. It has, probably undergone fewer changes and modifications, if we except those made within the last ten years, than any other of our farm implements, most of the forms of the modern harrow in use bearing a close resemblance to those of the ancients, as illustrated on medals and sculptures. The old harrow, and that used by our fathers till within the memory of men still living, was made of wood, of simple bars and cross-bars furnished with teeth. More recently the material used has been of iron, with teeth commonly pointed with steel, and this has partly obviated the objections made to this implement on account of its great weight, which required too slow a motion on the part of the team.

A light, sharp-toothed harrow, moved quickly over the ground, accomplishes far the best work in preparing the soil for the reception of seed. So important is it that this implement should be rapidly moved, that the work of the same implement, drawn sluggishly over the ground, or moved more rapidly, differs very widely in its results. A certain amount of weight is very important, it is true, and this weight differs according to circumstances; but it is desirable to have it in the most compact form. The recent improvements, by which a complete rotatory motion is secured, together with a certain degree of flexibility gained by pieces of framework hinged together so that any part of the implement can be lifted or moved without disturbing the operation of the rest, seem to leave little to desire in respect to this important farm implement. This is a case, as well as that of the plough, of most decided improvement in an implement of very ancient date, handed down to us, in fact, from remote antiquity.

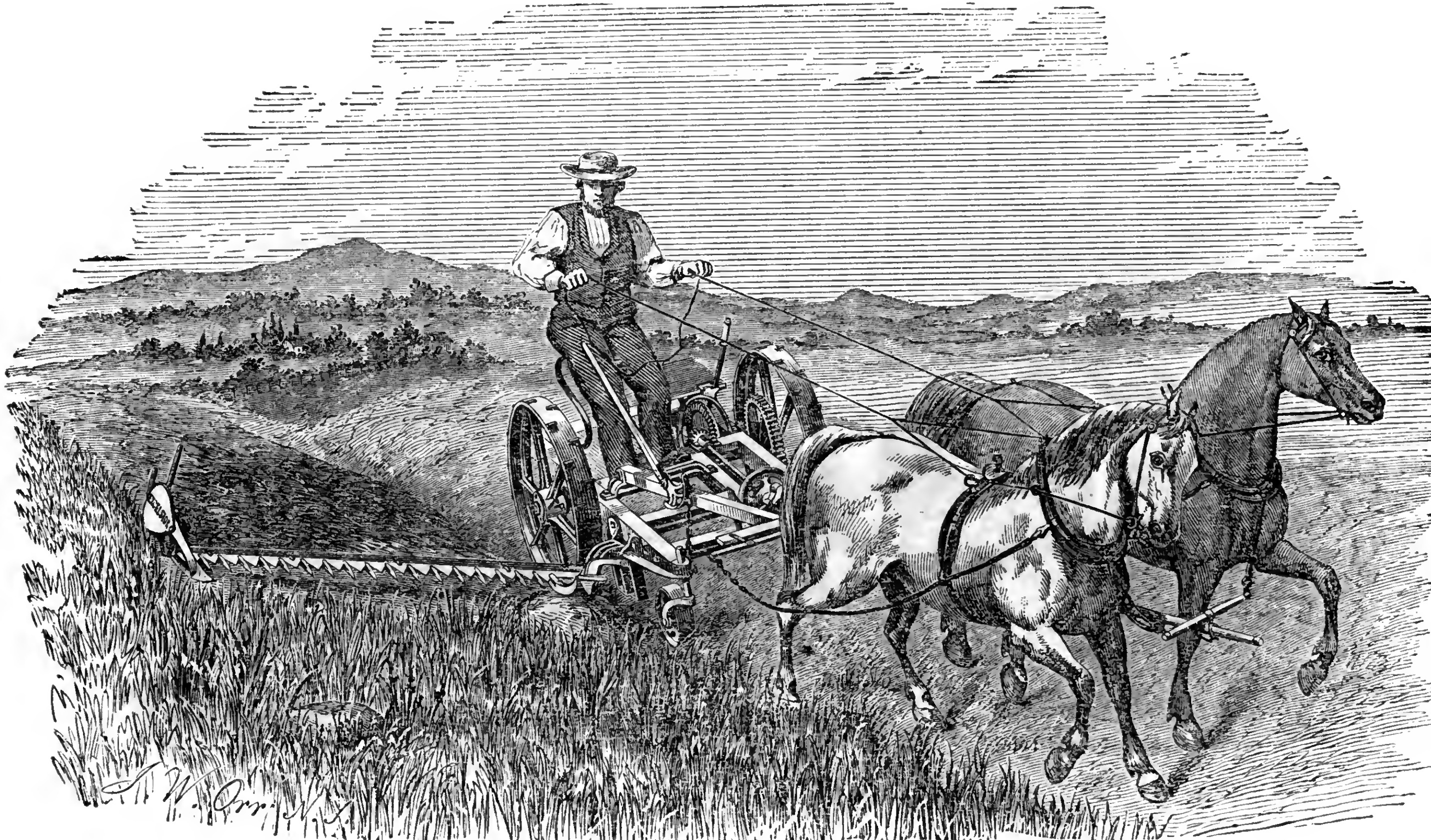
As specimens of important labor-saving implements of modern invention and construction, we may mention a large class known as horse-hoes, grubbers, cultivators, drills, seed-sowers, and others of like character. The seed-sowers and drills scatter the seed more uniformly than it could possibly be done by hand; dropping also, when it is desired, any concentrated or pulverized manure, and covering the rows. All the implements named, of which there is an infinite variety of forms, are most marked and decided improvements on manual labor, which was required by our forefathers for the same processes.

Another large class of implements, among the most important of modern inventions, are the various kinds of harvesters, particularly the reapers and the mowers.

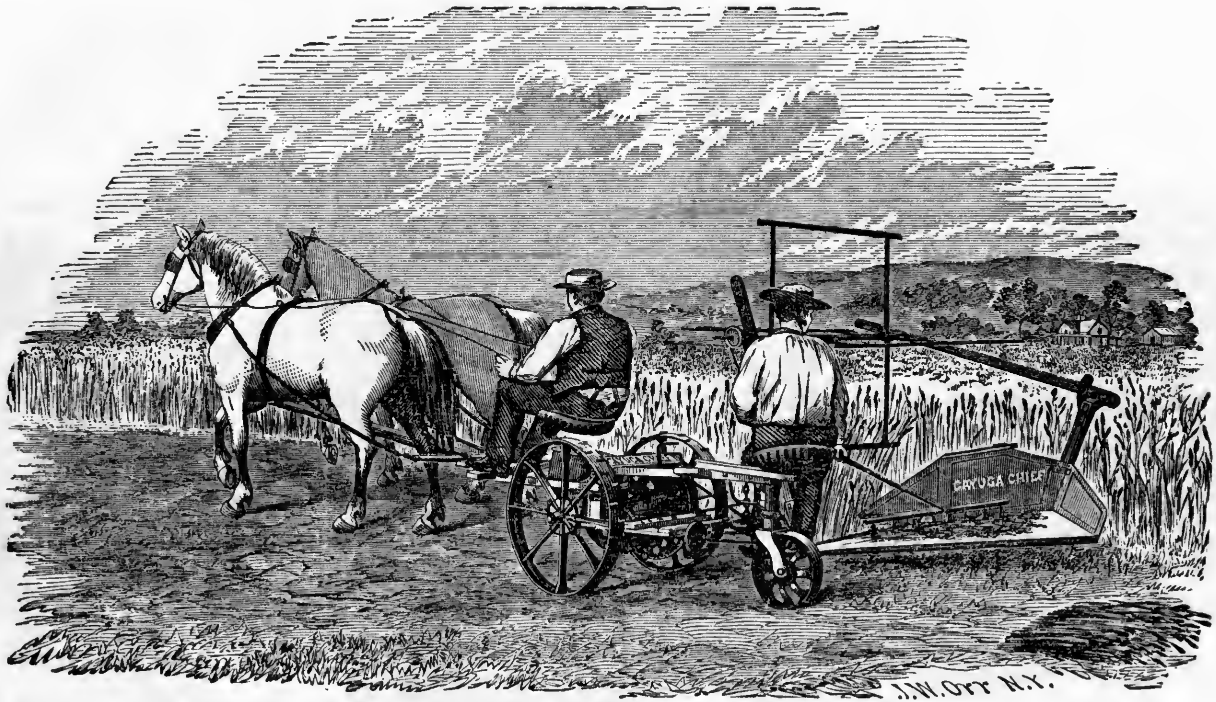
Many of our grain crops, like wheat, barley, and oats, come to maturity at nearly the same time. Wheat is liable to sprout in moist weather, and barley to become discolored if allowed to stand too long. The work of harvesting by the old method was necessarily slow and protracted. Previous to the introduction of the reaper, very large quantities of our most valuable grain were annually lost, owing to the impossibility of harvesting it properly and at the proper time. It is not, therefore, too much to say, that the successful introduction of the reaper into our grain fields has added many millions of dollars to the value of our annual harvest, not only by enabling us to secure the whole product, but also by making it possible for the farmer to increase the area of his cultivated fields, with a certainty of being able to gather in his whole crop.

The sickle, which was in common use for harvesting the grain crop till the introduction of the cradle, and, in fact, till a very recent date, was undoubtedly as old as Tubal Cain. No one who has had a practical experience of its use, bending over in the most painful position from "early morn till dewy eve," can fail to appreciate the immense saving of human muscle, and of slow and wearisome hand labor, by the introduction and use of the reaper.

It would have been an astonishing evidence of stupidity on the part of the ancients, who relied mainly on wheat and the other smaller grains, had they not tried, at least, to replace the sickle by something better. This they did, for it is recorded that the farmers of Gaul used a simple reaper, not long after the time of Christ. Pliny asserts that the inhabitants of that country fixed a series of



"EXCELSIOR MOWER" WORKING WITH THE CUTTER BAR ELEVATED AND RIGHT WHEEL PASSING THROUGH A DITCH.



WHEELER'S PATENT REAPER AT WORK.

knives into the tail-end of a cart, and this being propelled through the grain, clipped off the ears or heads, and thus it was harvested.

Many efforts were made in England and Scotland, at the beginning of the present century, to accomplish the same result, but with no great success. In the year 1833, Schnebley, of Maryland, obtained a patent on a machine for reaping grain; but that of Obed Hussey, of Baltimore, patented in the same year, has not only been successfully and somewhat extensively used from that time to this, in the western states, but has furnished the basis for the most successful models in this country, among the most noted of which are those of McCormick, of Virginia, and Manny & Atkins, of Illinois.

The American reaping machines have been brought to a high state of perfection within the last ten years. They have already a world-wide reputation. Their superiority is generally acknowledged, and the credit of having for the first time made the principles applicable to such machinery practically useful, undoubtedly belongs to our own ingenious mechanics. Five years ago the American machines were brought to trial at the exhibition at Paris, in competition with the world.

This trial took place in a field of oats about forty miles from the city, each machine having about one acre to cut. Three machines were entered for the first trial, one American, one English, and a third from Algiers, all at the same time raking as well as cutting. The American machine did its work in twenty-two minutes, the English in sixty-six, and the Algerian in seventy-two. At a subsequent trial on the same piece, when three other machines were entered, of American, English, and French manufacture, respectively, the American machine cut its acre in twenty-two minutes, while the two others failed. The successful competitor on this occasion, "did its work in the most exquisite manner," says a French journal, "not leaving a single stalk ungathered, and it discharged the grain in the most perfect shape, as if placed by hand, for the binders. It finished its piece most gloriously."

The contest was finally narrowed down to three machines, all American. Two machines were afterward converted from reapers into mowers, one making the change in one minute, the other in twenty. Both performed their task to the astonishment and satisfaction of a large concourse of spectators, and the judges themselves could not restrain their enthusiasm, but cried out "Good, good, well done," while the people hurrahed for the American reaper, crying out, "That's the machine, that's the machine!" "All the laurels," says the report of a French agricultural journal, "we are free to confess, have been gloriously won by Americans, and this achievement cannot be looked upon with indifference, as it plainly foreshadows the ultimate destiny of the new world!"

And so with the mowing machines. The hay crop of the country cannot be estimated at less than a hundred millions of dollars a year. It must be gathered at a season when labor is to be obtained with difficulty, and at even higher than the usual price of wages, and when the weather is often fickle and precarious, generally oppressively hot, making the task doubly irksome and unhealthy. But besides this, many acres of grass on our ordinary farms ripen at about the same time, which, if allowed to stand too long, will decrease in quantity and value of hay which might otherwise have been made from it. By the use of the mowing machine it can be secured and saved most quickly, easily, and cheaply.

Mowing is, at best, one of the severest of the labors of the farm, notwithstanding the efforts of poets and other writers to make us believe it is all fun. It calls into play nearly every voluntary muscle in the body, requiring not only the more frequent and regular movements of these muscles, but, on account of the twisting motion of the body, an unusually great exertion of muscular power. Nor does it require any small amount of skill to become a good mower, since it is proverbial that, unless the boy becomes accustomed to the scythe, and learns while young, he can never become a skilful mower. It is not at all surprising, therefore, that mechanical ingenuity should have been directed to shorten and lighten this severe operation.

The first mowing machine which met with any success in this country, is believed to have been that of William Manning, of New Jersey, patented in 1831, and which met with a limited success more than twenty years ago. In 1834 appeared the Ambler patent, simple in its construction, with a cutter bar of wrought iron, and a single smooth-edged knife, operated by means of a crank which gave it a vibratory motion. It was used in 1835 and 1836. A few other efforts were made about that time, and met with some slight success, but it was not till a recent date that the machine was constructed in a manner to give a confident hope of its ultimate and complete success. That hope has been fully realized, and the mower is one of the grandest agricultural inventions of modern times. Like all other inventions, it was adopted by the farmer with his usual caution, but its triumph has been so complete, that its utility and its economy are almost universally admitted, and the number manufactured, and the sales to farmers, have been immense, and are even now rapidly increasing every year. As an evidence of this, McCormick is reported to have sold no less than four thousand of his reapers to the farmers around Chicago, for the single harvest of 1860, and other manufacturers have no doubt met with similar encouragement.

Contrast also the slow process of raking hay by the common hand rake, with the rapid and easy method of gathering it with the horse rake, accomplishing with great ease to a single man who drives, the labor of at least ten men with the old hand rake. With a common revolving rake, from twenty to twenty-five acres a day may be gathered up, and sixteen acres a day have been raked with the simplest form. What a security on the approach of a storm, when the farmer would be comparatively helpless with nothing but the common rake to rely on!

But what shall we say of the modern threshing machine as compared with the flail? Who does not well remember its familiar sound, and that beautiful description of Cowper—

> "Thump after thump resounds the constant flail,
> That seems to swing uncertain, and yet falls
> Full on the destined ear"?

Only think of the difference in the results. At the trial of threshing-machines at the Paris exhibition, the victory was won by an American machine, and during the operation, to ascertain the comparative rapidity of threshing, six men were engaged in threshing with flails, who in one hour threshed sixty litres of wheat. In the same time

Pitt's American	machine	threshed	740	litres,
Clayton's English	"	"	410	"
Duvoir's French	"	"	250	"
Pinet's	"	"	150	"

and a French journal, in speaking of the trial, said: "This American machine literally devoured the sheaves of wheat. The eye cannot follow the work which is effected between the entrance of the sheaves and the end of the operation. It is one of the greatest results which it is possible to attain. The impression which this spectacle produced on the Arab chiefs was profound."

At the great fair in New York, in 1853, a machine was exhibited which not only threshed and winnowed the wheat, but measured it, placed it in bags ready for the market, and recorded accurately the number of bushels, and all by one continuous operation.

These vast and acknowledged improvements in harvesting and threshing grain will be seen to be of the utmost importance, when it is considered that we annually raise about two hundred millions of bushels of wheat, and of rye, barley, and oats over one hundred millions, and that the resources of the country may be developed, by the use of machinery, to an extent far beyond the reach of present calculation.

The reaper, the thresher, and the mower are types of the ever restless and progressive spirit of the age. They point out to us a glorious future, in which they will accomplish for us and for our country triumphs grander than the triumphs of arms, for they will develop the means of supporting the millions of human beings which the implements of war can only destroy.

Could the learned Malthus—who proclaimed the gloomy theory that war, famine, and pestilence were checks, designed by an all-wise Being to keep down the increase of population to a level with the means of sustenance—now rise up from his sleep of death and see the population of England more than doubled since his day, and that of this country multiplied many times, while the people are better fed, and better clothed, with less labor and less suffering, with the possibility of a famine wholly and forever removed, he might change his shameful doctrine, and adopt a more cheerful and hopeful view of the providence of God. With an immense multiplication of the human species in all civilized countries which have been devoted to the arts of peace and the development of their material resources, a bountiful Father has sent us a superabundance of food, instead of famine, and has taught us to rely on the exhaustless bounty of the fruitful earth, and upon his beneficent

UNIV. OF CALIFORNIA

LANDING AT JAMESTOWN

promise that seed time and harvest shall never fail to supply the daily wants of his children.

But with all the progress which we have made in improving the implements of the farm, we have not reached perfection. No bound is set to human ingenuity, and further means may yet be devised to shorten labor and increase the products of the soil.

We cannot hope, nor is it desirable, to avoid labor. This is not the object of improved machinery; but to make labor more attractive, agreeable, and productive; to bring into subjection the rude forces of nature, and make them do our bidding and increase our stores; to redeem thousands of acres now lying waste from wildness and desolation, and to make our country the granary of the world—these are triumphs we may hope to gain from the introduction and use of improved machinery, and in this view the subject commends itself to the attention of the highest intellect, and opens a field for the labors of the noblest philanthropy.

PROGRESS IN THE RAISING OF STOCK.

Allusion has already been made, incidentally, to the character of the cattle from which the early importations into this country must, for the most part, have been drawn.

The first animals that arrived in any part of the present territory of the United States were probably those taken to the colony on the James river, in Virginia, previous to the year 1609, the exact date of their arrival not being known. Several cows are known to have been carried there in 1610, and during the following year, 1611, no less than one hundred head arrived there from abroad.

It is probable that those first introduced there were brought over by the earliest adventurers, and others came from the West Indies. It is well known that some of their cattle came from Ireland. Those from the West Indies were the descendants of cattle brought to America by Columbus in his second voyage, in 1493. I have seen it asserted that so important was it considered that the cattle introduced into the infant colony should be preserved and allowed to increase, that an order was issued forbidding the killing of domestic animals of any kind, on pain of death to the principal, burning of the hand and cropping the ears of the accessory, and a sound whipping of twenty-four hours for the concealer of a knowledge of the facts. Such encouragement being given to the raising of stock, it is not surprising to find the number of cattle in Virginia in 1620 amounting to about five hundred head; and in 1639, to thirty thousand; while from the fact that in 1648 the number had been reduced to twenty thousand, we may infer that the restrictions on killing them had been removed. Many also had been sent to New England.

The first cattle that were introduced into the Plymouth colony, and undoubtedly the earliest brought into New England, arrived at Plymouth, in the ship Charity, in 1624. They were imported by Governor Winslow for the colony, and consisted of three heifers and a bull. A division of the stock, which appears to have been held in common, was made in 1627, when one or two are described as black, black and white, others brindle; an evidence that there was no uniformity of color. These animals were to remain in the hands of individuals receiving them for ten years, they to have the produce, while the old stock was still to be owned by the colony in common. Twelve cows were sent to Cape Ann in 1626, and in 1629 thirty more, while in 1630 about a hundred animals were imported for the "governor and company of the Massachusetts Bay in New England." These cattle were kept at Salem.

In the meantime, the first importation was made into New York from Holland by the Dutch West India Company, and the foundation laid for a valuable race of animals. The number in all introduced was one hundred and three, consisting of horses and cattle for breeding. The company furnished each tenant with four cows, four horses, some sheep and pigs, for the term of six years, when the number of animals received was to be returned, their increase being left in the hands of each farmer. Then the cattle belonging to the company were distributed among those who were unable to buy stock.

And so, for the settlements along the Delaware, cattle were introduced by the Swedish West India Company in 1627. It will be seen, therefore, that before the close of the year 1630, the number of horned cattle in all the colonies must have risen, by natural increase and by the importations above named, to several thousands.

And then, in 1631, 1632, and 1633, several importations were made into what is now New Hampshire, by Captain John Mason, who, with Gorges, procured the patent of large tracts of land in the vicinity of Piscataqua river, and immediately formed settlements there. The prime object of Mason was to carry on the manufacture of potash, and for this purpose he employed the Danes; and it was in his voyages to and from Denmark that he procured many Danish cattle, chiefly for the purposes of draught. They were, undoubtedly, considerably larger than the average of the cattle of England at that day, of a uniformly light yellow color, and made very fine oxen for labor. They soon became widely diffused over the whole region, and are said to have remained, with a great degree of purity of blood, or little intermixture, down to the year 1820. Traces of them can be found even at the present day. They were, no doubt, large and coarse animals, and well adapted to endure the severity of the climate and the hardships to which they were subjected in the lumbering operations of that new colony. They, unquestionably, did much to lay the foundation of the "native" stock of New England, over which they spread in the course of a very few years, and became mixed with the cattle imported into Salem and Plymouth, and probably, to some extent, with the Dutch cattle already alluded to; perhaps, also, with the black cattle of Spain and Wales, and subsequently with the long-horns and the short-horns, most or all of which crosses were accidental, or the result of individual convenience or other local circumstances. From them the working oxen of New England derive much of their character and reputation for strength, hardihood, quickness, and docility.

Now we find the sources from which the native cattle of this country sprang. The early importations into Virginia were originally derived, mainly, probably, from England; some were from the black cattle of Spain, though the importation of 1611 probably came from England; the cattle of the Plymouth colony came from the coast of Devonshire; those brought into New York from the island of Texel, on the coast of Holland, and were mostly, without doubt, the black and white Dutch cattle; those on the Delaware were brought from Sweden; those in New Hampshire were the large, yellow Danish cattle; and as the earlier importations were the most extensive that were made for many years, these various stocks were crossed, and thus formed the original stock of the country.

There is sufficient evidence to show that they were interchanged between the colonies to some extent, at an early day. Some of the Virginia cattle were early sent to New England, while others found their way to Virginia through Pennsylvania, so that the mixture was great and inevitable. Of the mode of keeping cattle in the Virginia colony, Glover, a cotemporary, in the *Historical Register*, says: "All the inhabitants give their cattle in winter is only the husks of their Indian corn, unless it be some of them that have a little *wheat straw*, neither do they give them any more of these than will serve to keep them alive; by reason whereof they venture into the marshy grounds and swamps for food, where very many are lost." And Clayton, another equally high authority, says, "that they neither housed nor milked their cows in winter, *having a notion that it would kill them.*" And still another, a Swedish traveller, Kalm, more recently, 1749, in speaking of the James river colony, says: "They make scarce any manure for their corn fields, but when one piece of ground has been exhausted by continual cropping, they clear and cultivate another piece of fresh land, and when that is exhausted proceed to a third. Their cattle are allowed to wander through the woods and uncultivated grounds, where they are half starved, having long ago extirpated almost all the annual grasses by cropping them too early in the spring, before they had time to form their flowers or to shed their seeds." The poorness of pasturage and want of food had caused the cattle to diminish in size from one generation to another, till they had become stunted and small, and were not improperly termed "little runts," or "natives."

In color, the natives, as already indicated, are exceedingly various. Crosses of the Denmarks with the Spanish and Welsh would naturally have made a dark brindle; crosses of the Denmarks and the Devons often made a lighter or yellowish brindle; while the more recent importations of Jerseys and short-horns have generally produced a beautifully spotted progeny. The prejudice in favor of deep red, which was long the favorite color of New England, is fast giving way to more variegated colors.

In the year 1553, some Portuguese had taken cattle to Newfoundland and Nova Scotia, while in 1604, a Frenchman had introduced the small French cattle into Acadia, from whence, in 1608, they were carried to Canada, and from there several animals were taken into what is now known as the "American Bottom," in Illinois, in 1682, where they increased rapidly. The first cattle imported into Carolina were obtained in England in 1670, and we find that the Indians on the Red River in Louisiana had cattle as early as 1690. The first importation into Georgia was made, so far as we are informed, in 1732, followed by others in 1735.

In 1750 the keeping of stock had assumed some importance in certain localities, particularly in the older eastern settlements, where it had become comparatively safe from molestation, for it is known that some large farmers in Rhode Island kept as many as one hundred cows and upward, and the sale of thirteen thousand pounds of cheese from one farm is recorded, and in one case seventy-three cows produced ten thousand pounds of butter in five months, or an average of very nearly a pound a day to a cow, which, for that length of time, must be regarded as a good yield.

It will be borne in mind that up to this time, and in fact for nearly half a century later, no well-directed efforts at improvement had been made even in England; but at that time some localities there possessed classes or races of animals peculiar to themselves, whose merits had begun to attract attention, though there was no general interest in the subject before the days of Bakewell, who "sat in the huge chimney corner of a log kitchen, hung round with the finest joints of his dried oxen, preserved as specimens of proportions; a tall, stout, broad-shouldered man, of brown, red complexion, clad in a brown, loose coat and scarlet waistcoat, leather breeches, and top boots," and demonstrated what could be done by attention to true physiological laws in the breeding of cattle. The choice of breeds and obtaining good crosses were nowhere thought of previous to his time. In fact, before the cultivation of the natural and artificial grasses and the introduction of the turnip and other root crops, the farmer had comparatively little control over the frames of his cattle. He was obliged to give them such food as he had, or rather they were obliged to take such as they could get, which, on a vast majority of the farms, both of England and the American provinces, at that time, was what would now be considered pretty hard fare. Hard seasons and the want of winter feeding and shelter were obstacles vastly more difficult to overcome then than now.

Those who should, "during the space of one year, keep the greatest weight of horned cattle," got the premiums offered by the London Society of Arts, rather than those who should exhibit the greatest degree of improvement in their animals. But with the increase and abundance of good food, the tide of improvement set in, and size began to be the grand aim of the earlier graziers, and the production of enormous monstrosities was the result. Now Bakewell, a man of remarkable sagacity and close observation, steps in and establishes a new system of animal development. With him mere size was no object. He wanted to build up a breed which should give the greatest amount of saleable beef for the amount of food consumed, having the best parts bearing a larger proportion to the offal than what was usually found. Smallness of bone, and tendency to fatten and mature early, he thought indispensable in cattle bred for the shambles. Up to his day, both in England and America, it had been customary to keep oxen till they were seven or eight years old, before they were fatted for the butcher. He travelled over England, Ireland, and Holland to find animals adapted to his purposes. "The old notion was," says Arthur Young, "that where you had large bones there was plenty of room to lay the flesh on. This, Mr. Bakewell has proved to be a mistake. He asserts the smaller the bones, the truer will be the make of the beast, the quicker she will fatten, and her weight will have a larger proportion of valuable meat." The greatest physiologists have shown, upon the highest scientific principles, that the formation of a large bony system is the result of defective nutrition.

Other breeders, stimulated in part by Bakewell's efforts, and the wide and honorable reputation he achieved, immediately entered the field of competition, and Chaplin became the champion of the Lincolnshire sheep, as Bakewell of the Leicesters; and the brothers Charles and Robert Colling directed their efforts to improving the short-horns, as Bakewell the long-horns; while the Duke of Bedford, Quartly, and others, not to be outdone, espoused the claims of the Devons, and Benjamin Tomkins those of the Herefords. So successful were these enterprising breeders, both in preserving purity of blood in their stock, and in extending the reputation of their several herds, that at Charles Colling's sale on the 11th of October, 1810, Comet was bid off at 1,000 guineas, or $5,000, and many other animals about as high in proportion; the forty-eight head sold, including considerable young stock, bringing no less than $35,579. The cow Lily, sired by Comet, brought 410 guineas, or $2,050; the bull Petrarch, also by Comet, sold for 365 guineas, or $1,825, and the calf Cecil for 130 guineas, or $650. There were seventeen cows, eleven bulls, seven bull calves, seven heifers, and five heifer calves, for which this successful breeder received an average of $741 a head. That sale, and that of Robert Colling in 1818, that of Lord Spencer in 1846, that of the Bates, or Kirkleavington herd in 1850, that of Lord Ducie two years later, and some still more recent and extensive sales, are the marked eras in the history of the short-horns in England, and it was through these sales, and the universal enthusiasm awakened by them, that the short-horns have become more widely spread over Great Britain, and more generally fashionable than any other breed.

Tomkins began with the Herefords in a small way about the year 1766, and at his decease in 1819, his whole herd, consisting of fifty-two animals, including twenty-two steers, and varying in age from calves to two-year-olds and upward, was sold at auction, and brought an aggregate of $23,368, or over $445 a head; one bull sold to Lord Talbot for $2,943, while several cows brought from $1,000 to $1,200 a head.

Both these breeds are celebrated for early maturity. Either of them may be prepared for market at two or three years of age, far better than the old style of cattle could be at five, six, and seven years, and be of nearly equal weights. I have mentioned these facts to show how it was that the average weight of cattle sold in the Smithfield market increased from 370 pounds in 1710, to over 800 pounds at the present time. A select committee of the House of Commons, in a report printed in 1795, after a full investigation, stated that since the year 1732, their neat cattle had, on an average, increased in weight and size at least one-fourth, or twenty-five per cent., which would fix the average weight in 1795 at about 462 pounds. The average age had formerly been over five years. In 1830, owing, in a large measure, to the enthusiasm which had been created, commencing first by the efforts of individuals, and radiating out through the community in every direction, the average weight had increased to 656 pounds, an increase, in twenty-five years, of more than forty per cent. in weight, while the average age had been reduced to four years instead of five. What a contrast! A saving of one whole year's consumption of forage, and an increase of forty per cent. in the profitable results, in the course of a quarter of a century! But since then the average age has been still further reduced, and the average weight a good deal increased.

Such being the striking results in England, it is not surprising that when an interest was awakened in the improvement of our agriculture, a desire was felt by intelligent breeders to avail themselves of the advantages which had already been gained abroad. Importations began, and a more systematic course of breeding was adopted; at first, by a very limited number of enterprising farmers, till, within the last twenty years, that number has rapidly increased, and the results have become more marked and perceptible.

It may be remarked in passing, that two modes of improvement were open to the farmer and breeder, either of which, apparently, promised good results. The first was to select from among our native cattle the most perfect animals not known or suspected to belong or to be related to any of the well-established breeds, and to use them as breeders. This mode of improvement is simple enough if adopted and carried on with animals of any known race or breed, and, indeed, it is the only course of improvement which preserves the purity of blood. This was chiefly the course adopted in England by Bakewell with the long-horns, by the Collings and others with the short-horns, by Tomkins, Price, and others, with the Herefords, and by the Duke of Bedford and others with the Devons. Had they resorted to any other, they would have run the risk of a total failure and ruin of those valuable races. Their object was not to build up a new breed by crossing, so much as to improve and perfect the races, already valuable, which were to be found in particular localities or counties, which gave them their name.

But our circumstances were entirely different. We had no race and no breed of cattle among us. The term *race*, properly understood, applies only to animals of the same species, possessing, besides the general characteristics of that species, other characteristics, which they owe to the influence of soil, climate, nourishment, and habits of life to which they have long been subjected by man, and which they transmit with certainty to their progeny, and it is essential that they should have possessed these characteristics from a time to which "the memory of man runneth not to the contrary." The term *breed*, on the other hand, applies to a family of animals built up by a long series of careful breeding, till certain desired characteristics become fixed, capable, and sure of being transmitted. As might be supposed, the characteristics and peculiarities of *races* are more inherent, more fixed and strongly marked than those of families, or breeds built up artificially. But in general the characteristics of both races and breeds are so permanent, and so well marked, that if an individual supposed to belong to any one of them were to produce an offspring not possessing them or possessing them only in part, with others not belonging to the race or breed, it would be just ground for suspecting a want of purity of blood.

This being the acknowledged, and only proper sense and use of these terms, it follows that no grade animals, and no animals not possessing fixed peculiarities or characteristics which they share with all other animals of the class of which they are a type, and which they are capable of transmitting with certainty to their descendants, can be recognized by breeders as belonging to any one distinct race, breed, or family.

The term "native," or "scrub," is applied to a vast majority of our American cattle, which, though born on the soil, and thus in one sense natives, do not constitute a breed, race, or family. They do not possess characteristics peculiar to them all, which they transmit with any certainty to their offspring, either of form, size, color, milking, or working properties. It does not follow, to be sure, that because an animal is made up of a mixture of blood, almost to infinity, he may not be, as an individual animal, and for specific purposes, one of the best of the species; and for particular purposes individual animals might be selected from among those commonly called "natives" in New England, and "scrubs" at the south and west, equal, and perhaps superior, to any among the families produced by the most skilful breeding, notwithstanding the fact that they have sprung from a great variety of cattle procured at different times on the continent of Europe, in England, and in the Spanish West Indies, brought together without any regard to fixed principles of breeding, but from individual convenience, and by accident; but it is true that our native cattle possess neither the size, the symmetry, nor the early maturity of the short-horns; they do not, as a general thing, possess the fineness of bone, the beauty of form and color, nor the activity of the Devons or the Herefords; nor do they possess that uniform goodness and quantity of milk of the Ayrshires, nor the surpassing richness of milk of the Jerseys; but above all they do not possess the power of transmitting the many good qualities, which they often possess in an extraordinary degree, to their offspring, which is a characteristic of all well-established breeds.

Now, to build up a breed, or family, on such a foundation, in the mode already indicated, requires great experience in selection, a quick and sure eye, and judgment of the true points in stock, a mind eminently unprejudiced, and a patience and perseverance perfectly indefatigable and untiring. It is absolutely necessary, also, to pay special attention to the calves thus produced—to furnish them at all times, summer and winter, with an abundant supply of nutritious food, and to regulate it according to their growth.

Few men could be found either capable or willing to undertake the herculean task of building up a new breed in that way from grade stock. A prominent and almost insuperable objection would meet them at the very outset, that it would require a long series of years—longer than the natural life of most men—to arrive at any very satisfactory results, from the fact that no two animals, made up, as our "native" cattle are, of such a variety of elements and crosses, could be found sufficiently alike to produce their kind. The principle that like produces like is perfectly true, and in the well-known breeds it is not difficult to find two animals that will be sure to transmit their own characteristics to their offspring; but with two animals which cannot be classed with any breed, the defects of an ill-bred ancestry will be liable to appear through several generations to thwart and disappoint the expectations of the breeder.

The second method is more feasible, and

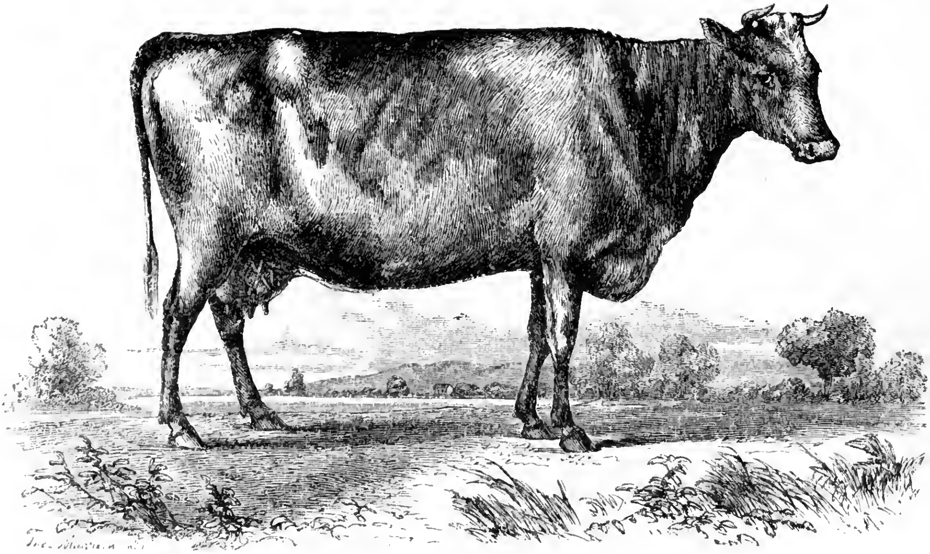
that is, to select animals from races already improved and well-nigh perfected, to cross with our cattle, selecting such animals from the well-established breeds as are best calculated for the special purposes for which we want them. If our object is to improve stock for the dairy, taking such only as belong to a race distinguished for dairy qualities; or, if resort must be had to other breeds less remarkable for such qualities, such only as have descended from large and generous milkers. We ought to be able to rely with some confidence upon getting the qualities which we seek. Milking or dairy qualities do not belong to any one breed or race exclusively, though, as they depend mainly on structure and temperament, which are hereditary to a considerable extent, they are, themselves, transmissible. In almost every breed we can find individual milkers which greatly surpass the average of the cows of the same family, and from such, many suppose good crosses may be expected without much regard to other circumstances. It is not accidental good qualities that we want, so much as those which are surely transmissible. We do not want to breed from an animal—a cow for instance—that is an exception to the rule of her race or family. A good calf from her would be, to a great extent, the result of chance. We cannot expect nature to go out of her course, to give us a good animal, if we violate her known laws as developed by our knowledge of physiological structure.

Such are a few of the considerations which, no doubt, led the early importers of the modern improved foreign stock to make an effort on our native and grade cattle. What has been the result? It can be clearly shown that there has been a large increase in the number of the cattle of the country. Of that there could, of course, be no question, since this increase would naturally follow from an addition of new territory and the more perfect development of the agricultural resources of the country. But I think it can be clearly shown, also, that there has been a positive improvement in the intrinsic qualities of the common stock of the country as a whole. I am far from detracting from the merits of our native cattle. They are far better than could have been expected from the loose manner in which they were "made up." Many of them have great merit, and individual animals are to be found among them, as already remarked, which would be hard to beat by any pure bred animals. As working oxen, the native cattle of New England are unsurpassed by any in the known world, and they have the reputation of being so, both in other parts of this country and in Europe, where their qualities are known. But they have their defects, and it is useless to blind our eyes to them.

I expect, therefore, to be able to show that some actual progress has been effected upon the common stock of the country. But to what is this progress owing? Is it merely that which is due to better keeping, both summer and winter? I have already intimated that the treatment the cattle of the country received during the most of the last century was far from being calculated to improve them, scarcely, even, to keep them on foot. Even so late as 1841, Mr. Colman asserted that the general treatment of cows at that time, in New England, would not be an inapt subject of presentment by a grand jury. I was cognizant of the manner in which the stock was kept in many a country town at that time, and I am strongly inclined to agree with him; and, judging from the well-known anxiety of those who enter milch cows now for premiums at the fairs, to show that their yield has been enormous, and that they have lived upon little or nothing, one would suppose their keeping was not much improved, even yet.

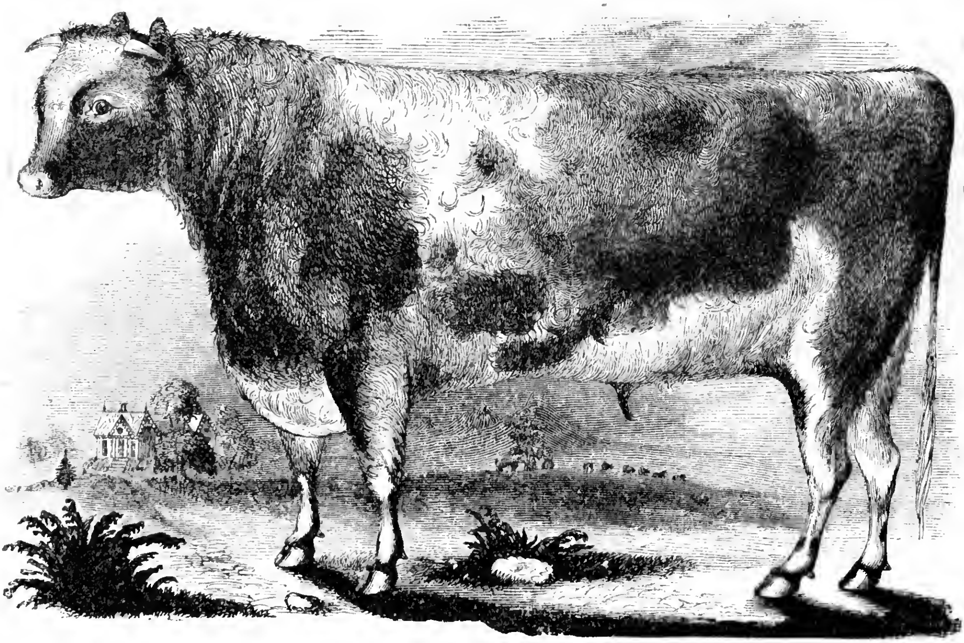
But, as compared with the last century and the earlier part of this, there has been a vast improvement in the shelter, mode of feeding, and the general treatment, and this has, of course, had its effect in increasing their milking qualities and their appearance. But, apart from this, there can be little doubt, I think, that there has been a positive improvement in our stock as a whole; that is, the general average of the stock of New England is better than it was forty or fifty years ago. There were individual animals then, among the native or common stock of the country, whose yield of milk was quite remarkable, and would be, at the present day, and among the best stock of the present time; but we cannot, and ought not to reason from individuals, but from the general average stock of the country.

These remarks have special reference to the stock kept in the eastern and older sections of the country—those parts where the herds are small, and kept not so much for raising for beef as for their other products, as milk, butter, cheese, and labor.



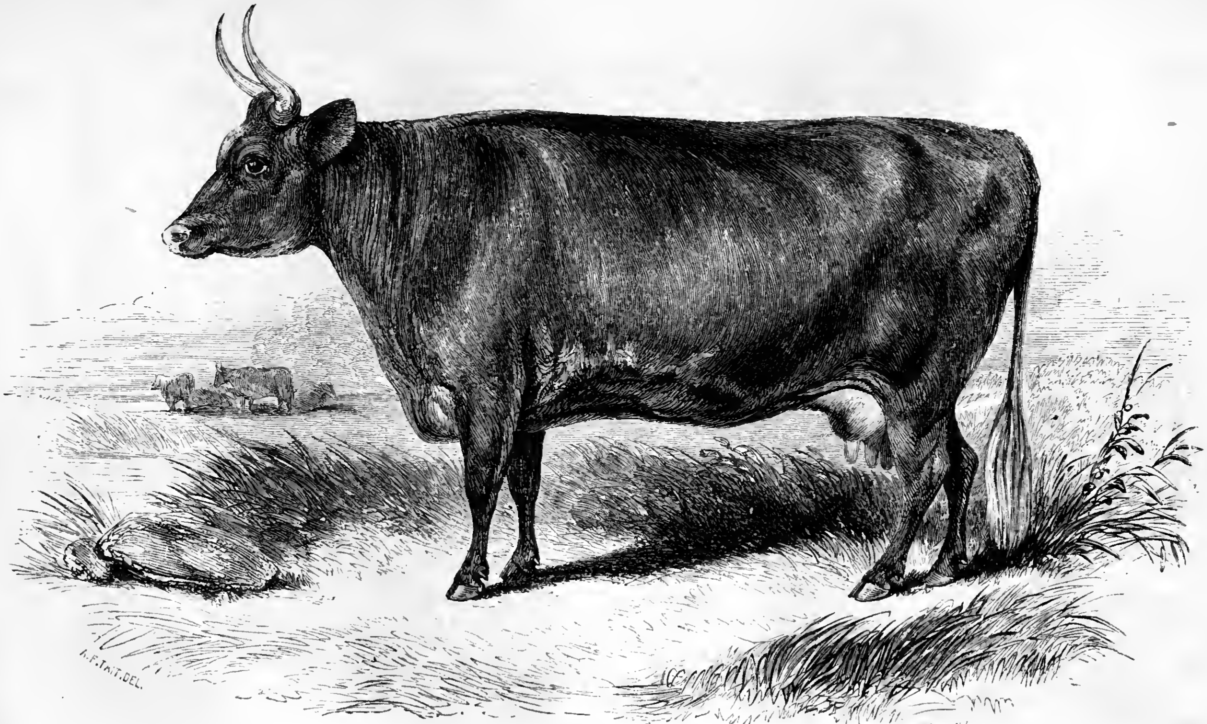
MILCH COW.

Engraved for C. L. Flint's "Treatise on Milch Cows and Dairy Farming."



SHORT-HORN BULL. DOUBLE DUKE.

Owned by the Harvest Club, Springfield, Mass. From Flint's Sixth Annual Report

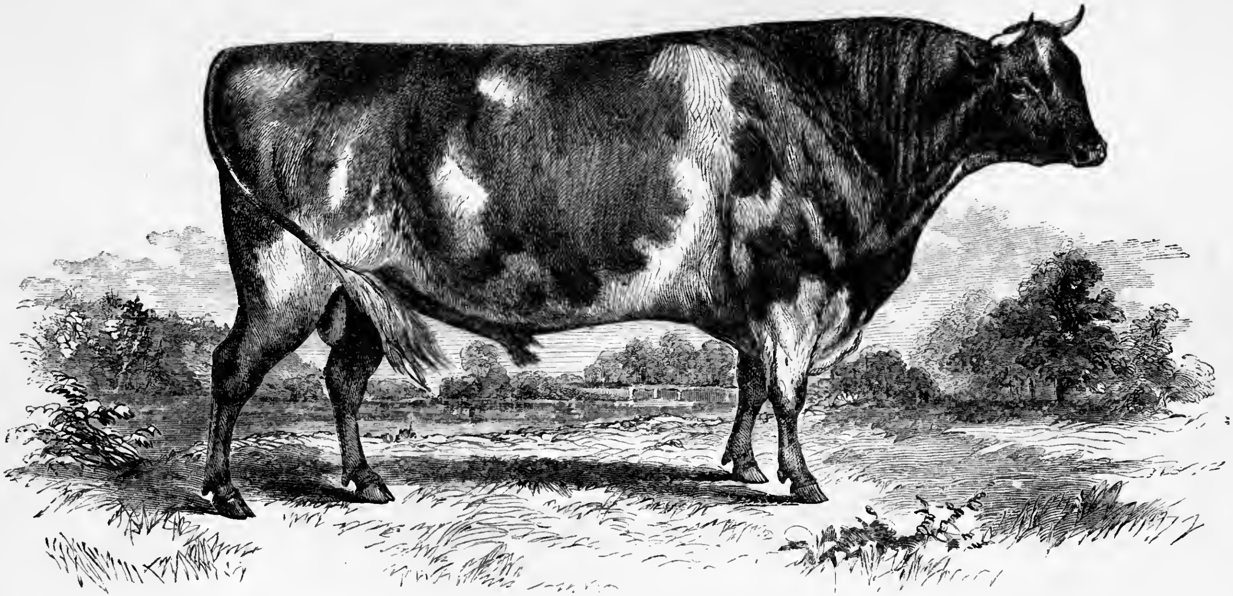


JENNY. (700.)

Winner of the first prize in class "Imported Devon Cows," at the New York State Agricultural Show at Elmira, 1855, and at the U. S. Agricultural Show at Boston, 1855. Bred by George Turner, Esq., of Barton, Exeter, Eng The property of Edward G. Faile, West Farms, Westchester Co., N. Y.

DEVON BULL. TECUMSEH. (567.)

Bred by Edward G. Faile, West Farms, Westchester Co., N. Y. Tecumseh took the first premium as a calf at the Show of the N. Y. State Agricultural Society in 1854; the first as a yearling at the Show of the same Society in 1855; the first at the Show of the U. S. Agricultural Society in 1855; the first as a two year old at the Show of the same Society in 1856; and the first at the Show of the American Institute in 1856. He was sold to Juan Emanual Macias, Esq., and taken to the Island of Cuba in 1857.



AYRSHIRE BULL.

Owned by Dr. Geo. B. Loring, Salem, Mass. Copied by permission from the Sixth Annual Report of Secretary of Massachusetts State Board of Agriculture.

In the great west, where the cattle are, and have for some years, been kept to supply the stalls in our eastern markets, and where, after all, as compared with other sections and other objects, early maturity and a tendency to fatten are of transcendant importance, no one could be so blind to the facts as to deny that there has been a vast and most gratifying progress even in the intrinsic qualities of the stock. Every car-load of those splendid Kentucky, Ohio, Indiana, and Illinois cattle shows this in a manner not to be mistaken. Compare them with the class of animals formerly, and even now in some sections, to be found at the west, and more commonly at the east, and mark the contrast. The one is thrifty, grows rapidly, fats easy, and is ready at a very early age for the market, while from an eighth to a quarter part of the cost of labor and of keeping, which must be incurred every year in raising such a class of animals as the other, is wholly lost from misapplication.

In 1850, there were 18,378,907 head of cattle in the United States, of which over six millions (6,385,094) were milch cows, nearly two millions (1,700,744) were working oxen, and ten millions (10,293,069) other cattle, not including horses, sheep, or swine; and the value of animals slaughtered amounted to the vast sum of more than one hundred and eleven millions of dollars ($111,703,142). Now if by the keeping of better stock we add to their value and the profit derived from them, without increasing the cost, we make, of course, an absolute gain on the receipts from the same amount of capital invested. A distinguished breeder places this in a clear light as follows: "Suppose that the eighteen millions of neat cattle now in the United States, by the infusion of better breeds among them generally, should, in their earlier maturity and increased product of milk and flesh, with an equal consumption of food, and by a moderately increased amount of care, produce an additional profit of one-fifth, or only twenty per cent.—certainly a moderate estimate—the annual value of such improvement will be that which is derived from an additional invested capital of thirty millions of dollars; a vast sum in the aggregate of our agricultural wealth." This is a true statement now, and it applied with still greater force when the spirit of improvement began.

But to return to the importation of modern improved stock from abroad for the specific purpose of improving the stock of this country. In the year 1783, three gentlemen of Baltimore—Messrs. Goff, Ringold, and Patton—sent to England for superior cattle; and, in 1785, a bull from this importation was taken to Kentucky, followed, not long after, by another lot of the same importation. A half-breed bull was taken to the same section about the year 1804, and is said to have greatly improved the stock of that state. Some of the cattle of that early importation were commonly called the "milk breed," and others the "beef breed." For a long time they went by the name of the "Patton stock." The beef breed were, probably, long-horns— large, coarse, and rough animals, but slow in maturing. The others are said to have been short-horns. Others were also taken from Virginia to Kentucky, but none of them were, probably, pure bloods, although the Patton stock gained a wide and deserved reputation.

In 1817, Colonel Sanders, of Kentucky, sent for twelve head of the best that could be found in England. Six of them were short-horns, or Teeswaters. Two of these short-horns were also imported for Kentucky in 1818. These various importations, commencing with the first high-bred animals taken to the west in 1785, were the pioneers; and though the pedigree of some of them could not be given, they not only infused superior blood into the stock of that region, but excited a spirit of emulation among the farmers there which had an exceedingly salutary effect. There is little doubt that some of the best cattle in southern Ohio owe their origin to the early imported animals of Kentucky.

A few short-horns were brought into Westchester county, New York, as early as 1792 and 1796. They were kept pure for some years, but finally became scattered, leaving their descendants in that section to this day. Other importations into New York were made as early as 1816 and 1822. In July, 1818, a short-horn bull, widely known as "Cœlebs," and a heifer, "Flora," were imported into Massachusetts by Mr. Coolidge, and sold, in 1820, to Colonel Samuel Jaques, of Somerville. From "Cœlebs," by selecting superior native cows, Colonel Jaques succeeded in raising a fine milking stock, long known as the "Creampots." "Flora" had fourteen calves between 1819 and 1833, ten of which were by "Cœlebs." The same year (1818), also, Gorham Parsons, of Brighton, Massachusetts, imported a pure breed short-horn bull, called "Fortunatus," or "Holderness," and his descendants were widely disseminated through New England. Another short-horn bull was brought into Massachusetts by Theodore Lyman, of Boston, from whence he was shortly after sent to Maine; and, in 1825, Mr. W. Pierce, of Portsmouth, New Hampshire, imported a celebrated short-horn, "Nelson," and the cow "Symmetry," the parents of the great ox "Americus," so large as to be taken about on exhibition, for which purpose he was afterward taken to England.

It was also in 1818 that Stephen Williams, of Northboro', Mass., imported the famous bull "Young Denton," the sire of many very excellent grade animals, the heifers proving fine milkers. Many other fine short-horns were taken into Massachusetts after the year 1820, but though they left some superior grades, they were not appreciated by the farmers generally, and attention was gradually directed to other breeds. New England, as a whole, is not the place for short-horns. They do better on more luxuriant pastures. Besides, they are not well adapted to the wants of the small dairy farmer, especially since the modern improvements of this justly celebrated breed have taken all the milk out of them. For a region better adapted to raising beef, and on naturally rich feed, they are unsurpassed for beauty and symmetry of form, for size and early maturity, and consequently for the profits they yield to the breeder and the grazier.

In 1824, Mr. Powell, of Philadelphia, commenced the importation of short-horns, and continued to breed them with great enterprise and success for many years. He had frequent sales, some of his stock going into Kentucky, others to Ohio, and elsewhere.

But the great impulse given to the importation of short-horns, was the formation of the Ohio Company for Importing English Cattle, in 1834. The sum of $9,200 was subscribed in shares of $100 each, and agents sent abroad, who returned with nineteen head, selected from the herds of celebrated breeders, arriving in October of that year. They were kept together under the care of an agent, and the number was increased by other importations till 1836, when they were sold at public auction and scattered extensively over Ohio. A dividend of $280 per share was immediately declared on the ninety-two shares, amounting to $25,760. The following year they made another extensive importation, which sold rapidly and well. Immense benefits have resulted from these efforts.

The sketch given above of some of the earlier importations of short-horns, has been somewhat extended for the purpose of showing the gradually increasing and extending interest and enterprise in breeding, but since 1840, importations of this magnificent breed have so far multiplied, that it would be out of place to attempt to follow them. The cream of the finest and most celebrated herds in England has been taken to this country, without regard to cost. Fabulous prices have been asked, and five and six thousand dollars for a single animal have, in some cases, been paid, to which was added the cost of transportation. So successful, indeed, have the more recent efforts been, that England has sent over here to buy short-horns from us; and so admirably adapted to stock raising is the climate of Kentucky, that this fine breed has been improved there to such an extent, that very few of the last 150 cows selected from among the best in England, could win the prizes from those born and bred on our native soil.

These superior animals are not all held in the hands of a few. They are within the reach of thrifty farmers, who are now awake to the profit of raising cattle that will make as much beef at two or three years old, as a native at double that age.

It is proper to refer very briefly to the efforts made at various times to introduce and experiment with the other well-established English breeds, and the success which has attended these efforts.

In 1817, the Hon. Henry Clay, of Kentucky, made an attempt to introduce the Herefords into that state, by the purchase of two bulls and two heifers, at a cost of £105, or about $500. This was the first well authenticated importation of this breed of any note. The Herefords belong to the class of middle-horned cattle, and were indigenous to certain districts of England, where they were known as far back as tradition extends. They have undergone considerable changes within the last hundred years, commencing with the efforts of Tomkins, already alluded to—not however, by means of crosses with other races, but by careful and judicious selections.

In point of symmetry and beauty of form, the well-bred Herefords may be classed with the improved short-horns, arriving, perhaps, a little slower at maturity, though remarkably inclined to take on fat. They never attain to such weights, but they generally arrive at the Smithfield market at two or three years old, and so highly is their beautifully marbled beef esteemed, that it is eagerly sought by the butchers at a small advance, pound for pound, over the short-horn. Weighing less than the short-horns, they yield a larger weight of tallow, which is one reason of the preference for them. The short-horn produces more beef at the same age than the Hereford, but consumes more food in proportion.

They have never been bred for milking or dairy qualities, and no farmer would think of resorting to them for that purpose.

In 1824, Admiral Coffin, of the royal navy, presented the Massachusetts Society for Promoting Agriculture, a Hereford bull and heifer, bred by Sir J. G. Cottrel from the Tomkins stock. The bull was kept by the Hon. J. C. Bates, of Northampton, Mass., and left a numerous progeny, which was very highly esteemed in that neighborhood. The largest importation into this country was that of Messrs. Corning and Sotham, of Albany, N. Y., in 1840, consisting of five bulls and seventeen cows and heifers. Other importations of the same breed were added to this herd in subsequent years. The Hon. L. A. Dowley, of Boston, imported several animals of the same breed in 1852, a part of which were kept for some time on the State Farm at Westboro', Mass., and were afterward sold to Mr. John Merryman, of Baltimore Co., Md., who has one of the largest and finest herds of Herefords in the country.

It will be readily seen from the characteristics of the race, as stated above, that they would be ill adapted to the wants of New England farmers as a general thing. They are profitable for the grazier; though, in a country of extreme fertility, like many parts of the west, and capable of bringing the short-horns to their highest development and perfection, they might not, on the whole, be able to compete successfully with them.

The importation of Devons into this country has been more numerous. Indeed, there are some who assert that the native cattle of New England owe their origin chiefly to the Devons, since the cattle first brought into the Plymouth colony are pretty well known to have been shipped on the Devonshire coast. But that they were any thing like the modern Devons there is little evidence; they certainly have very few of the highest characteristics of that race left. The general impression has arisen mainly from the fact that many of the native cattle of New England are red, and that is the favorite color.

However this may be, the improved North Devon is a very different animal from any that could, at that day, have been procured on the coast of Devonshire, or, in fact, anywhere else. This race dates further back than its history goes. It has long been bred for beef, and for the working qualities of its oxen, which, perhaps, excel all other races in quickness, docility, and beauty, and the ease with which they are matched. But as milkers the North Devon cows do not excel, nor indeed do they equal, some of the other breeds.

Some years ago a valuable importation was made by Mr. Patterson, of Baltimore, Md., who has bred them with special reference to developing their milking qualities, and now they would be remarkable as dairy stock as compared with any other pure breed, but they are very different animals from the common modern improved Devons, the dairy qualities of which have been very much disregarded.

The North Devons were also imported by the Massachusetts Society for Promoting Agriculture, and were kept together for some time, and then disposed of. So far as size is concerned, they are better adapted to New England farms than either the short-horns or the Herefords, while the form and color are so beautiful as to make them admired by many. But the milking qualities having been to a considerable extent bred out of them, especially those more recently imported, we have little to gain by preferring them over our native stock. They are good for beef, for which purpose they are chiefly raised in their native country, but the production of beef throughout most of the older sections of the country is an entirely secondary object. They are good for labor, on account of their quickness and ease of motion, but New England has equally good working oxen in its natives. They give rich milk, but the Jerseys give richer.

The Ayrshires and the Jerseys are, and have for a long time been bred with special reference to the dairy. The former, though a comparatively recent breed, were early imported into this country, and, I think, have, as a whole, proved very satisfactory, particularly as giving valuable crosses with our common stock. Grade Ayrshires are among the best animals for the use of small and dairy farms, and the cross-breds are, for all practical purposes, equal to the pure breds.

One of the cows originally imported by John P. Cushing, of Massachusetts, gave in one year 3,864 quarts of milk, beer measure, being an average of over ten quarts a day for the year; and the first Ayrshire cow imported by the Massachusetts Society for Promoting Agriculture, in 1837, yielded sixteen pounds of butter a week for several weeks in succession on grass-feed only. Our climate is not so favorable to the production of milk as that of England and Scotland. No cow, imported after having arrived at maturity, could be expected to yield as much under the same circumstances, as one bred on the spot where the trial is made, and perfectly acclimated. The Ayrshire cow generally gives a larger return of milk for the food consumed than a cow of any other breed.

Within the last ten years the Jerseys have been extensively imported into this country by the Massachusetts Society for Promoting Agriculture, and by many individuals in New England, New York, and Maryland. They have their place among us, but it is not on the majority of our farms. They give richer milk, and that with greater uniformity, than any other known breed, but the quantity is usually small, which would not do for the milk dairyman. They are usually small in body, and rather large consumers. On a dairy farm devoted exclusively to the making of butter, an infusion of Jersey blood is highly desirable. One or two Jerseys in a herd of twenty will often make a perceptible difference in the quantity and richness of butter. For gentlemen in the vicinity of cities, who keep but one or two cows to supply their own table, they are also especially adapted.

They have consequently multiplied rapidly in the vicinity of cities on the Atlantic seaboard. In 1853 there were, for instance, but about seventy-five pure-bred Jerseys in Massachusetts; now they number several hundred, while the grades are innumerable, many of them proving to be very fine.

The influence which the introduction of superior foreign stock has exerted, has not been confined to their own intrinsic merits, nor to the actual improvement which they have effected by means of crossing upon the common stock of the country. It has led to better treatment of native stock, partly by increasing, to some extent, the interest in cattle and the knowledge of their wants and requirements, and partly from the fact that there was a general disposition among the mass of farmers to say that if the natives were kept as well, they would outstrip the fancy stock.

But still the improvement in the common stock of the eastern and middle states, or those portions devoted to the dairy and other stock interests than the raising of beef, over and above what can be ascribed to better treatment, has been small compared with what it has been in those states devoted more exclusively to grazing. During the past ten or twelve years, for example, the live stock of Ohio has increased in valuation—according to the official returns made to the state auditor—more than two hundred per cent., while, in the same time, no class of stock has increased in numbers one hundred per cent. A part of this, to be sure, may be fairly ascribed to an increased demand for stock, and a consequent higher value, but there can be no question that intrinsically better animals have superseded the inferior native stock to a considerable extent. The number of horned cattle in that state, in 1836, was 372,866, valued at $2,982,928. In 1846 the number had increased to 920,995 head, and the valuation to $7,527,123. In 1850 the number was 1,103,811, and the valuation $11,315,560. In 1857 the number was 1,655,415, and the valuation was $21,662,223. The ratio of increase in value has been greatly accelerated since the means of communication by railway have so greatly increased the facilities for information. When the first great importation and sale was made, in 1834-6-7, it was not accessible to the mass of cattle breeders, and acquired more of a local than a general reputation. What is true of Ohio is true to nearly an equal, if not even greater extent of most of the other western states.

While speaking of the different objects for which cattle are kept in various parts of the country, it may be interesting to compute the actual products, per cow, in butter and cheese in the several sections. According to the census of 1850, the average number of pounds of butter produced per cow, per annum, in the various states, was as follows:—

	lbs. per cow.		lbs. per cow.
Florida	5	Maryland	43
Texas	10	Indiana	45
Georgia	13	Iowa	47
South Carolina	15	Delaware	50
North Carolina	18	Wisconsin	56
Alabama	18	Massachusetts	62
Arkansas	19	Ohio	63
Mississippi	20	Maine	69
Tennessee	33	Michigan	70
Missouri	34	New Hampshire	73
Virginia	34	Connecticut	75
Rhode Island	34	Pennsylvania	75
Kentucky	39	New Jersey	79
Louisiana	41	Vermont	83
Illinois	42	New York	85

Some of the states, like New York, for instance, sell vast quantities of milk in its natural state, and yet the quantity of butter per cow will be found to be large compared with those states where cattle are kept more especially for beef. To conclude that the stock of Kentucky, Illinois, or Ohio is inferior to that of New York because the yield of butter per cow is inferior, would be premature. The objects for which the stock of those states is kept are different, and for the purposes of grazing, the cattle of the western states may be far better adapted than any other would be.

Let us now see what is the amount of cheese annually produced per cow in the several states. In some of them it appears to be infinitesimally small. The list stands as follows, beginning with a hundredth part of a pound:—

	lbs. per cow.		lbs. per cow.
Louisiana	.01	Indiana	2.25
South Carolina	.02	Illinois	4.00
Maryland	.04	Iowa	4.00
Alabama	.13	Wisconsin	6.00
Georgia	.14	Mississippi	10.00
Delaware	.16	Rhode Island	11.00
Florida	.24	Maine	18.00
Arkansas	.30	New Jersey	30.00
Texas	.40	New Hampshire	31.00
North Carolina	.43	Ohio	36.00
Tennessee	.70	New York	53.00
Kentucky	.88	Massachusetts	54.00
Missouri	.89	Vermont	59.00
Virginia	1.37	Connecticut	62.00

Vermont produced more cheese than all other states put together except New York, Ohio, Maine, Connecticut, Massachusetts, and New Hampshire, and that, too, from 146,128 cows. The total number of pounds of cheese produced in the United States, as shown in the census of 1850, was 105,535,219, or about four and a half pounds to each individual of the whole population. The export for that year was 10,361,189 pounds, which left for consumption in this country, not far from four pounds for each individual. If we suppose the consumption to be equal in all the states, it would appear that only seven of the states produce their own cheese; these are Maine, New Hampshire, Vermont, Massachusetts, Connecticut, New York, and Ohio. If now we consider the proportion of the number of cows kept in the various states to the population, it will throw additional light on the mode and object of keeping stock; for while, in many of the states, the products in milk, butter, and cheese are husbanded with the greatest care, the farms are comparatively small, and the number of cows an individual can keep and manage is limited, in others a large number are kept and allowed to roam over the heavy and luxuriant pastures, to grow and fatten, no account whatever being made of their dairy products.

The number of cows per individual was as follows, stated in decimals:—

Maine	.22	Alabama	.29
New Hampshire	.29	Florida	.83
Vermont	.46	Mississippi	.35
Massachusetts	.13	Louisiana	.20
Rhode Island	.13	Texas	1.01
Connecticut	.23	Kentucky	.25
New York	.30	Tennessee	.24
New Jersey	.24	Arkansas	.44
Delaware	.21	Missouri	.33
Maryland	.14	Ohio	.27
Virginia	.22	Indiana	.28
North Carolina	.25	Illinois	.34
South Carolina	.28	Iowa	.24
Georgia	.36	Wisconsin	.21

The products from stock might be stated in another interesting point of view as follows: The northern states, comprising New England, New York, New Jersey, and Pennsylvania, with 166,358 sq. miles, and a population of 8,626,852, keeping 2,058,604 milch cows, produced, according to the last census, 251,593,899 pounds of butter and cheese, valued at $25,159,389. They kept, also, 494,280 oxen, and 1,834,297 other cattle, not, of course, including horses, sheep, or swine. At the same time the western states, comprising Ohio, Michigan, Illinois, Indiana, Wisconsin, Iowa, California, Minnesota, and the territories, with an area of 1,918,216 sq. miles and a population of 4,900,369, had 1,363,253 milch cows, and manufactured 98,266,884 pounds of butter and cheese, valued at $9,826,688. They had also 341,883 oxen, and 2,236,056 other cattle. The southern states, comprising Delaware, Maryland, Virginia, North and South Carolina, Georgia, Florida, Mississippi, Alabama, Louisiana, Texas, Arkansas, Tennessee, Kentucky, and Missouri, with 851,448 sq. miles and a population of 9,664,656, had 2,963,237 milch cows, and manufactured 68,634,224 pounds of butter and cheese, valued at $6,863,422. They also had 2,835,358 oxen, and 5,632,717 other cattle. These aggregates are computed by Mr. Kettell, the author of a valuable treatise on *Southern Wealth and Northern Profits*, New York, 1860, and they show that, contrary to the opinion quite prevalent in some of the northern states, the south is largely engaged in raising and keeping stock, an interest which might, indeed, be very greatly extended, owing to the unrivalled advantages of climate.

It is unfortunate that the number of milch cows and oxen was not given in the census of 1840. We have, consequently, no accurate details with regard to the increase of particular classes of stock; but we know that the rate of increase during that decade was about twenty per cent. The aggregate number of neat cattle was given in 1840 at 14,971,586, and in 1850 at 17,778,907. The amount of butter produced in 1850 was 313,266,962 pounds, and that of cheese 105,535,219 pounds; neither of which were given in 1840 as separate items. We had, in 1850, about two millions of working oxen, or more accurately, 1,700,744; and of other cattle, 16,078,163. The amount invested in neat stock, it will thus be seen, cannot be less than two hundred millions of dollars at the present time.

A branch of farming involving so vast an amount of capital cannot be considered of small importance. Its development is worthy to command the highest intelligence and the most consummate skill, and its rewards are ample and encouraging.

HORSES.

That the horses in this country have undergone a vast change and improvement during the last century—or, rather, during the last half century—there can be no reasonable doubt in the mind of any one who will take the trouble to investigate the history of this animal. A simple, though complete change of the principal uses to which horses are put, would naturally have produced a change in the horses themselves, without any well-directed effort at breeding. For, as we have seen in our previous sketch of the condition of things during the last century, which continued with slight local modifications even into the present century, the chief means of carrying on our inland business, including a vast amount of heavy transportation, was the horse. The roads were in a most wretched condition, compared with the admirable roads of the present day, except, of course, those in the more thickly settled portions around the larger centres of population. They were seldom built of any thing but the natural soil thrown up from the sides, and often not this. The forest was felled, and the ground left for many a thousand miles without the precaution of making any side ditches at all, and over such a pathway the freight of a great part of the country was to be moved, in wagons made so as to be capable of the hardest usage. Over such roads light carriages would have been comparatively useless, and a speed now seen every day, would have been unsafe for them. The mail contracts over a very large part of the country were made at a speed lower than four and five miles an hour, and heavily loaded teams, and heavy mail and passenger coaches, kept the roads for a considerable part of the year in a state not calculated to encourage fast driving. The farmer had to haul his produce often long distances to market, and needed a heavy kind of horse. Now he has a market almost at his very door. The long line of lumbering teams is rarely seen. The old mail coach has little left to do. As many horses are now required, and even more than before, but their work is very different. The vast improvements in agricultural implements have also lightened the labors of the horse. Our wagons are of lighter construction, our ploughs run easier, our lands are freer from rocks and stumps, and quick, hardy horses often take the place of oxen, and of the larger, heavier, and much slower horses of half a century ago.

The farmer or the country gentleman who is accustomed to ride in the cars at the rate of thirty or forty miles an hour, would not be satisfied to step out of them and have to travel at the rate of five or six miles an hour. So that the purposes for which horses are now wanted are, as a general thing, very different from what they used to be. Speed, which was formerly little required, is now considered an indispensable requisite in a good horse, and though our horses are made up, as we shall see, of almost, if not quite as great a variety of blood, and with as little regard to the true principles of breeding, as our native cattle, yet they are, in many respects, distinct from all other horses. They possess, in many sections of the country, a surpassing degree of speed and power of endurance, the result, in part, of the altered condition of things, and greatly, also, of more attention to breeding and training.

The first horses taken from Europe to the western continent, were brought over by Columbus in his second voyage, in 1493, and the first introduced into any part of the territory now comprised within the United States, were brought over and landed in Florida by Cabeça de Vaca, in 1527. These numbered forty-two, but all perished for some cause or other soon after their arrival. The horses found wild on the plains of Texas and the western prairies are, probably, descendants of the fine Spanish horses abandoned by De Soto on the failure of his expedition and the return of his disheartened adventurers. In 1604, a French lawyer, M. L'Escarbot, brought over horses to Acadia, and from there the French, who extended their settlements into Canada in 1608, took the horses which, probably, laid the foundation of what are now known as Canadian ponies, having, no doubt, lost much of their original size by the severity of the climate and limited summer forage. Though degenerated in size, they still show traces of Norman blood, from which they probably sprang.

In 1609 six mares and a horse were taken to the settlement at Jamestown, in Virginia, and in 1657 the exportation of horses from that colony was strictly prohibited. In 1629-30 horses were introduced into the colony of the Massachusetts Bay by Higginson. These were brought from Leicestershire, in England. The Dutch West India Company had imported horses from Flanders, probably, into New York, in 1625, and it is thought by some that the Conestogas derive their origin from this source. The French, who settled in Illinois in 1682, had many Canadian horses, which were allowed to run on the extensive "ranges" in their vicinity.

Thus we see, in part, the varied sources from which the native horses of this country came. To these were added, from time to time, in the middle and southern states, more or less of thorough-bred, or racing stock, which essentially modified the stock with which it became mixed. The horses of New England, especially of Vermont and Massachusetts, have been used chiefly as roadsters and for general utility. They possess the most admirable qualities of power, speed, and endurance, and, for quick work and travel on the road, they are unsurpassed by any horses in the world. Low, in his "History of Domestic Animals," says of the people of this country: "They prefer the trot to the paces more admired in the old continent, and, having directed attention to the conformation which consists with this character, the fastest trotting horses in the world are to be found in the United States."

Among the changes which have been effected within the last fifty years in the horses of New England, on which the high encomium given by Prof. Low is chiefly based, none, certainly, have been more marked than the increase of speed. Fast trotting was scarcely known in the time of the old "Justin Morgan," nor was the speed of the horse considered of any special money value till the invention of the modern light buggy and the improvement of the roads, already alluded to. This quality has now become essential to the convenience and comfort of nearly all classes of society. Most people want a horse to go off easily at the rate of eight, ten, or twelve miles an hour, and the horses that do it are now very common, whereas formerly, they were only the very rare exception to the general rate of speed. A demand very soon creates a supply, and the farmer who breeds horses knows his own interest well enough to study the tastes of the community, and to breed accordingly. In point of speed, therefore, there can be no question that a very great increase has been attained by careful breeding, particularly within the last twenty years. In other points some improvement has been made, such as general good qualities of style, action, temper, form, constitution, and endurance. The aggregate money value has been greatly increased, because the number of fast horses and the general average of intrinsic good qualities in horses has been increased, and these command their value. But, perhaps, the tendency has been to congregate the best horses in the cities and large towns, and to draw them from the country. Few farmers want to keep a horse for farm and general purposes, that will bring from two or three to five hundred dollars.

Two distinct varieties of horses are now, and have for the last few years been favorites for the road. Neither of these can have any pretensions to the claim of being a distinct race, though they have both become distinct families, well known under their respective names. The peculiarities of both are so well marked, as not to deceive the practised eye. Of these, the Morgan has been alluded to, as deriving its name from the owner of the founder of the family, or the old "Justin Morgan," foaled in West Springfield, Mass., in 1793. The sire of this remarkable stallion is supposed to have been "True Briton," a half thorough-bred. The old "Justin Morgan" soon went to Vermont, 1795, and there laid the foundation of the Morgans of that state, producing the celebrated "Bulrush," "Woodbury," and "Sherman" Morgans, all of which added vastly to the wealth of the breeders and farmers of that section. The descendants of these horses have been spread far and wide. The "Justin Morgan" was a small horse, only about fourteen hands high, and weighing only about nine hundred and fifty pounds. The Morgan horse of the present day is of somewhat larger size, and usually varies from nine hundred and fifty to ten hundred and fifty pounds. He is remarkable for compactness of form, strength, and docility; and for the infinite variety of purposes for which the New England horses are wanted, is probably unsurpassed. He is much sought after for use on the road, and in omnibuses, hacks, and lighter carriages.

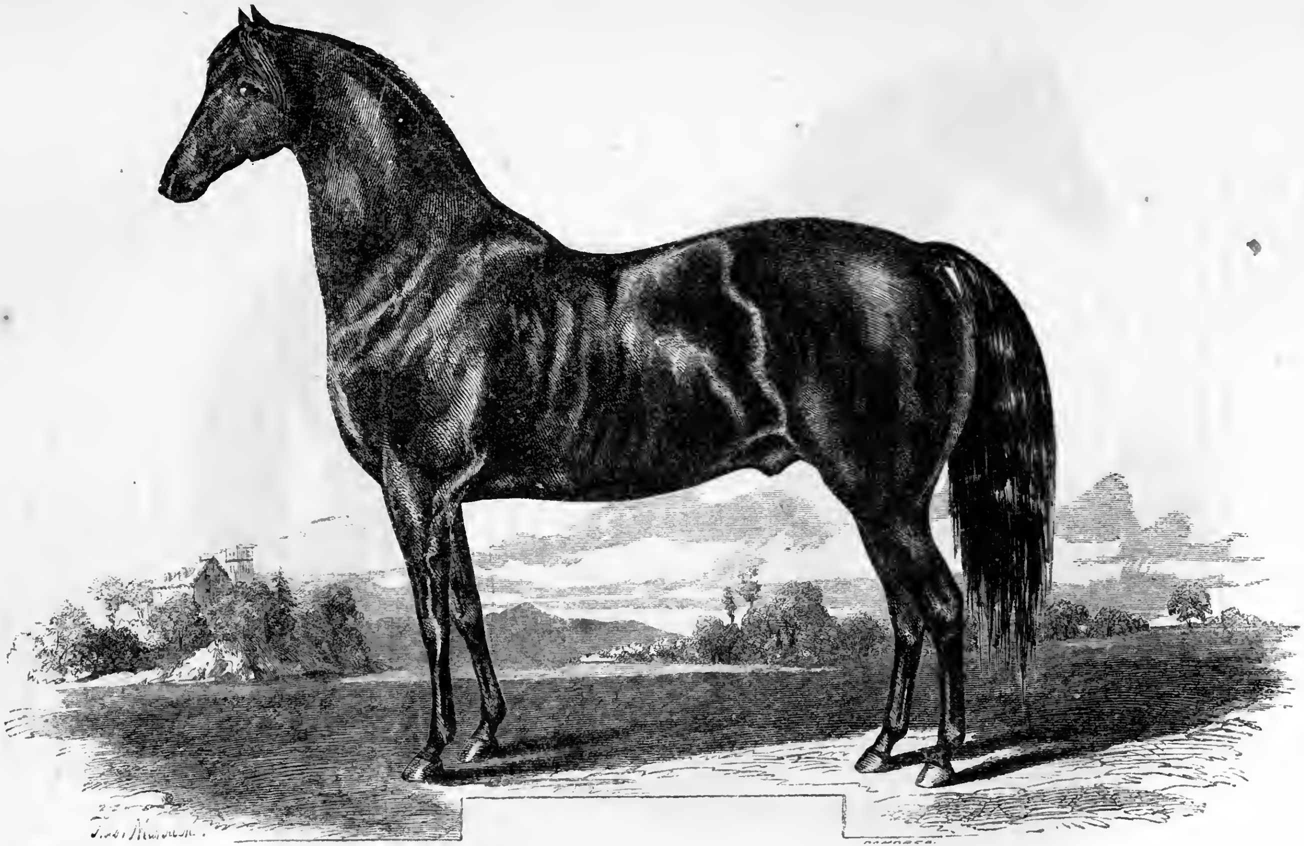
The other family, also widely known, not only in New England, but throughout the country, is the Black Hawk. The founder of this family was a horse of that name, celebrated for transmitting his qualities to his offspring, as well as for his great speed as a trotter. He was kept in Vermont till his death in 1856, at the age of twenty-three years. As roadsters, the Black Hawks are often very excellent, possessing a high and nervous style of action, an elastic step, and a symmetrical and muscular form. It is not too much to say that those two classes of horses have added many millions of dollars to the value of the horses of this country. They infused a new spirit into the business of breeding in New England, and had an effect on the enterprise of the farming community, similar to that which the introduction of short-horns had on the general improvement of the stock of the western states.

The style of horse which has been most imported and bred in the southern states, especially in Maryland and Virginia, is quite different. The cavaliers cultivated and encouraged the sports of the turf, and the thorough-bred was early introduced, and bred with much enterprise. Good saddle horses, which in New England are comparatively rare, are very common at the south, where the manly and healthful exercise of horseback-riding has for a long time been almost universally practised, both as a pastime and a common mode of travelling. The interest in breeding thorough-bred horses has been kept up in Kentucky, also, and some of the most renowned running horses of this country hail from that state.

There is a difference of opinion among good judges of horses, as to whether the cross of the thorough-bred horse on the common horse of the country would effect any improvement when viewed from the stand-point of general utility. For special purposes, as for the production of good saddle horses, the value of this cross would, no doubt, be conceded. But the gait most highly prized and most desirable for general utility is the trot, and the mechanical structure best adapted to trotting and running is quite different. At the same time it must be admitted, I think, that some of our best trotters have had strong infusions of thorough-bred blood. Some say, however, that the form of the thorough-bred has been changed, and so far as compactness, muscle, and endurance are concerned, degenerated. This is an opinion merely, which would apply with greater force to the general average of thorough-breds or racers in England than in this country. The experiment is undergoing full and fair trial in New England at the present time.

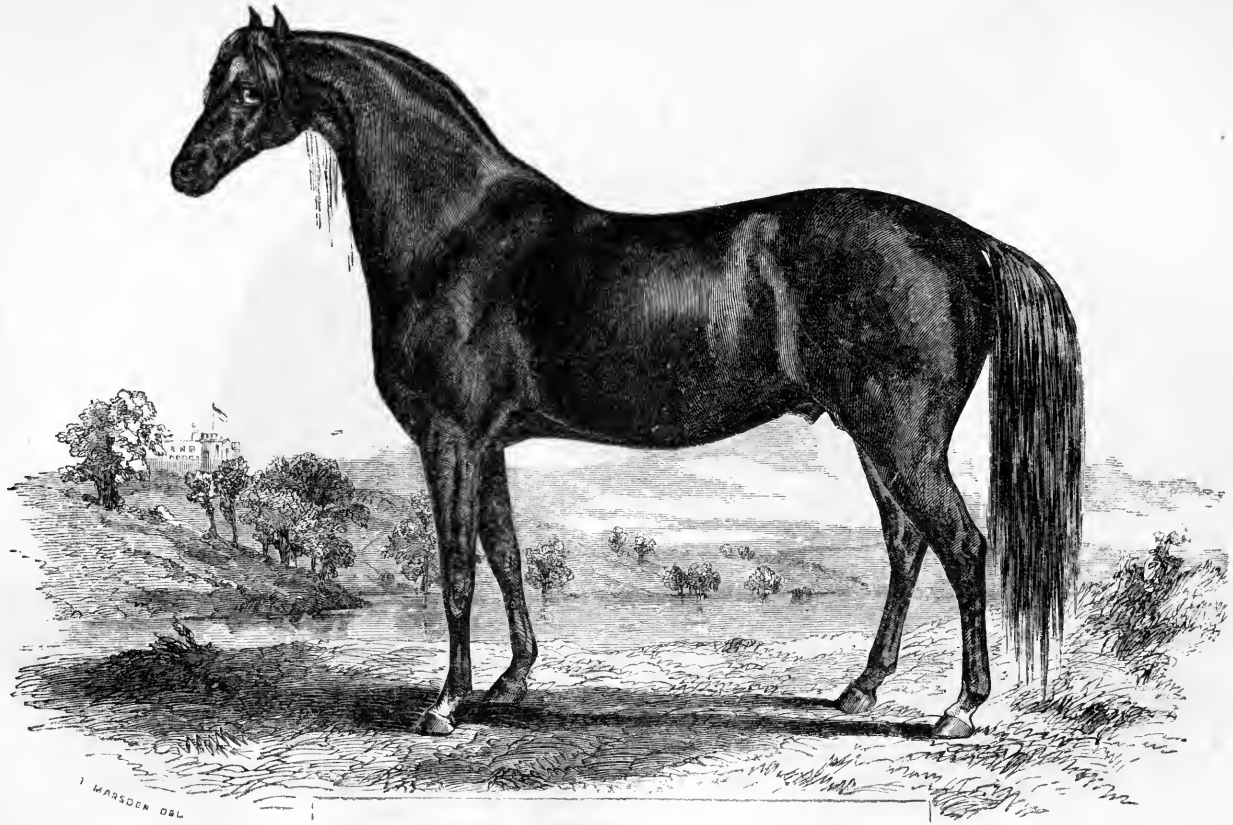
The Conestoga is a large and very heavy breed of horses, often met with in the middle states, and used mostly for the purposes of slow draught in the drays of our large towns and cities.

But while it is evident that the intrinsic value of our American horses has been vastly improved, their aggregate number has also been greatly increased during the last fifty years. Unfortunately, the census of 1840 did not take an account of horses by themselves, and we cannot tell, with exactness, the ratio of increase from that time to 1850, when the number of horses, exclusive of those of large cities and large towns, which were not returned, was 4,336,719.



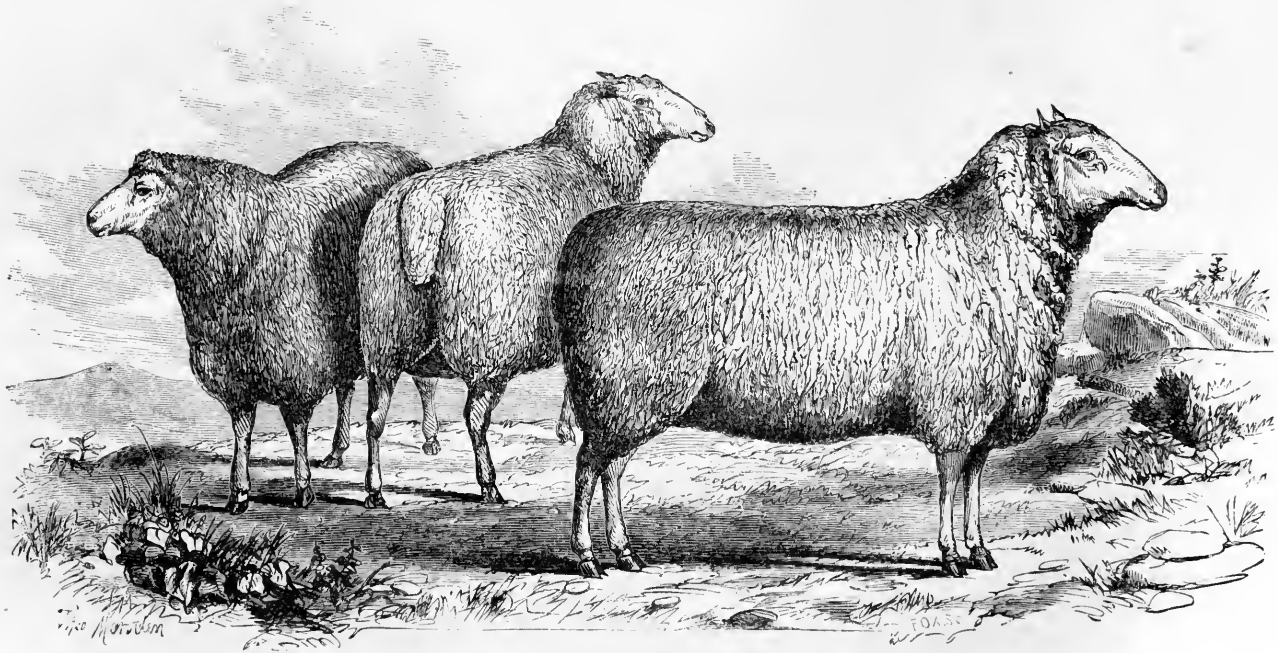
PETERSHAM MORGAN.

Engraved for Fifth Annual Report of the Secretary of the Massachusetts State Board of Agriculture. First prize at the Massachusetts State Fair, 1857.



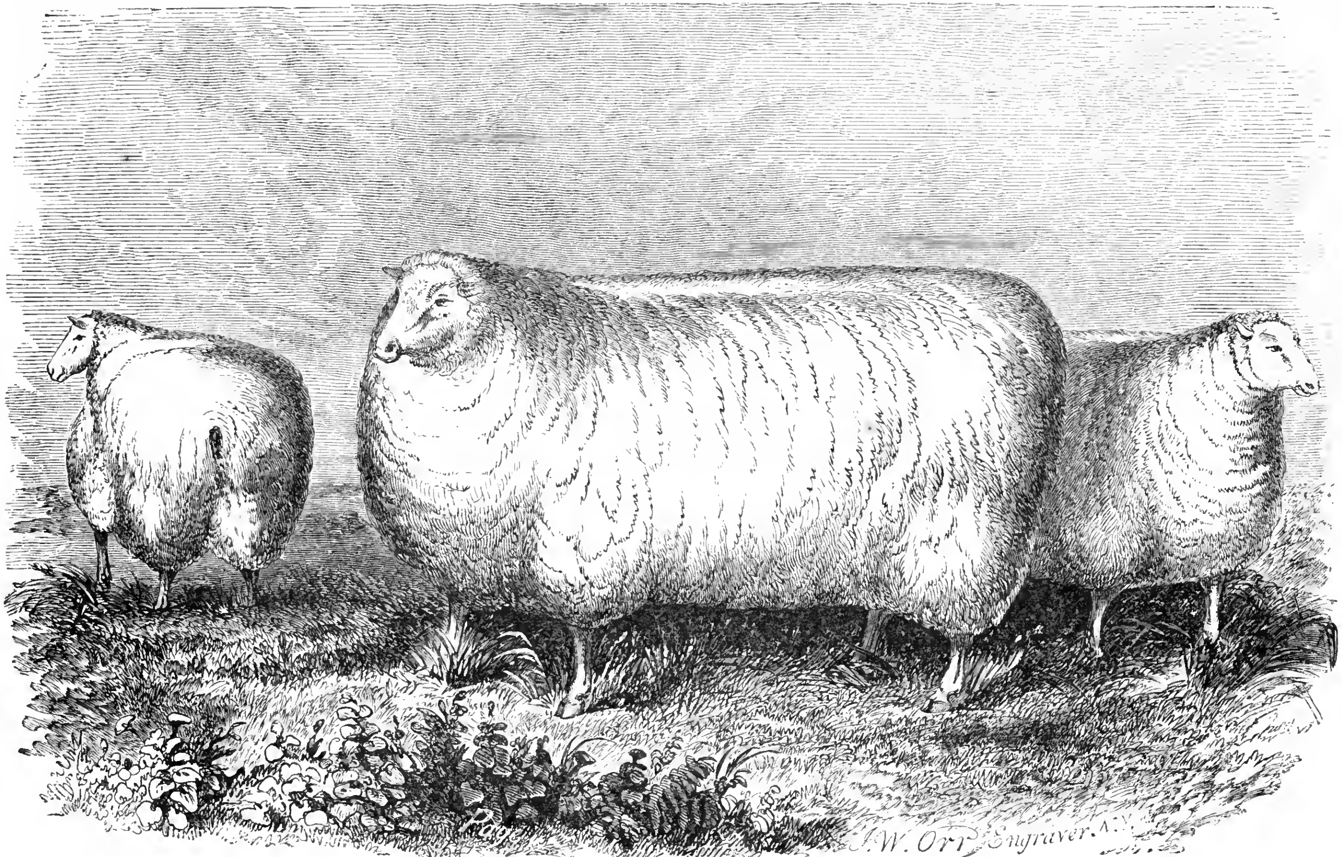
TROTTING CHILDERS.

Sired by old Black Hawk. Owned by Lambert Maynard, Bradford, Mass. Engraved for C. L. Flint's Report to the Massachusetts Legislature.



COTSWOLD SHEEP.

Owned by Thos. J. Field, Northfield, Mass. Copied by permission from Fifth Annual Report of C. L. Flint to the Legislature of Massachusetts.



IMPROVED KENTUCKY SOUTH DOWNS.

The number of horses, mules, and asses, in 1840, was 4,335,669, while the aggregate number of these classes in 1850 was 4,896,050, that of mules and asses being 559,331. Why the number of horses owned in the many large cities of the country, and constituting no small item of the national wealth, was not included in the returns, I am not fully informed. From the numbers stated above, it appears that there is about one horse to every five persons in the United States. New York had one horse to seven inhabitants; Pennsylvania one to six and six-sixteenths; Ohio one to four; Kentucky one to three free inhabitants. In Ohio and the new states of the north-west, the increase in the number of horses kept pace with that of the population. In the other states, owing partly, probably, to the multiplication of railroads, the increase was in a somewhat slower proportion. The number of horses in the United States is more than three times as large as in Great Britain.

The south, by the last census, had 2,044,377 horses; the west had 1,220,703; and the north had 1,073,639.

SHEEP.

Another branch of farming which has been subject to more or less vicissitude, is that of sheep husbandry. The first sheep imported into this country were, probably, those taken into Virginia in 1609. They came from England, and thrived so well that in 1648 they had increased to three thousand.

About the year 1625, some sheep were introduced into New York by the Dutch West India Company. These came from Holland, and, together with others which arrived in 1630, proved to be too much of a temptation to dogs and wolves, for it is stated that in 1643 there were not more than sixteen sheep in the whole colony.

Sheep were brought into the Plymouth colony, and that of the Massachusetts Bay, very soon after the settlement. They were kept on the islands in Boston harbor as early as 1633, and in 1635 the number of sheep in the New Hampshire settlement, near Portsmouth, was ninety-two. In 1652 the number of sheep in and around Boston had largely increased, since there were four hundred in Charlestown. In 1660 they were introduced upon the island of Nantucket, and the raising of wool grew up to be of some importance there.

Sheep husbandry, in the earlier history of the country, was carried on very differently, for the most part, from what it has been more recently. There were few extensive flocks, but in the days of homespun it was very common for the farmer to keep a number sufficient for home consumption. In fact, it was almost a matter of necessity. But the old native sheep was a coarse, long-legged, and unprofitable animal. The first fine-woolled sheep introduced into the country were those brought from Spain by Mr. Wm. Foster, of Boston, in 1793. He speaks of them as follows:—

"In April, 1793, on returning from Cadiz, where I had been passing several years, I brought out an original painting, by Murillo, and three merino sheep—two ewes and a ram—the export of which, at that time, was severely prohibited, and attended with much difficulty and risk. We had a long passage—seventy-five days—and the sheep were in a dying condition. Fortunately, there was on board a Frenchman, that had been with the Spanish shepherds, who cured them by administering injections. Being about to leave this country for France, soon after my arrival in Boston, I presented these sheep to Mr. Andrew Craigie, of Cambridge, who, not knowing their value at that time, 'simply ate them,' as he told me years after, when I met him at an auction, buying a merino ram for $1,000."

Another small importation of merinos was made in 1802, and again in 1809 or 1810, about which time a complete merino fever ran through the whole farming community, which had its day, and then subsided.

The embargo of 1808 led many to turn their attention to wool growing, and fine wool soon rose to the high price of $1.50 and $2.00 a pound. In 1809-10, no less than 3,650 merinos were imported and distributed throughout the United States. The importance of these early importations can hardly be overestimated. They furnished our woollen manufactories with the raw material at a time when it would have been extremely difficult to obtain it from abroad.

In the ten years from 1840 to 1850, the sheep of the United States increased two and a half millions, and numbered about twenty-two millions, or more accurately, 21,723,220. But in New England there was a remarkable falling off from 3,811,307 in 1840, to 2,164,452 in 1850, making a loss of forty-five per cent., while in the five sea-board states of New York, New Jersey, Pennsylvania, Delaware, and Maryland, the decrease was twenty-two per cent. The increase was chiefly in the southern and western states. The production of wool steadily increased, for in 1840 we raised 35,802,114 pounds, valued at $11,345,318; in 1850 we raised 52,516,959 pounds, worth $15,755,088; and in 1855 we raised 61,560,379 pounds, worth $23,392,944, being a gain of forty-six per cent. But as some evidence of improvement, it may be stated that the average weight of fleece increased from 1.84 pounds in 1840, to 2.43 in 1850.

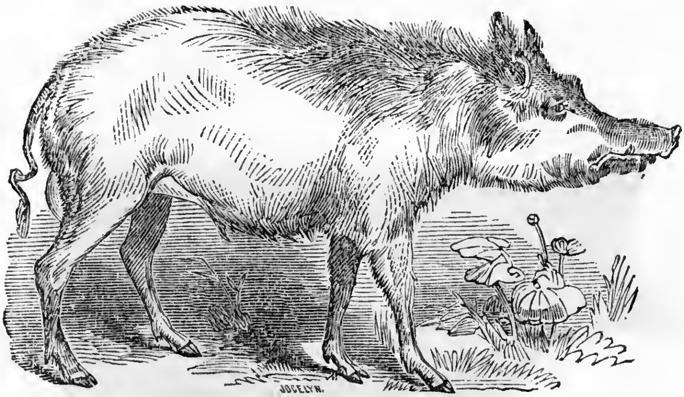
Since the opening of the great railway lines to the west, two prominent causes have operated to diminish the number of sheep, and attention to this branch of farming, in New England. One was, that previous to that time, we had rushed into fine wools, or merino sheep, almost worthless for the market. When, therefore, the competition of the great west was let in upon us, with the facilities for transporting wool, we had little left but a parcel of carcasses worth about as much as so many cats.

Massachusetts cannot and ought not to attempt to raise wool, which can be brought from Ohio, and in fact from the extreme west, or from Texas, at about a cent a pound freight. And so, instead of changing the breed, and raising the south-downs, or the cotswold, or some other adapted to the market, the farmer discarded sheep altogether, thinking they didn't pay, and the kind of sheep he had did not.

Another reason was the extreme annoyance of dogs, which would often destroy the profit of a whole year in a single night. We are not, therefore, surprised to find that the number of sheep in Massachusetts declined from 378,226 in 1840, to 188,651 in 1850, and to 145,215 in 1855. This last evil has now been remedied in some of the eastern states, Massachusetts taking the lead, by a law designed for the protection of sheep against dogs, which offers great inducements for entering again upon the business of sheep raising, and many are now availing themselves of it. Growing mutton and lamb for the market at any thing like the present high prices of those articles in the eastern market, is one of the most profitable, and at the same time agreeable branches of farming. Our provision markets must be supplied from a nearer source than the prairies of the west; and in this particular the eastern farmer need fear no competition. And the same holds good to a great extent along the Atlantic coast, or in the vicinity of the great markets.

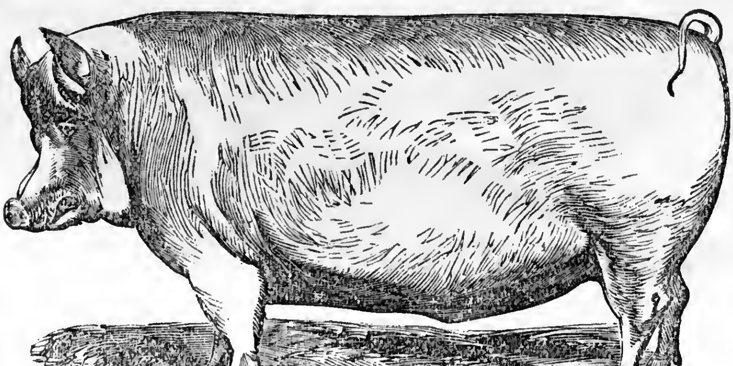
In the meantime the capacities and the adaptation of the climate of the south for the raising of wool are being more and more appreciated, and that section is growing more wool. It has been shown by the experience of the last ten years, that by proper attention to breeding, the hilly portions even of the extreme south may be profitably devoted to the production of wool. At the World's Fair at London, in 1851, the fleece that commanded the highest premium for the fineness and beauty of staple, was grown in Tennessee. Germany, Spain, Saxony, and Silesia were there in strong and honorable competition. "Nature," says the owner of the premium fleece, "gave me the advantage in climate, but the noble lords and wealthy princes of Europe did not know it, neither did my own countrymen know it, until we met in the Crystal Palace of London, before a million of spectators. While their flocks were housed six months in the year, to shelter them from the snow of a high latitude, and were fed from the granaries and stock-yards, mine were roaming over the green pastures of Tennessee, warmed by the genial influence of a summer sun; the fleece thus softened and rendered oily by the warmth and green food, producing a fine, even fibre."

So that whether it be north or south, east or west, sheep are, on the whole, the most valuable of the domestic animals kept on our farms, on account of their small cost and large returns, especially since they are well known to improve the land on which they graze. The total product of wool in the United States, as shown by the census of 1850, was 52,516,959 pounds. The amount had increased in nineteen years, or from 1832, only 5,599,633 pounds, and that, too, with a high duty on wool ranging from four cents a pound, and forty per cent. *ad valorem*, to thirty per cent. *ad valorem.* But in Great Britain the production was 275-000,000 pounds—an increase in twenty-two years, with a duty to protect and encourage the wool-grower, of 163,376,271 pounds. The value of wool imported into this country in 1850 was $1,681,691, while the value of this article exported that year was $22,-778, so that the excess of value of imported over that exported was $1,658,913, all of

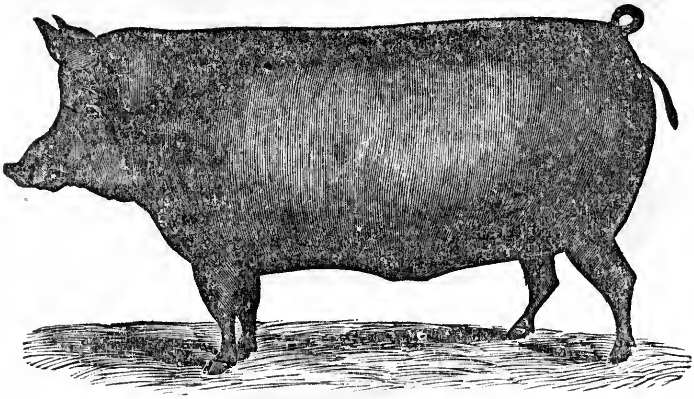


SOUTHERN PINE WOODS HOG.

WESTERN BEECH NUT HOG.



IMPROVED SUFFOLK.



IMPROVED ESSEX.

BERKSHIRE HOG.

which might, and ought to have been saved to the country. But while we imported so large an amount of foreign wool, the value of woollen manufactured articles imported was no less than $16,259,649. The value of such articles exported by us was only $171,-300, leaving an excess of imported woollen articles, of the enormous sum of $16,088,-349. Putting this and that together, we find the value of raw and manufactured wool imported in 1850 over that exported, $17,747,-262. The value of raw wool manufactured in New England in 1850 was $16,055,233, and the number of pounds used was 43,118,-059. Probably the census of 1860 will show a very considerable improvement over that of 1850. The immense facilities for wool-growing in Texas, and some other localities, were not sufficiently known to be appreciated ten years ago.

Let us see where the wool we did raise in 1850 was actually produced. The south, including Maryland, Delaware, the District of Columbia, Virginia, North Carolina, South Carolina, Georgia, Alabama, Louisiana, Florida, Texas, Missouri, Mississippi, Kentucky, Tennessee, and Arkansas, comprising an area of 851,448 sq. miles and a population of 9,664,656, raised 6,821,871 sheep, and 12,797,829 pounds of wool, valued at $3,-839,348.

The west, comprising Ohio, Michigan, Illinois, Indiana, Wisconsin, Iowa, California, Minnesota, and the territories, having an area of 1,918,216 sq. miles and a population of 4,-900,369, had 7,396,331 sheep, and produced 17,675,129 pounds of wool, valued at $5,-302,538.

The north, comprising New England, New York, New Jersey, and Pennsylvania, an area of 166,358 sq. miles and a population of 8,626,852 souls, had 7,505,018 sheep, and raised 21,972,082 pounds of wool, valued at $6,591,624.

To conclude, therefore, we have made some decided progress, both in the numbers and in the intrinsic value of our flocks. The number of skilful breeders is increasing, and the different sections of the country understand better the capacity and adaptation of their own localities for the production of mutton and lambs for the market, or the growing of wool for the manufacturer.

SWINE, AND THE PORK BUSINESS.

Few animals are so susceptible of change and improvement in the hands of the skilful breeder as the hog. This animal comes to maturity in so much less time than the horse or the cow, and increases with so much greater rapidity, as to offer larger inducements to improve and perfect it.

Ferdinand de Soto probably brought the first swine into this country, in 1538. These came from Cuba, and were landed in Florida. They were probably descended from some brought over by Columbus in 1493. The Portuguese, it is well known, brought swine into Nova Scotia and Newfoundland as early as 1553, where they rapidly multiplied.

The London Company imported swine into Virginia in 1609. They increased so fast, that in 1627 the colony was in danger of being overrun with them, while the Indians fed on pork from the hogs that had become wild from running at large in the woods.

Meantime, they were introduced into the Plymouth colony in 1624, by Gov. Winslow, and into New Netherlands—now New York—in 1625, by the Dutch West India Company. In all the colonies, as well as in the French settlements in Illinois, they were allowed to run at large with considerable freedom, and fed on mast, though it was soon found that pork fed on Indian corn was much sweeter than that mast-fed.

It is not probable that any special attention was paid to breeding, with reference to improving this animal, till near the close of the last century. The first improvements effected that excited any considerable interest, seem to have been produced by a pair of pigs sent from Woburn Abbey by the Duke of Bedford to General Washington. Parkinson, the Englishman to whom they were entrusted for delivery to the general, was dishonest enough to sell them on his arrival in this country. They were long known as the Woburn, and, in some sections, as the Bedford hog, and were originated by a fortunate cross of the Chinese and the large English hog. There is no doubt they were splendid animals, with many fine points, small bones, deep, round barrel, short legs, feeding easily, and maturing early, and often weighing at a year or a year and a half old, from four to seven hundred pounds, with light offal, and the first quality of flesh. They were mostly white—somewhat spotted. They were very common at one time in Maryland, Delaware, and Virginia, and were bred somewhat extensively by Gen. Ridgeley, of Hampton—a fine country seat in Baltimore county, Md.—who sent a pair of them to Col. Timothy Pickering, of Hamilton, Mass., who bred them till they became quite noted over a wide extent of country. They are now extinct. It is worthy of remark that the Byfield breed originated in the same way, by a cross of the Chinese and the common hog, bred by Gorham Parsons, in Byfield, Mass. This breed became famous, and was very much sought after for many years, and is even now found in Ohio.

Previous to the introduction of the Woburn hog, the classes of swine that had prevailed in the eastern and middle states were coarse, long-legged, large-boned, slab-sided, and flab-eared, an unprofitable and an unsightly beast, better calculated for subsoiling than for filling a pork barrel. An effort had been made to improve them, about fifty years ago, and before the valuable breeds above alluded to had become generally known, by the introduction of an animal commonly called, at that time, the grass-fed hog, which appeared about the time of the introduction of merino sheep, and were often sneered at as the "merino hog." Chancellor Livingston took very great pains to disseminate them, if, indeed, he did not originally import them. They are said to have been an exceedingly well-formed beast, with small heads, round bodies, compact and well made, legs short and small-boned, spotted in color, with a kind of dusky white on a black ground. As they were looked upon as an innovation, they had to encounter the force of public sentiment, but their intrinsic good qualities finally prevailed, and they became popular.

Since that period the introduction of many varieties of superior hogs, both from Europe and Asia, has effected a very marked improvement in the common hog of the present day, though it has been a too frequent practice to breed indiscriminately. A pure breed, like the Suffolk, the Berkshire, or the Essex, may be used to cross for a specific purpose, but the pure breed ought again and constantly to be resorted to, or the result will be likely to be unsatisfactory. It requires great skill and judgment to breed judiciously, and it ought to be made a special branch of farming to a greater extent than it usually is, in order to insure the preservation and perpetuation of purity of blood.

It is well settled that neither the eastern nor the middle states can compete successfully with the west in the raising of swine and the production of pork on a large scale. The cost of grain in those sections of the country would prevent it. A limited number of hogs can be kept to advantage in a section of small farms, sufficient to consume and thus economize the refuse of the dairy and other farm products, that would otherwise be liable to waste, but beyond this, the keeping of swine is not only not profitable, but an absolute bill of expense.

But in Ohio, Kentucky, Illinois, Indiana, and other states where corn can be raised with little labor, and in unlimited quantities, the cost of pork is trifling compared with the keeping of swine in the eastern states. The raising and packing of pork has, therefore, very naturally grown up in the western states, and vast quantities are exported from there every year, including pigs on foot, by railway, slaughtered and sent off in the whole carcass, and in hams, shoulders, and sides, smoked, and in the shape of barrelled pickled pork.

The native hogs of the west—that is, the descendants of those taken there by the earlier settlers, and common there till within a very recent period—were admirably calculated for the primitive condition of civilization in which they were placed. They were well calculated to shirk for themselves, as they had to do, and became as fleet as the deer, while their strength of head, neck, and tusks enabled them to fight any wild beast of the forest, and withstand any extent of exposure to the weather. They were diametrically opposite in every prominent good quality to the improved swine of the present day. Instead of speed and fleetness of foot, the farmer wants sluggishness in his hogs; instead of coarse, rawny bones, he wants fine, small-boned animals; and instead of a thick, hard coat, he wants a fine head, thin coat, ready fattening qualities, and general thriftiness. And so the Suffolks became the favorites, and produced many most excellent crosses with the old natives. In other parts of Ohio, where improvement has taken place, the Byfield, the Chester County, the Berkshire, the China, the Irish Grazier, or some other of the many excellent improved breeds have been introduced, and effected a great and perceptible change. The western farmer wants greater size than he finds in the pure Suffolk or the pure bred Essex, but he also wants most of the excellent qualities which a cross of these breeds on the large and coarser natives produces.

It is a somewhat singular fact, that according to the last census, the number of swine kept in the United States exceeds that of sheep by nearly *ten millions;* that of the former being over thirty millions, or 30,354,213, while that of the latter was 21,723,220. In point of numbers, Tennessee takes the lead of all the states, having no less than 3,104,800, while her number of sheep was only 811,591. Kentucky, at the same time, had 2,891,163 swine, and 1,102,091 sheep. Indiana is ahead of Ohio in the number of swine, the former having 2,263,776, to 1,964,770 in the latter. The geographical distribution of the aggregate number of swine in the country was as follows: The south, embracing the states mentioned on a previous page, had 20,808,948; the west had 6,874,996, and the north had 2,670,469.

But no one, with a simple knowledge of the aggregate number of swine, would form an adequate idea of the enormous extent to which the business of raising and packing pork for exportation has grown up within the last few years, and it is important to look at the statistics of this business, especially as it is carried on at the west. And as Cincinnati is the largest pork market in the United States, and indeed in the world, not even excepting Cork and Belfast, it will be interesting to state in brief the manner in which the business is conducted there, from which the mode of management in the other large cities of the west may be obtained. The following facts are gathered chiefly from statistics published by Mr. Cist, of Cincinnati.

The slaughter houses are in the outskirts of the city, fifty by one hundred and thirty feet each in extent, the frames boarded up with movable lattice-work at the sides, ordinarily kept open to admit the air, but shut during intense cold, so that the hogs may not be frozen so stiff as not to be cut up to advantage. Each establishment employs as many as one hundred hands, selected for their strength and activity.

The hogs being confined in adjoining pens, are driven, about twenty at a time, up an inclined bridge, opening into a square room at the top just large enough to hold them. As soon as the door is closed, a man enters from an inside door, and with a hammer weighing about two pounds, fixed to a long handle, knocks each hog down by a single blow between the eyes. In the meantime, a second adjoining apartment is being filled with as many more. A couple of men seize the stunned hogs, and drag them through the inside door to the bleeding platform. Here each gets a cut in the throat with a sharp-pointed knife, and the blood falls through the lattice floor. After bleeding a minute or two, they are slid off this platform into the scalding-vat, about twenty feet long, six feet wide, and three feet deep, kept full of water heated by steam, the temperature being easily regulated. As the hogs are slid into one end of this vat, they are pushed along slowly by men standing on each side with short poles, turning them over so as to get a uniform scalding, and moving them onward so that each will reach the other end of the vat in about two minutes from the time it entered. Ten hogs are usually passing through this scalding process at the same time, being constantly received in at one end, and taken out at the other, where there is a contrivance for lifting them out of the water two at a time, by one man operating a lever which raises them to the scraping table, five feet wide and twenty-five feet long, with eight or nine men on each side, and usually as many hogs on it at the same time, each pair of men performing a separate part of the work of removing the bristles and hair; the first two take off only those bristles which are worth saving for the brush makers, taking only a double handful from the back of each hog, which are deposited in a box or barrel close at hand. The hog slides on to the next two, who with scrapers remove the hair from one side, then turn it over to the next two, who scrape the other side; the next scrape the head and legs; the next shave one side with sharp knives; the next shave the other; the next do the same to the head and legs. Each pair of men have to do their part of the work in twelve seconds, or at the rate of *five hogs a minute,* for three or four hours at a time! When the hog arrives at the end of this table, all shaved smooth, another pair of men put in a gambril stick and swing the hog off on the wheel, which is about ten feet in diameter, revolving on a perpendicular shaft extending from the floor to the ceiling, the height of the wheel being about six feet from the floor. Around its outer edge are placed eight large hooks, about four feet apart, on which the hogs are hung to be dressed.

As soon as the hog is swung from the table to one of these hooks, the wheel turns one-eighth of its circuit, and brings the next hook to the table, and carries the hog a distance of four feet, where a couple of men dash it with clean cold water and scrape it down with knives to remove any loose hair or dirt that it may have brought along off the table. Then it moves again and carries the hog four feet further, where another man cuts it open in a single second and removes the larger intestines, or such as have no fat on them worth saving, and throws them out at an open doorway at his side; another move of four feet carries it to another man, who lifts out the rest of the intestines, the heart, liver, etc., and throws them upon a large table behind him, where four or five men are engaged in separating the fat and other valuable parts; another move and a man dashes a bucket of clean water inside and washes off all the filth and blood. This completes the cleaning, and each man has to do his part of the work in just twelve seconds, as there are only five hogs hanging on the wheel at the same time, and this number are removed and as many more added every minute. The number of men inside, not including the drivers outside, is fifty, so that each man in effect kills and dresses a hog every ten minutes of working time, or forty in a day. At the last move of the wheel a strong fellow shoulders the hog, and another removes the gambril stick, and backs it off to the other part of the house, where it is hung up for twenty-four hours, to cool, on hooks, in rows on each side of the beams just over a man's head, where there is space and hooks for 2,000 hogs, or a full day's work at killing. The next day they are taken off by teams to the packing houses.

The hauling of the hogs from the slaughter to the packing houses is of itself a great business, keeping more than fifty of the largest class of wagons employed, each loading from sixty to one hundred and ten hogs at a load. They are unloaded and piled up near the scales in rows as high as possible. Another set of hands is engaged in carrying them to the scales, where they are weighed singly. From the scales they are taken to the blocks, where the head and feet are first struck off with such precision that no blow requires to be repeated. The hog is then divided into three parts, separating the ham and shoulder ends from the middle, when these are again divided into single hams, shoulders, and sides. The leaf lard is then torn out, and every piece distributed with the exactness and regularity of machinery to its appropriate pile. The tenderloins—about two pounds to a hog—are sold to the sausage makers. The shoulders and hams thus cut, undergo further trimming to get them into shape, and are sorted for their appropriate markets. When lard is high, the packer trims so close as sometimes to make the entire shoulder into lard. If the pork is intended to be shipped off in bulk, or to be smoked, it is piled in great masses and covered with fine salt, at the rate of fifty pounds of salt to two hundred pounds of meat. If otherwise, the pork is packed in barrels with coarse and fine salt.

The different classes of cured pork are made up of different sizes and conditions of hogs; the finest and fattest make clear and mess pork, and the rest, prime pork or bacon. According to the inspection laws, clear pork is to be put up of the sides, with the ribs out, and none but the largest class of hogs can receive this brand. Mess pork is made up of all sides, with two rumps to the barrel. Pork of lighter weights may pass as prime. The shoulders, two joles, and sides—enough to fill up the barrel—constitute prime pork.

The mess pork is used for the commercial marine and the United States navy. The prime is usually packed, also, for ship use and the southern markets; while the clear pork goes out to the cod and mackerel fisheries. Bulk pork is intended either for immediate use or smoking. That for immediate use is sent off in flat boats to the lower Mississippi; but the great mass is sent to the smoking houses, each of which can cure from 175,000 to 500,000 pounds at a time. The bacon is sold to the iron manufacturing regions of Pennsylvania, Kentucky, and Ohio, the fisheries of North Carolina, Maryland, and Virginia, and to the coast, or Mississippi region above New Orleans. Of 500,000 hogs cut up, the produce will be about 180,000 barrels of pork, 25,000,000 pounds of bacon, and 16,500,000 pounds of lard. The lard is shipped for the Havana market, where it is extensively used for cooking, and takes the place of butter to a great extent. Large quantities of it are also shipped to England and France.

One establishment is devoted to the putting up of hams and the trying out of grease from the rest of the hog, and its operations reach from thirty-five to forty thousand hogs in one season. The entire carcasses, except the hams, are put into large tanks, and subjected to steaming at the rate of seventy pounds to the square inch, which reduces the whole to the same consistency, and every bone to powder. The fat is drawn off by cocks, and the rest taken off for manure. The great masses of heads, ribs, back-bones, feet, and other trimmings cut up at different pork houses, are subjected to the same process, to extract every particle of grease. This concern turned out, in one season, 3,600,000 pounds of lard, five-sixths of which was No. 1. It is refined as well as steamed by the process, and comes out of extreme purity and beauty. Six hundred hogs a day pass through these tanks. Besides, there are a large number of lard oil factories in Cincinnati—thirty or forty, at least—which do an immense business. One of them has manufactured into lard oil and stearine, 140,000 pounds a month all the year round. 11,000,000 pounds of lard were run into lard oil in one year, making 24,000 barrels of lard oil, of forty or forty-two gallons each, which was sent to the Atlantic cities to be used as such, or in the adulteration of sperm oil; much of it, also, being sent to France to be used in the adulteration of olive oil, the cost of which it very much reduces. The skill of French chemists enables them to incorporate from 65 to 70 per cent. of this miserable lard oil with that of the olive.

Then the star candle factories take the stearine, subject it to hydraulic pressure, and are prepared to manufacture 30,000 pounds of star candles a day. More than 3,000,000 of pounds of this stearine have been made in one year into star candles and soap in these factories.

Then the soap manufactories take up the offal, try out the grease, and make 100,000 pounds of ordinary soap a week, to say nothing of an immense quantity of finer soap, soft soap, etc. The glue factory uses up the hoofs of the hogs. Then come the bristle dressing establishments, employing a hundred hands preparing bristles for the eastern markets. Then come the prussiate of potash establishments, using up the hair part of the hoofs and other offal, making vast quantities of prussiate of potash for the use of the print factories of New England, where it is wanted for coloring purposes, while the blood of the hog is manufactured into Prussian blue. Thus every part of the hog is economized, no part being lost.

The following table shows the number of hogs packed in Cincinnati each year for twenty-seven years:—

1833	85,000	1847	250,000
1834	123,000	1848	475,000
1835	162,000	1849	410,000
1836	123,000	1850	393,000
1837	103,000	1851	334,000
1838	182,000	1852	352,000
1839	190,000	1853	361,000
1840	95,000	1854	421,000
1841	160,000	1855	356,786
1842	220,000	1856	405,396
1843	250,000	1857	344,512
1844	240,000	1858	446,677
1845	196,000	1859	382,826
1846	205,000	1860	

But in addition to this, there are very many other points where the business is carried on extensively, but in a similar manner to that described above.

The magnitude of this business will appear more striking and important when it is considered what a vast amount of labor it requires and creates, furnishing employment to thousands, at a season when their regular work, in many cases, would naturally cease. Think of the coopers, not only in and around the large cities, but all over a great section of country, making lard kegs, pork barrels, and bacon hogsheads in winter, many of them working their farms in summer. Then the vast number who must be busy in getting out staves, and hoop-poles, and headings, which is also winter work. All these various occupations, including the more immediate operations of slaughtering and packing in the city of Cincinnati alone, give work probably to at least ten thousand men, who, if it were not for the pork business, would be earning comparatively little during fully one-third of the year. And this in and around one city, and the adjacent country towns. But, as already intimated, other states are largely engaged in the same pursuits, as the following table, showing the number of hogs killed and packed during the last two years previous to the present, will indicate:—

No. of hogs killed in	1857-8.	1858-9.
Ohio	610,060	624,109
Kentucky	372,609	377,117
Indiana	441,885	407,636
Illinois	463,577	596,136
Missouri	176,386	155,774
Tennessee	42,875	65,172
Iowa	85,583	158,217
Wisconsin	16,000	32,702
	2,208,975	2,416,863

An increase of over $10\frac{1}{4}$ per cent., or in all, of 227,888 hogs *packed*.

In the above statistics of stock of various kinds, no account has been taken of the enormous increase of domestic animals of all kinds in California during the last ten years, which will be found to be vastly greater than most people have any idea of. The number of milch cows in that state, at the present time, is but little short of three hundred thousand, or about one to every two inhabitants, while the increase of horses, oxen, sheep, and swine has been equally astonishing. When it is considered that the state is scarcely yet eleven years old, and that its agricultural resources are almost wholly undeveloped as compared with its capacities for improvement and production, some idea may be formed of the aggregate agricultural wealth which it is destined to add to the country.

We have thus alluded briefly to the various classes of live stock in the United States, and shown its progressively increasing value, and we find the sum total of all classes to be nearly five hundred and fifty millions of dollars ($544,180,516), while the value of slaughtered animals was about one hundred and twelve millions, or more accurately $111,703,142. If to this we should add the value of farm implements and machinery, and that of the farms themselves, we find the whole investment to amount to about four billions of dollars, or $3,962,353,395, in the year 1850, while local or state statistics, and the previous ratio of increase, would indicate a large increase upon that sum for the present time; and the question naturally arises, what is the annual income from this vast capital invested in farming, and the labor which is a necessary incident to it?

Let us refer to the leading products for a satisfactory reply:—

PRODUCTS OF THE SOIL.

In a range of latitude extending almost from the tropics to the regions of frost and snow, we should naturally expect to find a great variety of climate, and the products more especially adapted to it. And such is the case. The products of our agriculture are infinitely varied, and all the great staples form a most important part in promoting the national prosperity. But if, among them all, one can be said to hold pre-eminence over the rest, the palm must be yielded to the golden corn, rearing its imperial form and tasselled banner high over all its compeers, and founding its claim to royalty, as the prince of cereals, by the universality of its uses and its intrinsic importance to mankind.

Its flexibility of organization is truly wonderful; for while it grows best on moist, rich soils, and with great heats, there are varieties of it which can be raised at the height of more than eight thousand feet above the level of the sea. The warmest regions of the torrid zone produce it in abundance, while the short summers of Canada have varieties adapted to them which arrive at maturity with almost the same certainty as those under a hotter sun and a longer season.

INDIAN CORN, therefore, as being the great staple crop of the country, demands our first attention.

This plant is of American origin. It was found in cultivation among the aborigines of the country at the time of its discovery by Columbus. It is referred to by the oldest historians of Peru. It has been found growing wild in various parts of Central America, and Humboldt, who must be regarded as the most eminent authority, says: "It is no longer doubted among botanists that *Maize*, or Turkish corn, is a true American grain, and that the old continent received it from the new."

It is well known that Indian corn entered, in some form or other, into the mythology and the religious ceremonies of the Indians, both of North and South America, long before they were disturbed by the appearance and approach of civilization. Schoolcraft mentions an interesting allegory of the Ojibwas, which has since been clothed with an unusual fascination by the graceful language of Longfellow.

A young man went out into the woods to fast, at the period of life when youth is exchanged for manhood. He built a lodge of boughs in a secluded place, and painted his face of a sombre hue. By day he amused himself in walking about, looking at the various shrubs and wild plants, and at night he lay down in his bower, from which, being open, he could look up into the sky. He sought a gift from the Master of Life, and he hoped it would be something to benefit his race. On the third day he became too weak to leave the lodge, and as he lay gazing upward he saw a spirit come down in the shape of a beautiful young man, dressed in green, and having green plumes on his head, who told him to arise and wrestle with him, as this was the only way in which he could obtain his wishes. He did so, and found his strength renewed by the effort. This visit and the trial of wrestling were repeated for four days, the youth feeling at each trial that, although his bodily strength declined, a moral and supernatural energy was imparted, which promised him the final victory. On the third day his celestial visitor spoke to him. "To-morrow," said he, "will be the seventh day of your fast, and the last time I shall wrestle with you. You will triumph over me and gain your wishes. As soon as you have thrown me down, strip off my clothes and bury me on the spot, in soft, fresh earth. When you have done this, leave me, but come occasionally to visit the place, to keep the weeds from growing. Once or twice cover me with fresh earth." He then departed, but returned the next day, and, as he had predicted, was thrown down. The young man punctually obeyed his instructions in every particular, and soon had the pleasure of seeing the green plumes of his sky visitor shooting up through the ground. He carefully weeded the earth, and kept it fresh and soft, and in due time was gratified at beholding the mature plant, bending with its golden fruit, and gracefully waving its green leaves and yellow tassels in the wind. He then invited his parents to the spot to behold the new plant. "It is Mondamin," replied his father, "it is the spirits' grain." Tradition says they immediately prepared a feast, and invited their friends to partake of it; and that this is the origin of Indian corn.

However this may be, we know that the first attempt by the English to cultivate it within the present limits of the United States, was made on James river, in Virginia, 1608 or 1609. They adopted the mode of culture in practice by the Indians, as given on a preceding page. A year or two after, it is said they cultivated in all as many as thirty acres. The pilgrims found it in cultivation by the Indians around Plymouth, and immediately began its cultivation, manuring it with alewives. As early as 1621, Gov. Winslow visited the Nemasket Indians, at Middleboro', Mass., who fed him on *mazium.*

The cultivation of this important grain was, then, fairly begun at the very first settlement of the country, and it has been continued with slight modification, but constantly extending and increasing in its aggregate product, down to the present time. It is a remarkable fact shown by a comparison of the censuses of 1840 and 1850, that the product largely increased during the ten years, in nearly every state of the Union, and in no state did it retrograde. In New England it increased 50 per cent. in that time, and its increase since has been quite as great, if not even greater, than previous to 1850.

Among the earlier exports of the country we find frequent mention of the number of bushels of Indian corn, showing that a considerable surplus was produced in many localities a century ago. Thus, the amount exported from South Carolina in 1748 was 39,308 bushels, and in 1754, 16,428 bushels. The amount shipped from Savannah in 1655 was 600 bushels, and in 1770, 13,598 bushels. And so North Carolina exported no less than 61,580 bushels as early as 1753. Virginia for several years previous to the Revolution exported 600,000 bushels a year, and from the port of Norfolk alone, 341,984 bushels in the year 1791; while in 1795 the amount from that port reached 442,075 bushels. At the same time the amount sent from City Point, Virginia, in 1791 was 21,180 bushels, including meal, and in 1795, 33,358 bushels.

The amount shipped from Philadelphia in 1752 was 90,740 bushels, and in 1767 there were exported from there 60,206 bushels. In 1771 it reached 259,441 bushels, and in 1796 it amounted to 179,094 bushels, in addition to 223,064 barrels of Indian meal.

There were 2,510 bushels shipped from Portsmouth, N. H., in 1776; and in 1777, 1,915 bushels; which amount increased in 1778 to 5,306 bushels; while in 1779, the export amounted to 3,097. The export of this grain from the same place was 6,711 bushels in 1780, and 5,587 bushels in 1781.

But previous to the first-mentioned date (1776), this grain was on several occasions imported into Portsmouth, and up the Piscataqua river, to the extent, in 1765, of 6,498 bushels, owing, probably, to a severe drought in the year previous, and the spring of 1765, which seriously affected the corn crop. And again, in 1769 the import to that section amounted to 4,097 bushels, followed in 1770 by 16,587 bushels. During that year there was a "very melancholy dry time," in July and August; a drought of such severity that there was little prospect of corn.

The worms had done much injury in the spring, and a "very uncommon sort of worm, called the canker worm, ate the corn and grass all as they went, above ground, which cut short the crops in many places." And again, in 1772 the pastures all dried up, and there was very little corn, and all kinds of grain suffered very much; so that the amount of corn imported into Portsmouth and vicinity was 4,096 bushels in that year.

But the total amount of Indian corn exported from the colonies in 1770 was 578,349 bushels. In 1791 it amounted to 2,064,936 bushels, including 351,695 bushels of Indian meal. In 1800 the aggregate number of bushels exported was 2,032,435, including 338,108 bushels of meal; while in 1810 the export of this grain was only 140,996 bushels, of which 86,744 bushels were in the form of Indian meal.

The product of Indian corn, as may be gathered from the amount exported, had never reached any thing like the figures which it has attained within the last thirty years. This was not owing merely to the fact that the avenues to the great west were not then opened—though, of course, they have vastly multiplied the market facilities for this and other products—but chiefly to the fact that the real advantages of cultivating this as a staple or reliable crop, were not then appreciated as they are now. Add to this the fact that it was comparatively little used as human food in any part of Europe, and we have a reason sufficient to account for the fact that the product was comparatively small. The inland farmer had no market for it, the cost of transportation of so bulky a product prevented him from teaming it to any great distance, and the local demand was so limited that there was no object in raising much more than was absolutely needed for home consumption.

In the year 1816 the crop of Indian corn was very generally cut off throughout the northern states by frequent and severe frosts, so that as a cultivated crop it fell into disrepute in many sections, and was cultivated less for some years, by individual farmers, till its intrinsic importance as a sure and reliable crop brought it gradually into favor. At the time it was first included in the United States census, in 1840, the aggregate yield of the country was 377,531,875, or nearly four hundred millions bushels. In 1850 it had reached within a fraction of six hundred millions, being returned as 592,071,104, occupying 31,000,000 of acres. The value of this enormous crop was $296,034,552. This was a gain of 57 per cent., or 214,539,229 bushels, while the increase of population during the same period was only 35 per cent. According to the estimate of the secretary of the treasury, the crop of Indian corn in 1855 was between seven and eight hundred millions, or nearly double that of 1840. But this estimate was entirely too low, the crop being the largest and best that year that had ever been raised in the country, and amounting, at least, to 1,000,000,000 bushels, and its value, at a low estimate, was $400,000,000.

We see, therefore, on reference to the census, that this crop formed about three-sixteenths of the whole agricultural product of the country in 1850, and that the proportion of improved land devoted to corn was .333, while the number of bushels to each person in the country was 25.53.*

From the amounts of corn stated above, as raised in 1840 and in 1850, it will be seen that we had a very large surplus over and above what we needed for home consumption; though it must be evident that vast quantities are, and must be required to feed to the large number of cattle and swine, which we have seen are annually prepared for the shambles. It appears from official statistics that the exportation of Indian corn has rapidly increased since 1820, when it amounted to only 607,277 bushels, valued at $261,099, and 131,669 barrels of Indian meal, valued at $345,180, making an aggregate of $616,279. In 1830-1 the number of bushels of corn exported from the country was 571,312, valued at $396,617, and 207,604 barrels of Indian meal, valued at $595,434. In 1840-1 the number of bushels of corn exported was 535,727, valued at $312,954, with 232,284 barrels of meal, worth $682,457.

But in 1845-6 the amount rose to 1,826,068 bushels, valued at $1,186,663; and from that in 1846-7 to 16,326,050 bushels of corn, worth $14,395,212. The next year, 1847-8, it reached nearly six millions of bushels; and in 1848-9 to upward of thirteen millions, valued at $7,966,369.

* France produced in 1826 but 17,280,000 bushels, while in 1847 she produced 33,400,000 bushels—being an increase of nearly 100 per cent. in twenty years. Russia produced 16,000,000 of bushels in 1850.

The amount of Indian corn and Indian meal exported from the country from 1851 to 1858 may be seen as follows:—

	Bush. of corn.	Value.	Bbls. of Indian meal.	Value.
1851,	3,426,811	$1,762,549	203,622	$622,866
1852,	2,627,075	1,540,225	181,105	574,380
1853,	2,274,909	1,374,077	212,118	709,974
1854,	7,768,816	6,074,277	257,403	1,002,976
1855,	7,807,585	6.961,571	267,208	1,237,122
1856,	10,292,280	7,622,565	293,607	1,175,688
1857,	5,505,318	5,184,666	267,504	957,791
1858,	4,766,145	3,259,039	237,637	877,692

The amount of exports is, of course, regulated very much by foreign demand. If breadstuffs are scarce in Europe and prices high, they are immediately shipped from this country to take advantage of the market. If the reverse is the case, and prices are low, our surplus is kept at home. It is but a few years since the foreign demand for breadstuffs began to any extent. Now and then would occur a year of unusual scarcity, to be sure, but it was rare to find any extensive demand year after year for our surplus products. The increase of population beyond the point of capacity to produce, in Great Britain and the continent of Europe, now gives the bread question an importance paramount to all others with the European statesman, and it is having and will have a powerful influence on our agriculture. Consumption has overtaken production—got beyond it, in fact, in some of the countries of Europe—and henceforth importation must supply an ever increasing demand, since, however much the agricultural production of western Europe may increase by the improving condition of its agriculture, it cannot hereafter keep up with the natural increase of population, which, at the present time, in Great Britain, is at the rate of a thousand per day. This crowding population will appear in its true light, in an agricultural point of view, when it is considered that if the United States and its territories were as thickly populated as Great Britain, they would contain about 750,000,000 of people, a number nearly equal to the whole population of the globe.

The year 1824, it is asserted by some, was the turning point at which consumption overtook and exceeded production in England. Since that time the agricultural production of Great Britain has been vastly increased by the improvement of agriculture and live stock; but great and perceptible as improvement has been, it has not, and cannot fully supply its overgrown population. The famine in Ireland in 1847, causing the loss of half a million of lives by starvation, and the political revolution which soon followed on the continent in 1848, growing out, to a great extent, of a short supply of food, are fresh in the minds of every one.

Now this surplus of population and the consequent permanent demand for the productions of our soil are of comparatively recent date, and we have hardly, even yet, begun to realize their importance and the influence which they are hereafter to exert in developing the resources of our soil. It was only a century ago (1756) when D'Anqueville, a political economist of France, said: "England could grow corn enough in one year to supply herself for four." Now, though she has, at least, three times as much land under cultivation as then, and though the yield of her products to the acre has been more than doubled, yet she imports food in the shape of corn, wheat, oats, meal, and flour to the extent of more than £45,-000,000, or $225,000,000. Now, though western Europe has been supplied, to a large extent, from Russia and other parts of the world, it is becoming more and more evident that it has got to look more and more to this country for its supplies, and this fact is recognized by many of the leading journals and statesmen of Europe, as, for instance, the *Mark Lane Gazette*, which says: "One fact is clear, that it is to western America that we must, in future, look for the largest amount of cereal produce."

It was fortunate, therefore, for the prosperity of the country, and especially for the prosperity of its agriculture, constituting by far the largest and most important interest, that just about the time when a more extensive demand for its surplus products grew up in Europe, the means were provided for throwing this surplus into good markets.

After the triumphant termination of the war of the Revolution, the importance of developing the material resources of the country impressed itself upon the minds of far-seeing statesmen. Washington himself projected a canal, extending up the Potomac, to connect the great west—then comparatively uninhabited—with the Atlantic coast, and though the enterprise was premature, and the requisite capital could not, at that time, be procured, it shows the grand conception of his noble mind, and that he foresaw the vast importance which the agriculture of that great country was destined to assume. But that state of things could not always remain in a country rapidly recovering from the stagnation of a long protracted struggle for independence, and the events of a second war showed most clearly the necessity of increased facilities of intercommunication. Then we had no canals to speak of, and no good roads. The great extent of sea coast, the magnificent bays, and the mighty rivers which intersected the country were the chief means of industrial intercourse, and these could be blockaded, crushing our commerce and bankrupting individuals, to the serious injury of the whole country. Then DeWitt Clinton conceived the project of connecting the waters of the Hudson with those of Lake Erie, by a canal so vast in extent as to strike everybody with astonishment. President Madison went so far as to express the opinion that it could not be accomplished, even with the treasures of the whole federal government. But Clinton persisted, and in 1825, eight years from the time it was begun, a canal of three hundred miles in extent, costing over $9,000,000, bore the produce of the west to the New York market.

The success of this grand enterprise stimulated other improvements of a similar character, and opened up sources of wealth, the mere enumeration of which would appear to be fabulous. Railroads soon followed, annihilating distance, as it were, and bringing the growing centres of trade into close communication. We now have nearly 30,000 miles of railroads, forming a complete network all over the country. At the time of the Revolution, the great state of Ohio was a wild forest that had rarely been penetrated by any white man, except, perhaps, the adventurous hunter. In 1800 she had but little over 40,000 inhabitants. Now railroads connect her many large and prosperous cities and her innumerable villages, and take the produce of her fertile farms to the seaboard markets.

These means of communication are of so recent date, that any prediction of their ultimate results in developing the agricultural resources of these states would be premature. Indeed, the capacity for the production of human food, which is still comparatively undeveloped in that section, can hardly be estimated. The progress within the last twenty years has been so rapid and unprecedented, as to appear altogether marvellous.

But Indian corn, though by far the most important product, is not the only great staple production of the country, and we turn our attention to

WHEAT.

The wheat crop of the country is scarcely less important than that of Indian corn, and, in some respects, it is even more important. This, like the other grains, was cultivated in this country at a very early date, having been sown by Gosnold, on the Elizabeth Islands, on the southern coast of Massachusetts, as early as 1602, at the time he first explored that coast. In 1611 it seems to have been first cultivated in Virginia, and so much did it commend itself to the early settlers, that in 1648, if history is to be relied on, there were several hundred acres in that colony. It soon fell into disrepute, however, as a staple crop, for the cultivation of tobacco was found to pay better, and for more than a hundred years it was comparatively little cultivated. Premiums were offered to encourage its culture, but they were not sufficient to check the growing attention to tobacco.

It is certain that wheat had been cultivated by the Dutch colony of the New Netherlands, for it is recorded that samples of this grain were taken to Holland in 1626, to show what could be done in the new country.

It is not certain that it was cultivated in the Plymouth colony immediately upon its settlement, though it is highly probable that not more than a year or two would have been allowed to pass before so important a plant would have received its due attention. In 1629, wheat and other grains for seed were ordered from England, and in 1631 there arrived a vessel with thirty-four hogsheads of wheat flour.

The culture of wheat was undoubtedly commenced almost simultaneously with the settlement of the country, but it seems never to have attracted any very great attention for more than a century, Indian corn and potatoes being more relied upon for subsistence. It was never raised in New England, in early times, with so much success as it has been during the present century. As early as 1663, it was found to be very subject to blast and mildew. Early in July of that year, "the best wheat," says an old manuscript diary that I have consulted, "as also some other grain, was blasted in many places, so that whole acres were not worth reaping. We have had much drought the last summer (1662), and excess of wet several other springs, but this of blasting is the first so general and remarkable that I yet heard of in New England."

But this blasting is frequently "heard of" afterward, for the very next year (1664) the wheat was very generally blasted, "and in sundry towns scarce any left." And the blast returned again in 1665 and 1666 with great severity. This explains why it never became a prominent crop in New England. There never was a time in the history of this section of the country when it was a sure and reliable crop, unless it be the present, with our improved modes of culture, our better knowledge of proper modes of tillage, deep ploughing, and thorough drainage. I have no patience to read the cant which is constantly paraded in the papers of this and other countries about the exhausted soils of New England. How often do we see it stated that they are "run out," that they won't bear wheat, and the return of the census of 1850 is compared with that of 1840 to show an enormous falling off, as if it were owing to the fact that it is impossible to grow wheat. It is not so. As good crops can be and are grown in Massachusetts now as there ever were. It is as safe a crop now as it ever was, and as profitable. But "the census shows a falling off," is constantly sounded over the country, till people are led to believe it cannot be raised on account of the impoverished condition of the soil. The census does show a decline of this crop in New England between 1840 and 1850, and a large one. But the wheat crop was injured in 1849—that being the year on which the statistics of the crops of 1850 are returned—to a degree wholly unprecedented, not only in New England, but in several of the largest wheat-growing states. The returns, therefore, made in June, 1850, do not correctly indicate the usual quantity of grain grown in the United States. Nor will the census of 1860 give any thing like an adequate idea of the magnificent crop of wheat produced in that year (1860) throughout the northern, middle, and western states.

But wheat is subject to many losses by insects, rust, smut, frost, drought, storms, and other casualties, as well as poverty of the soil. In some recent years it has been very greatly damaged in central and western New York, and in Ohio, by the wheat fly; in other years, the weevil. When the former, the wheat fly, makes its appearance, there is no known remedy but to discontinue the culture of wheat in that locality till it disappears. After a time, the culture of wheat may be resumed with a reasonable hope of freedom from this pest. This is one reason of the little attention, comparatively, paid to the culture of this crop in New England for the last few years. The farmers in many localities are resuming its culture again. I know many and many a magnificent field of wheat in Massachusetts this year (1860), that will average twenty-five, thirty, and thirty-five bushels to the acre, of as full and fair a kernel as ever grew; and many an acre in Massachusetts has averaged over forty bushels this year. It is the opinion of many practical farmers that they can raise thirty-five bushels of wheat as easy as fifty bushels of corn to the acre. But the census of 1860 will not return the full crop.

There were other reasons for the falling off than the impoverishment of the soil. A part of these have been alluded to, and are to be found in the comparative uncertainty of the crop; but a more direct and important cause was the opening of direct railroad communication, and the cheap freight system, with the west. The farmer could produce other crops for the market which paid well, and it was better for him to buy flour than to raise it. He could not compete with the west in raising wheat, but he could in raising milk for the market, in raising fruit—which finds a ready sale at his door—in raising vegetables, which the multiplication of manufacturing villages in his neighborhood created a demand for. And so his industry was merely turned into another channel for a time, and very wisely too.

During the last century considerable quantities of wheat were raised along the Hudson and the Mohawk, and in New Jersey and Pennsylvania; and, as we have seen in the case of Indian corn, the exports were somewhat respectable in years of scarcity in Great Britain, France, Spain, Portugal, and the West Indies, even previous to 1723. In 1750 New Jersey took the lead of all the colonies in growing wheat.

The amount of flour exported from New York in 1749-50, was 6,721 tons, besides many bushels of grain; in 1756 it was 80,000 barrels. The amount exported from New Jersey in 1751 was 6,424 barrels. The amount shipped from Philadelphia in 1752 was 125,960 barrels, and 86,500 bushels of wheat. In 1771 the export of flour from that place was 252,744 barrels, and in 1772, 284,827 barrels; in 1784, 201,305 barrels; in 1787, 193,720 barrels; in 1791, 315,785 barrels. Virginia, for some years prior to the Revolution, exported about 800,000 bushels of wheat. The aggregate amount of flour exported from the United States in 1791 was 619,681 barrels, and 1,018,339 bushels of wheat. In 1800 the export amounted to 653,052 barrels, and 26,853 bushels of wheat. In 1810 the export was 798,431 barrels of flour, and 325,024 bushels of wheat.

Considering the unfavorable season of 1849, we are not surprised to find that the increase of the wheat crop during the ten years from 1840 to 1850 was but 15 per cent. It is possible that with a good wheat year in 1849, the rate of increase would have appeared to keep pace with that of Indian corn. In the eastern states, as we have seen, it declined; in the middle states it was nearly stationary, the increase being little over 15 per cent. The aggregate number of bushels in 1840 was 84,823,272; in 1850 it was 100,485,944.

It is quite probable that changes have taken place in the soils and productiveness of some sections of the older states, owing to careless and ignorant management. In a new and very sparsely populated country, where each man had to rely mainly upon himself for every thing he had, it could hardly have been otherwise. I am satisfied, however, that a reaction has fairly begun, that more attention is paid to the management of farms, that more intelligence and skill are brought to bear upon agriculture, which statistics will eventually show.

But by far the most extensive and astonishing changes, in an agricultural point of view, are those presented to us in the rise and development of the west, whose almost illimitable fields are the wonder and admiration of modern times. The "west" is, indeed, in the understanding of most people, an imaginary and movable line. Fifty or sixty years ago it was understood, in the eastern states, to be somewhere in central or western New York, and the difficulty of reaching it exceeded in magnitude that of visiting the most remote corner of Kansas, now. This line has been moving west with the advance of civilization ever since. It now comprises several of the largest and most prosperous states of the Union, and is destined to rank as the granary of the world.

The first foothold that modern agriculture got in this vast field was secured in the same year of the founding of Philadelphia, 1682, when white settlements were made in the southern part of what is known as the "American bottom," a tract of country extending for about a hundred miles in length—from Alton, twenty miles above St. Louis, down to Chester, at the mouth of the Kaskaskia river—by five miles in width. This region lies in Illinois, and forms the eastern border of the Mississippi river. Here, far removed from eastern civilization, a bold and hardy, but honest and peaceable company of French, from Canada, and from France itself, established the old villages of Kaskaskia, Prairie du Rocher, St. Philip, Cahokia, etc., chiefly for the purpose of opening a fur trade with the Indians. A part, probably at least half, of the settlers, however, finding the soil exceedingly rich, devoted themselves to the cultivation of land, and the country for a considerable extent around these villages soon became productive of wheat and other necessaries of life.

This was the first settlement beyond the Alleghany mountains, and preceded by a whole century the first settlements of Kentucky and Tennessee. For a hundred and fifty years those farmers lived in peace and harmony with the natives. They were not, to be sure, very skilful in the art of agriculture. It was but rudely pursued at that time in the mother country. The implements used in farming, even in the best cultivated regions of Europe, were then extremely rude as compared with those of the present day; but here, in this remote outskirt of civilization, they were far more rude and uncouth than those used by farmers who had greater facilities for making them.

But notwithstanding this rude and imperfect culture, so great was the fertility of the virgin soil to which it was entrusted, the wheat grew luxuriantly, and they often had a surplus, useless and comparatively worthless to them, since the expense of getting it to market exceeded its value when it had arrived there. Who would be expected to make improvements in farming under such circumstances? With the demand for home consumption supplied with but trifling labor, with no inducements beyond a supply of their own limited wants, they could not be expected to exhibit the enterprise and thrift of farmers having greater interests at stake. But they went further, and entertained the same prejudice against any new notion, and repugnance to any change, as that cherished at the same time in the older colonies. The old-established practice was good enough for them, and they clung to it with a tenacity worthy of a better cause.

The cultivation of Indian corn was not introduced among these early western farmers till long after they established themselves in that region—not, indeed, till after Louisiana had become a part of our national territory; but then, it took the place of wheat to a considerable extent, it being thought a more reliable crop, while the stalks furnished a more valuable winter fodder for cattle. When once introduced, it was cultivated on the same land year after year, for many years in succession, a practice which was continued in that section till a very recent date. Instead of linens and woollens, which were mostly worn at the same period among the country people at the sea-board, these farmers usually raised a small patch of cotton, and made their own garments, often using, also, the skins and furs of wild beasts. These latter became so important, as to be used as the currency in business negotiations, a deer-skin being of the highest kind, and serving as the unit.

Thus lived these quiet colonists, without change, and with slight improvements, from one generation to another, poor but independent, with food enough, cattle and hogs enough, few wants to supply, clinging with inveterate tenacity to old customs, and resisting innovations, till the time of the cession of the country east of the Mississippi by France to England, in 1763, at which time the colony was at the height of its prosperity. The horses they raised were the small Canadians, said by some to have been derived from the pure Arabian, and obtained originally through Spain. They were very hardy, more so than the American horses of that time, and were rarely crossed with any other race; but little or no care was taken of them for more than a hundred years, and they were allowed to run on the range without grain. Their cattle were small, with black horns, derived also from Canada. The French kept large numbers of fowls, usually had excellent gardens, and cultivated some fruit, among which were some valuable varieties of pears and apples.

That section of country being conquered and taken from England in the Revolution, not a few of the American soldiers, finding the country so fertile, remained and settled there; and it is said, that at least three-fourths of the Americans who had settled in Illinois previous to the war of 1812, had served as soldiers in the Revolution.

After the Revolution, in fact, numerous settlements were made, till, in 1817, the state was admitted into the Union. After that period, farms and farmers increased more rapidly than they had hitherto done, and the production of wheat and Indian corn rapidly increased. The cradle soon took the place of the sickle. In 1830 the first successful steam flour mill was erected, and gave a new impulse to the raising of wheat. Up to this time, comparatively few cultivated meadows were to be found, and the wild, coarse grasses of the prairies and river bottoms were chiefly relied upon for winter fodder for horses and cattle. Of course, when cattle are running at large, but little improvement can take place in the breed, and but little had actually been attempted in this direction. But now the spirit of improvement began with renewed vigor, and we shall see how rapidly the agricultural resources of that great state have been developed within the last quarter of a century.

What applies to this particular state, will apply with nearly equal truth to almost the whole of the great north-west. The progress of agriculture in Illinois and the adjoining states cannot be better illustrated than by referring to the rise and growth of the city of Chicago, which has now become the greatest primary grain depot in the world, its exports being nearly twice as great as those of St. Petersburg, and exceeding those of Galatz and Ibrail combined, by upward of five millions of bushels a year.

In 1829, Chicago may be said to have had no existence. It was then laid out, and the sale of lots took place in the autumn of that year. In 1840 it contained but 447 inhabitants. In 1845 its population had grown to 12,088, and in 1850 that number had doubled, and the population amounted to 28,269. In 1855 it had increased to 88,509, and in 1860 to 109,263.

The pre-eminence of Chicago as a grain depot is due in part to its geographical position, but to a great extent, also, to the great facilities for receiving, warehousing, and shipping grain. Her immense warehouses are erected on the river and its branches, and railroad tracks run in the rear of them, so that a train of loaded cars may be standing at one end of a large elevating warehouse, and while its load is being raised by elevators at the rate of from 7,000 to 8,000 bushels per hour, at the other end the same grain may be running into vessels, and be on its way to Buffalo, Montreal, or Liverpool within six hours' time. The Illinois Central railroad grain warehouse can discharge twelve cars loaded with grain, and at the same time load two vessels with it, at the rate of 24,000 bushels per hour. It can receive grain from twenty-four cars at once, at the rate of 8,000 bushels per hour. And numerous other immense grain houses can do the same thing. Grain can, therefore, be handled with wonderful dispatch as well as with cheapness. The warehouse alluded to, that of the Illinois Central railroad, is capable of storing 700,000 bushels of grain. It can receive and ship 65,000 bushels in a single day, or it can ship alone 225,000 a day! But this is only one of the magnificent grain warehouses, and there are many others, some of which are of nearly equal capacity, and in the aggregate they are capable of storing 3,395,000 bushels. They can receive and ship 430,000 bushels in ten hours, or they can ship alone 1,340,000 bushels in ten hours, and follow it up the year round. In busy seasons these figures are often doubled by running nights.

The amount of capital in grain warehouses alone exceeds three millions of dollars, to say nothing of a large amount of capital invested in other incidental means of conducting this immense business.

The amount of wheat shipped from Chicago in 1853 was 1,680,999 bushels; of Indian corn, 2,780,253 bushels; and the amount of oats, 1,748,493 bushels. The amount of wheat shipped from there in 1857 was 10,783,292 bushels; of Indian corn, the same year, 6,814,615 bushels; and of oats, 416,778 bushels. The shipment of flour has kept constantly increasing. In 1853 it was 131,130 barrels; in 1854 it was 224,575 barrels; in 1855 it was 320,312 barrels; in 1856, 410,989 barrels; and in 1857, 489,934 barrels.

The shipment of all kinds of grain, and flour as grain, in 1854 amounted to 12,902,320 bushels; in 1855, to 16,633,813 bushels; in 1856, to 21,583,291 bushels; and in 1857, to 18,032,678 bushels. In 1860 the shipments are estimated to amount to at least from thirty to forty millions of bushels. In the first eight months of this year (1860) they amounted to over twenty-one millions!

It is to be considered that the agriculture of the region which feeds the warehouses of Chicago is but yet in its infancy. The resources and the capacity for production are still to a very great extent undeveloped. The country is still sparsely settled, compared with the older states, and the operations of agriculture are carried on under great disadvantages, with a great scarcity of labor, and in many cases a want of capital.

The reader will now be able to appreciate, to some extent, the vast importance of the improvements in agricultural implements and machinery, which have already been described on a preceding page as having been made within the last twenty years. With the implements and processes in use within the memory of most men, it would be impossible to attain such magnificent results in the way of agricultural produce. There are at the present time, in the city of Chicago, some five or six large manufactories engaged in making and selling agricultural implements and machinery, each employing from one hundred to three hundred hands, besides other large establishments at Rockford, Freeport, Alton, and many other places, employing throughout the state more than ten thousand persons. There are at least a dozen reaper and mower manufactories, and other establishments devoted to making threshers, cultivators, ploughs, drills, etc., and the demand for these improved machines is rapidly increasing.

But Chicago is only one of the great centres for the receipt of agricultural produce directly from the farmer, and St. Louis, Cincinnati, Cleveland, Buffalo, Rochester, and many other large points might be mentioned, of nearly equal importance, to say nothing of many of the large grain-dealing cities of the south, like Richmond, for instance.

In view of these facts we can realize that agriculture produces, as was estimated in 1854 by the superintendent of the census, more than sixteen hundred millions of dollars a year; and that in the state of New York, where "the assessed value of the real estate is eleven hundred millions (1,107,272,715) of dollars, notwithstanding the enormous wealth of the metropolis, the agricultural interest pays *four-fifths* of the taxes."

Of the aggregate number of bushels of wheat returned by the census of 1850, and which, as has been intimated, gives an exceedingly inadequate idea of the ordinary produce of this grain, the south, embracing the states mentioned on a preceding page, produced 27,878,815 bushels, valued at $25,090,933; the west produced 41,394,545 bushels, valued at $37,255,088; and the north produced 30,761,941 bushels, valued at $27,865,746.

The crop of wheat of the present year is probably the largest by far ever raised in this country, and will not probably fall short of 230,000,000 of bushels. With the surplus of last year still on hand we shall have nearly 70,000,000 of bushels for exportation to foreign countries.

What has been said in speaking of the exports of Indian corn, may be said, also, of wheat, that the amount sent abroad is regulated very much by the extent of the demand there. The surplus of this grain—that is, the amount that can be spared for shipment to foreign ports, over and above what is required for home consumption—is as elastic as India-rubber. If Europe wants our wheat, or our flour, and is compelled to pay good prices, either from a short crop, a disturbed state of political affairs, or any other cause, it is impossible to set bounds to our surplus, because the more she wants, the more we have to spare, and the less Europe, or any foreign country wants, the less we have to export. If little wheat is wanted abroad, it is used more freely at home, and the balance is stored for future use. If large quantities of it are required abroad, less will be used at home, the people resorting to Indian corn and meal to a large extent. The amount of export is, therefore, regulated by the price. If foreign countries are willing, or are compelled to pay for it, we can supply them to any extent under any ordinary circumstances. The export in 1846 was 13,268,175 bushels; in 1847, 12,309,972; in 1848 it reached 26,312,431 bushels, under the stimulus of the high prices consequent upon famine in Ireland; in 1849 it fell off to 10,366,417, and again, in 1850, to 8,656,982 bushels, when it began to increase again, and amounted in 1851 to 13,948,499, and in 1852 to 18,680,686; in 1853 it was 18,958,993 bushels, and in 1854 no less than 27,000,000!

In the statement of the above staple crops, little or no credit is given to the productions of California, which was admitted into the Union on the 9th of September, 1850. At that time it was not generally thought to rank anywhere as an agricultural state. Its wheat crop was returned, in 1850, at only 17,228 bushels; its Indian corn at only 12,236 bushels; and its other agricultural products in proportion. In 1852 the wheat crop of that state was less than 300,000 bushels, and the imports of flour in 1853 were no less than 500,000 bushels; it sold, at times, as high as fifty dollars a barrel. In 1859 the wheat crop was more than 6,000,000 of bushels, while the crop of 1860 very greatly exceeded that, so that many a shipload was exported to South America, Australia, China, and even to New York and Liverpool.

The corn crop of California has increased in like manner since 1852, when it amounted to only about 60,000 bushels. It was over 1,000,000 bushels in 1860! The barley crop is double now what it was in 1852; and the oats, which then were worth less than $100,000, are worth this year nearly $2,000,000. Then only about a hundred thousand acres were under cultivation in the whole state; now the number of acres is nearer a million and a half. Then, nobody thought the state would ever be able to raise even its own flour. Now, with less than a fortieth part of her lands under cultivation, she is exporting flour to foreign countries. California could probably support a population of twenty millions under a full development of her agricultural resources.

PRODUCTION OF OTHER GRAINS.

Rye is not, at the present time, so extensively used for food as formerly. The amount grown is, therefore, comparatively small. Rye was introduced and cultivated in all the colonies at the earliest periods of their settlement, and its meal was mixed with Indian meal for the making of bread, in New England, as early, certainly, as 1648, and perhaps even as early as 1630, and that custom became very common. The export of this grain has never been very extensive, and since the demand for wheat has been so much increased, its extent of cultivation has diminished rapidly.

In 1796, no less than 50,614 barrels of rye meal were exported from Philadelphia, and in 1801 the United States exported

392,276 bushels of rye. In 1812 the export was only 82,705 bushels.

The aggregate product of rye, as returned in the census of 1840, was less than nineteen millions of bushels, or 18,645,567, and this fell off, in 1850, to 14,188,813 bushels, a decrease of 4,456,744. The use of rye for the purpose of distillation and the manufacture of malt liquors is much less now than formerly, and this accounts for the falling off in its cultivation. It is, however, a profitable crop in New England, and a yield of from forty to fifty bushels to the acre is by no means uncommon, while the straw is in such demand, in many sections, as to enhance very materially its value as a crop.

Oats.—The culture of the oat is more extensive than that of rye. It was introduced into the colonies immediately after their settlement by Europeans, having been sown by Gosnold, on the Elizabeth Islands, as early as 1602, and cultivated to greater or less extent from that time to the present. But though much more extensively produced than rye, its consumption as food for animals is so great in this country, that it has never formed any considerable article of export, though an average of about 70,000 bushels was shipped for some years previous to 1820.

The yield of this crop in 1840 was returned as 123,071,341 bushels, and in 1850 it had increased to 146,584,179 bushels, a gain of 23,512,838 bushels.

The geographical distribution of this crop was as follows:—

The south raised 49,891,107 bushels, valued at $17,459,035; the west produced 37,122,771 bushels, valued at $12,992,971; and the north produced 59,570,301 bushels, valued at $20,817,175. Oats are grown in all the states, but by far the largest yield was in New York and Pennsylvania. The crop of oats for 1860, in New England, was larger and more abundant than was ever before known, unless, possibly, that of 1816 was an exception. It is, probably, at least 30 or 40 per cent. above the average, growing with a luxuriance which was a subject of universal remark among farmers.

Barley, like the other grains already mentioned, was sown on the first settlement of the colonies, having been first cultivated by Gosnold as early as 1602, on the Elizabeth Islands, on the Massachusetts coast, and by the settlers at Jamestown, in Virginia, in 1611, where, however, it soon gave way to the more lucrative production of tobacco. Samples of it were sent from the Dutch colony at New York in 1626. Good crops of it were raised in the colony of the Massachusetts Bay as early as 1630; and in 1796 the principal agricultural product of the state of Rhode Island was barley.

But this crop has never gained root to any extent in this country, either as a desirable product for home consumption or for foreign export. Its chief use has been for malting and distillation.

The census of 1840 returned the product of barley as 4,161,504 bushels, and this had increased in 1850 to 5,167,015 bushels, a gain of 1,005,511 bushels. It has doubtless increased some since, but not so as to become a crop of any great importance in a national point of view.

By far the largest portion of the crop of 1850 was raised in the northern states, which returned no less than 4,166,611 bushels, valued at $3,747,650; while the west raised only 842,402, valued at $754,161, and the south but 161,907 bushels, which was valued at $145,716.

Buckwheat.—This grain has never been cultivated to any great extent in this country, though it was introduced into the colony at Manhattan Island by the Dutch West India Company, and raised there as early as 1625 or 1626. Its culture was continued by the Dutch to some extent, and they used it as provender for horses. It was also cultivated by the Swedes, who settled along the Delaware in New Jersey and Pennsylvania.

Not being extensively cultivated, it has not, of course, entered much into our commerce, though it has been shipped, to some extent, in the shape of flour. The quantity returned by the census of 1840 was 7,291,743 bushels. This had increased in 1850 to nearly nine millions, or 8,956,912 bushels, a gain, in the ten years, of 1,665,169 bushels. It is probable that the next census will return the crop of 1859 as upward of eleven millions of bushels, with a value of about $4,500,000.

The geographical distribution of the crop of 1850 was very nearly as follows:—

The south raised 405,357 bushels, valued at $202,678; the west raised 1,578,578 bushels, valued at $789,289; the north raised 6,971,667 bushels, valued at $3,485,833.

The cultivation of buckwheat has the effect to cleanse the land, which has been one reason for its increase, while the price it commands makes it a profitable crop.

CLOVER AND GRASS SEED.—In connection with the smaller grains should be mentioned the production of clover seed, and that of the various grasses, which, in some sections, has become an item of some importance.

The census of 1850 returned the amount of clover seed produced as 468,978 bushels. Of this, Pennsylvania raised by far the largest quantity of any one state, and Ohio came next.

The amount of grass seed raised was 416,-831 bushels, and in this product New York took the lead of all the states, exceeding the next highest producer, New Jersey, by more than thirty thousand bushels.

Of the clover and grass seeds together, the south raised 123,517 bushels, valued at $370,551; the west raised 142,764 bushels, valued at $428,292; and the northern states raised 619,501 bushels, valued at $1,858,503.

THE POTATO.

The potato is more universally cultivated in this country than any other crop, except, perhaps, that of Indian corn. At what time it was first introduced, as a cultivated plant, into the American colonies, is not known, but it was, no doubt, soon after the settlement. It is mentioned among the seed ordered for the Plymouth colony, as early, certainly, as 1629, but it was not recognized, probably, as an indispensable crop, till near the middle of the last century, when it appears to have been very widely known and esteemed. As many as 700 bushels were exported from South Carolina in 1747, and in 1796 no less than 9,004 bushels were shipped from Philadelphia.

It is well known that the sweet potato was first introduced, and came to be regarded as a delicacy in England, and the allusions to the potato by the earlier English writers who mention this plant, refer to the sweet, and not to the common potato.

It has formed a somewhat important article of export, though by no means to be compared, in this respect, with wheat and Indian corn. We exported in 1821-2 about 129,814 bushels, valued at $45,758. In 1844-5 the export amounted to 274,216 bushels, valued at $122,926, and exportation has continued, to some extent, every year since then. The number of bushels of potatoes returned by the census of 1840 was 108,298,060. In 1850, owing to the prevalence of the disease, it fell off to 104,056,-044 bushels, of which 38,268,148 bushels were sweet potatoes. The crop may now amount to 125,000,000 bushels.

PEASE AND BEANS.—Though not entering extensively into the commercial interests of the country, the product of pease and beans is still important, both from its extent and value for home consumption.

Beans are said to have been first cultivated by Capt. Gosnold, on the Elizabeth Islands, as early as 1602. They appear to have been cultivated by the Dutch, at Manhattan, in 1644, and about the same time in Virginia. But it is well known that beans were cultivated by the natives, long before their introduction by the whites, and it is probable that pease were, also.

In the year 1755, the amount of pease exported from Savannah was 400 bushels, and in 1770, 601 bushels. The amount exported from Charleston in 1754 was 9,162 bushels. North Carolina exported 10,000 bushels in 1753.

The total amount exported annually from the United States for twenty years previous to 1817, was 90,000 bushels, while the beans annually exported during the same period amounted to from thirty to forty thousand bushels.

The census of 1850 returned the amount of pease and beans as 9,219,901 bushels. The value of these crops exceeded $16,000,000.

THE GRASS AND HAY CROP.

Owing to the necessity that exists throughout all the northern portion of the United States to stall-feed the stock from three to six months of the year, the grass and hay crop assumes there an importance which it has not in the more southern portions of the country.

I have alluded, briefly, on a preceding page, to the fact that, at the time of the early settlement of the colonies, no attention had been paid in the mother country to the cultivation of either the natural or the artificial grasses. Attention to this branch of farming was gradually forced upon the settlers of the more northern portions of the country. For want of sufficient and suitable winter nourishment, the cattle, which were scarce and expensive, were often found dying of starvation, notwithstanding the efforts made to secure a supply of salt hay from the many marshes in the vicinity of the Plymouth and the Massachusetts, as well as the Dutch and Swedish colonies.

It was, no doubt, many years before it became possible, in the nature of things, to provide full supplies for their cattle, and it was not unfrequently the case, even after the culture of grasses was introduced, that the cattle were obliged to browse in the woods in a long and hard struggle for life, owing to the loss of crops by drought and imperfect cultivation.

The cultivation of timothy, the most important and valuable of the forage grasses, was not introduced, according to Jared Eliot, who wrote in 1750, till a few years previous to that date, having been found by one Herd, in a swamp near Piscataqua. He propagated it till it was taken to Maryland and Virginia by Timothy Hanson, after whom it is most frequently called. The well-known orchard grass was cultivated as early as the middle of the last century, for we know it was introduced from Virginia into England in 1764, or thereabout. The June, or Kentucky blue grass, was probably indigenous, and sprung up in the pathway of the settlers, as it does now, wherever the footstep of civilization penetrates. But it was not till a recent date that the general culture and improvement of the grasses received the attention it deserved.

The grasses spring up almost spontaneously in many localities, it is true, otherwise the settlers would have suffered far more severely than they did. From the time when the great mandate went forth, even before the creation of man, "Let the earth bring forth grass," it has been a law of nature to clothe the earth with verdure as soon as the advance of civilization lets in the light upon the soil by the first clearings of the pioneer settler.

The progress made in the cultivation of grasses and the production of hay has been greater within the last half century than ever before. This will appear, especially when we consider the improvement in the means of cultivating and harvesting the crop. The culture of clover had been commenced, in some parts of the country, previous to that time, but it had not established itself in the farmer's favor to any very great extent, and the indigenous grasses were chiefly relied on, while the seed used in many parts of the country was that which had fallen from the hay-mow, foul, of course, and full of weeds.

According to the census of 1840, the hay crop of the United States was 10,248,108 tons. In 1850 it was 13,838,642 tons, an increase of 3,590,533 tons. The hay crop of the present year cannot be less than 15,000,000 tons, with a value certainly not less than $150,000,000. To this is to be added the value of the grass crop, which is not less than that of the hay, and we have an annual production of at least $300,000,000, an amount nearly equal to all the other agricultural products of the country, excepting wheat and Indian corn.

The production of hay is, to a certain extent, a tax upon the farmer imposed by the severity of climate. In a mild climate and short winters, the necessity for curing hay in any considerable quantities is avoided. Less hay is made, of course, at the south than at the north. The same number and size of cattle would require less artificially prepared fodder in a mild climate than in a severe one. Maine, for instance, raised 755,889 tons of hay, and kept 385,115 head of cattle and horses, consuming about two tons a head on an average. Illinois, with 601,952 tons of hay, kept 1,190,264 head of cattle and horses, using but little over half a ton per head; while Alabama, which made only 32,685 tons of hay, kept 915,911 head of cattle, the proportion being but one ton of hay to thirty head of cattle. There is, it is true, some compensation in this, as in most other things, and that is the extreme difficulty of growing the ordinary natural grasses in a southern latitude, on account of the severe drouths. It is almost impossible to produce a fine, close, permanent turf south of the 39° of latitude, and considerable quantities of cured hay are taken from the northern and eastern ports to most of the southern ports every year.

There is, also, another most important compensation in the greater facility afforded by the wintering of cattle for economizing manure, and thus keeping up the fertility of the soil. For example, tobacco culture is said to have impoverished the soil of Virginia. One reason for it was, that keeping comparatively few cattle, and never housing them, but rather "browsing" them from one year's end to another, there was no possibility of saving and making a great quantity of manure. Till the introduction of guano, it was extremely difficult to get manure for the tobacco field, and exhaustion was inevitable. In Massachusetts, on the other hand, there is no crop that a wheat or corn crop will follow so well as that of tobacco, for the reason that the grower, knowing the requirements of the plant, manures it very highly, as he easily can, and the soil, instead of being exhausted from year to year, is actually growing richer. Increasing the hay crop, therefore, notwithstanding its cost, enables the farmer to keep more stock in such a manner as to make more manure, and more manure enables him to keep up the fertility of the land.

We are not surprised, therefore, to find the geographical distribution of the crop as returned in 1850 as follows:—

The north produced 9,473,605 tons, valued at $94,736,050; the west produced 3,227,253 tons, valued at $32,272,530; the south produced 1,137,784 tons, valued at $11,377,846.

There can be no reasonable doubt that the quality of hay made now, over that usually made in former times in this country, has been improved, to say nothing more of the vastly improved facilities for harvesting it. More correct ideas are entertained of the extent and mode of curing it, and the quality is improved in proportion as a higher knowledge is brought to bear upon it.

THE CULTURE OF FRUIT.

The establishment of state and county agricultural societies, and of stated exhibitions, in which the products of the orchard and the garden had a prominent place, introduced a new era in the culture of fruit. The early settlers made some attempts to introduce apples and pears, some bringing with them the seeds of these fruits, with the supposition, no doubt, that they should have the like again.

The first apples raised in this country were, probably, from trees planted on Governor's Island, in the harbor of Boston, from which, on the 10th of October, 1639, ten fair pippins were brought, "there being not one apple or pear tree planted in any part of the country, but upon that island." Governor Endicott had on his farm in Salem, now in Danvers, in 1640, the first nursery of young fruit trees that was ever planted in this country; and it is related that he sold five hundred apple trees for two hundred and fifty acres of land, or at the rate of two trees for an acre—a good bargain for the purchaser, if he took good care of his trees.

But the cultivation of fruit was extremely rare in the early history of the country. Indeed, it could hardly be said to have been cultivated at all, as a part of the produce of the farm, till a comparatively recent date. At the close of the Revolution, and, in fact, at the end of the last century, it would have been impossible to have found in the whole country the number and varieties of good fruits which might now be found in a single good farming town. There were orchards of seedling apples, and many of them were far better than none, but that is nearly all that can be said for them. They were raised chiefly for the making of cider. Most of the favorite varieties of the present day had then no existence; and if any very superior apple had existed in any isolated locality, it could not, from the very nature of things, have become generally known and appreciated, for, as we have seen, the barriers which separated the rural population of that day were so great as often to leave them in ignorance of what was passing, even in a neighboring town. A seedling equal to the Baldwin apple might have remained unknown twenty miles off from the beginning to the end of the last century. Apples were apples, and all apples were fit to make cider, and that was enough.

It was regarded as absurd for any but a young man to set out trees; and when a man of seventy began to plant an orchard, the idea was so ludicrous as to subject him to the ridicule of the whole neighborhood.

But, during the first quarter of the present century, many large orchards were planted in different parts of the country, still with particular reference to the production of cider. The fruit crop of the country was of so little importance as not to have been thought worthy of a place in the collection of our national statistics, even so late as 1830; now it amounts to considerably over thirty millions of dollars a year, and is fast growing to be one of the most important products of the country, the annual sales numbering hundreds of thousands of barrels.

The oldest horticultural society in the United States was founded only about thirty years ago (1829). For some years such associations were few and feeble, on account of the want of sufficient public interest in the subject. Fruit of the choice varieties was a luxury which could be enjoyed only by the wealthy. Now there is scarcely a cottage in a country town or village which has not its grape vines, or its apple or pear trees. The public no longer ridicule the man who plants choice trees, with the hope of enjoying their fruit. Modern science, in this direction, secures speedy returns.

The American Pomological Society was established in 1848, and since then kindred societies have been established in several of the states, and are exerting no small degree of influence. It is scarcely twenty-five years since two or three small nurseries in the vicinity of our large cities, occupying not over five hundred acres in the whole country, supplied the wants of the United States and the Canadas. Now there exist more than a thousand nurseries; and in one county of New York alone—that of Monroe—there are between three and four thousand acres, producing every year more than $500,000 worth of trees; while there are sold every year, in the whole country, from fifteen to twenty millions of trees, with a value of $5,000,000. It is estimated that the nurseries of Onondaga, and the neighboring counties of New York, contain at this moment at least fifty millions of trees for sale. These figures give but an inadequate idea of the actual present extent of this great business of the country, but they are sufficient to indicate the wide-spread interest in the cultivation of fruit among the people.

It is a gratifying fact that our native fruits are appreciated as they deserve. Of the thirty-six varieties of apples recommended by the American Pomological Society for cultivation, thirty are natives; of the fourteen varieties of plums, ten are natives; and so are more than half the pears and all of the strawberries. It is not many years since all the strawberries in our markets grew wild and were brought from the fields, when not a single variety had been produced by hybridization in America. Last year a single cultivator in Massachusetts grew them at the rate of 160 bushels per acre, and sold them at the rate of $1,300 per acre; while others, in Connecticut and other states, did even better than that, from seedling varieties. The fruit crop of Massachusetts was officially returned in 1845 at $744,000; while in 1855 it amounted to $1,300,000; and in 1860 to upward of $2,000,000; and the increase in many other parts of the country has been in a similar or even greater proportion. In the fall and winter of 1858–59, there were exported from the port of Boston alone no less than 120,000 barrels of apples, mostly Baldwins. The product of fruit for 1860 is larger, by 200 per cent., probably, than it ever was before. The two or three preceding years were comparatively bad fruit years, and in the meantime thousands of young trees have come into bearing which never bore before. The crop of 1860 is, therefore, wonderfully large, and of unsurpassed excellence.

The climate of the southern states has often been stated to be unfavorable to the growth of our common staple fruits, except peaches, figs, oranges, and the like; but experience has shown that it is not so. There is one orchard in Mississippi of 15,000 pear trees, another in Georgia of 9,500; and in other sections, where the effort has been made, success has almost invariably attended it. It is true, the pomology of the south is in many respects peculiar. The mistake has been in selecting northern varieties, instead of seedlings of the south and other native varieties, many of which are found to exist, and to be superior in size, flavor, and beauty, while in keeping qualities they are not inferior to good northern varieties.

The south can, therefore, raise apples in large quantities, and of a very high quality, by the selection and proper cultivation of varieties adapted to its soil and climate. The few earnest and intelligent pomologists who have had long experience there, rank the apple as the surest and most reliable of all fruits except the grape. So far, comparatively little attention has been given to the culture of the apple and the pear by the mass of southern planters; partly, no doubt, from an impression that such fruits were not suited to that locality; but the experience of the most intelligent horticulturists in that part of the country has, I think, fully established its practicability, especially for the native southern winter varieties. And so of the pear. Very many of the favorite varieties at the north grow and bear well at the south, either as standards or dwarfs, in a deep, mellow, well tilled soil, care being taken to train the top of the tree low and spreading, so as to shield the trunk and the root from the too fierce rays of the sun. And as to the peach, it is at home at the south, and grows in the highest degree of perfection. One grower in that part of the country sends north from seven to ten thousand dollars worth of peaches every year before they are ripe in the middle states.

Now if such are known to be the results

of only ten, fifteen, and twenty years of enterprise in this branch of rural economy, what may we not anticipate when the vast number of young trees planted in the middle and eastern states within the last five years, come into bearing? If any one is disposed to feel disheartened at the prospect of sales, or fear the market will be glutted, let him take courage in the fact that the demand is ever on the increase, not only from the multiplication of consumers, but from the fact that there is a growing conviction that fruit is the most healthful food. The exportation of fruits, particularly of apples, is rapidly increasing. But that the present comparative abundance has not diminished the profits of fruit-growing, the Fruit-Growers' Society of Western New York state through a committee that three white Doyenné pear-trees, owned by Mr. Phinney, of Canandaigua, one of them small, produce annually from $50 to $60 worth of fine fruit, while another of the same variety, in the same place, seventy years old, has not failed of a good crop for forty years, and has averaged twenty bushels a year for twenty years, which have been sold on the tree for $60 a year. This one tree has produced for the New York market $3,750 worth of pears. Three large trees of the same kind, owned by another individual, yielded in 1854 eleven barrels, which sold for $137.

Then, too, we are to include the luxuriant growth of fruits in California, now becoming celebrated as a fruit-growing region. Five years ago the apple-trees in that state scarcely numbered a hundred thousand; now, in 1860, there are more than a million trees in bearing. Peach-trees then numbered only a hundred and seventy thousand; now, there are more than a million and a half. Pear-trees have increased in five years from twenty thousand to three hundred thousand; apricots, from four thousand to a hundred and fifty thousand trees; plums, from ten thousand to a hundred and thirty thousand; and grape vines, from three hundred thousand in 1855, to eight millions in 1860! The number of vines more than doubled in two years from 1856 to 1858. A popular writer says the growth on the grape-vines the last year would make one long green creeper that would reach from San Francisco clear across the continent, and then over the sea to England. "Who knows," says he, "but what Englishmen will yet suck their wines from California cellars? At the rate we are going on, somebody has got a great deal of wine-drinking to do, to use up the California production of ten years hence. But people must make up their minds, or their palates, to like still wines that are at once fiery and sour, if they intend to patronize California vineyards, and rejoice in the plenty and cheapness of our products; for our grapes insist on being sweeter than the best grapes of which foreign wines are made. They contain 20 per cent. of sugar against 13 11-100 per cent. in foreign-grown specimens, while the proportion of free acid is much less. As a consequence, there is 15 per cent. of alcohol in our light wine, which is double what is detected in the European light wines, and nearly as much as is contained in the stronger ports, sherries, and Madeiras." The value of the grape crop two years ago (1858), amounted to $1,000,000, and it amounts now, probably, to over $8,000,000.

The culture of the vine in California is very simple, and gives astonishing profits. An acre in ordinary calculation is enough for a thousand vines; and each vine in full bearing will produce a gallon of wine. The average of well-managed vineyards is often much greater, and two or three gallons to a vine is no uncommon product. A good man, with a horse and plough, and at work only about eight days in the year, can tend from eight to ten acres of vines. The grape flourishes in all parts of California, but the counties of Los Angeles, San Bernardino, and San Diego are, perhaps, the most noted, though the Napa valley, and many other localities, are about equally suited to it. The capabilities of the three counties above named, for the production of the grape, are ascertained to be equal to 100,000,000 vines, or more than 100,000,000 gallons of wine a year!

About 650 vessels leave the Mediterranean for this country every year, loaded with figs, lemons, oranges, limes, almonds, and the products of the vine, the whole amounting to about seven and a quarter millions of dollars. Time will show that California can easily produce all these products of an equal quality, and in abundance sufficient to supply the whole country, and still have a surplus for her own consumption. That this statement is by no means extravagant, is evident from the fact that the growth of the grape during the last three years surpasses any thing ever known in the most highly favored regions of the Rhine, Italy, or France.

A pear-grower of Roxbury, Mass., has one acre devoted to this fruit, the oldest trees being about twenty years old, but more than half of them young. From two trees, the Dix and Beurré Diel, he has taken more than one hundred dollars worth a year, and from the whole acre more than a thousand dollars a year. Another prominent pear-orchardist in Brighton, Mass., commenced operations in 1841 with eight trees on the ground. He has now 1,200 trees, set out in different years, more than half of them since 1854. Since that time he has received from five to six hundred dollars a year for his crop, and says that if he had confined himself to a judicious selection of varieties, his crop would now bring him over $2,000 a year.

These are, of course, special cases, but instances of a similar kind might be multiplied almost indefinitely, showing that where good judgment and skill are used, success is comparatively sure. No other country offers such opportunities to the scientific pomologist, or to the farmer, for the growth of apples and pears, and it is not probable that the supply will reach the demand for many years to come.

Nor has the culture of the cranberry, and other smaller fruits, been neglected. The practical cultivation of the cranberry is of very recent date, having commenced on Cape Cod, where several hundred acres of cultivated plants are now in profitable bearing condition. Its culture is rapidly extending to other parts of the country, where suitable lands exist.

The census of 1840, the first to take note of the extent and value of the orchard and garden products of the country, makes the fruit crop of that year, or rather of 1839, to be $7,256,904, in addition to 124,734 gallons of domestic wine. The census of 1850 states the amount of orchard products at $7,723,186, and 221,249 gallons of domestic wine, showing an increase of only $466,282 in the value of fruit, and 96,515 gallons of wine. This was thought by some to be too low, but it should be borne in mind that the interest in fruit culture, now so very general and widespread, had hardly begun in 1840, and though it rapidly increased, so that young orchards had very greatly multiplied all over the country in 1850, they had not then come into full bearing. Nor was the manufacture of wine any thing like so extensive as it has since become. The census of 1860 will present us with far more gratifying results.

It is perfectly proper to ascribe a large proportion of the increase of orchards and fruits, and of the interest manifested in them, which for the last ten years has been wholly without a precedent in this country, to the influence of the agricultural exhibitions, and to the multiplication of the valuable treatises and periodicals on the subject, calling the attention of the people to the vast amounts of money which had been spent yearly in importing grapes, wines, figs, prunes, raisins, currants, and even pears,* from foreign countries, all of which might be raised here equally well, and to the inexhaustible treasures which were within the reach of every landholder; all that was wanting being the proper exertion to develop them. For several years Hovey's *Magazine of Horticulture* was the only periodical exclusively devoted to the garden and the orchard, and that was confined chiefly to the few who gave their attention especially to fruit culture. Previous to the appearance, in 1845, of Downing's "Fruit and Fruit Trees of America," Manning's "Book of Fruits" and Renwick's "American Orchardist" were the only popular works which had any considerable circulation, the admirable treatises of Coxe, Prince, and a very few others, being confined chiefly to professed horticulturists and nurserymen. Downing's work was, in fact, the first that had a quick and extensive circulation among the people. It appeared just at the time when the want of such a work began to be widely felt; while he had the immense advantage of the information which had been industriously accumulated by the Massachusetts and the London horticultural societies, and by the labors of some of the most noted horticulturists in the country, who had been constantly experimenting and importing new fruits, multiplying seedlings, and improving the nomenclature of varieties.

Then appeared Thomas' "American Fruit Culturist," a valuable popular work after Downing's plan, and Cole's "American Fruit Book," a storehouse of valuable information, in such small compass as to come within the easy means of every one. All these works contributed largely to diffuse a more correct

* So recently as 1851 a considerable quantity of pears were actually imported from France by the New York confectioners.

taste, and to excite a wide-spread interest in the subject; and they are entitled to great credit as being, in some measure, the pioneers in this department.

But yet, though many grand results have already been obtained, the science of pomology is still in its infancy, and far greater results may be confidently expected hereafter.

From the progress in the cultivation of fruits, which has been styled by some the poetry of farming, let us turn to the

CULTURE OF TOBACCO.

No sooner had Columbus landed on the island of Cuba, in 1492, than a gentlemanly chief very politely offered him a cigar. From that day to this the plant has grown rapidly in favor, and from being the solace of the roaming savage of America, it has become a luxury, universal as the habitation of the globe. It has been truly remarked that every country or tribe of human beings has had, from time immemorial, its own peculiar narcotic, either aboriginal or imported, and that the universal instinct of the human race has led, somehow or other, to the universal supply of this want or craving; as, for instance, tobacco in America and its islands; the thorn apple, cocoa, tobacco, and hemp in South America; hops and tobacco in Europe; hemp in Africa; aminita, opium, betel-nut, and tobacco in Asia; showing that it is natural for man, after supplying the necessities of life by food, to desire to multiply his enjoyments, intellectual and animal, and for the time to exalt them; and we cannot ascribe so universal a habit, increasing with the growth of population, to mere whim or fancy for self-indulgence. It is, perhaps, a necessity imposed by nature, and second only to that greater necessity, the satisfaction of the craving of hunger.

Certainly, the extent to which it is cultivated, occupying so large a proportion of the best arable lands of some countries, which are equally adapted to wheat; its great importance in a commercial point of view, and the variety of ways in which it is employed to gratify the senses, present a striking feature in the history of the human race.

"Thy quiet spirit lulls the lab'ring brain,
Lures back to thought the flights of vacant mirth,
Consoles the mourner, soothes the couch of pain,
And breathes contentment round the humble hearth;
While savage warriors, soften'd by thy breath,
Unbind the captive hate had doom'd to death."

It has steadily pushed its way in the face of every opposition which ridicule, prejudice, legislative prohibition, threats of excommunication, and every conceivable persecution could bring against it, simply because nature demanded its use in some form or other. The celebrated Locke took a more rational view, and said, "Bread or tobacco may be neglected, but reason at first recommends their trial, and custom makes them pleasant." But, on the other hand, "the most high and mightie prince," James I., by the grace of God king of Great Britain, "a slave to vices which could not fail to make him an object of disgust," took a different view of the prevalent practice, and wrote a "Counterblaste to Tobacco," stigmatizing its use as "A custom loathsome to the eye, hateful to the nose, harmful to the brain, dangerous to the lungs, and in the black, stinking fume thereof nearest resembling the horrible Stygian smoke of the pit that is bottomless." Every thing which is really and truly founded in nature and reason, however mysteriously, will ultimately prevail, whoever sets himself up to oppose it; and the progress of the culture and use of this plant is an instance of it. King James wrote in 1616, and in 1624 Pope Urban VIII. published a decree of excommunication against all in the church who took snuff; and in 1634 smoking tobacco was prohibited in Russia under penalty of having the nose cut off; and in Transylvania the penalty for growing this plant was a confiscation of the farmer's whole property; and even so recently as 1719 the senate of Strasburg forbade the cultivation of it, from the fear of its diminishing the culture of corn. But "they manage things better in France," and the far-sighted Richelieu imposed upon it a duty, very small at first, which continued till 1674, when the government of Louis XIV. increased the duty, and made the culture and trade in tobacco a monopoly, and granted it to an individual for six years, in consideration of the payment to the government of the large sum of $145,000. In 1720 the consideration was increased more than 100 per cent., and in 1771 it amounted to $5,500,000 a year. In 1844 the revenue from tobacco alone yielded the French government the enormous sum of $20,000,000, and it has since constantly increased on an average from half a million to a million dollars a year. So much for Richelieu; and it must be admitted, even by the most prejudiced opponents of tobacco, that this policy was more sensible than that of his neighbors who mutilated, and some of whom cut off the heads of all smokers.

The English first saw it cultivated, and smoked in clay pipes, by the Indians of Virginia, in 1585, and it was probably introduced into England by Raleigh, as early as 1586. In 1615, the gardens, fields, and streets of Jamestown, Virginia, were planted with tobacco, and it became not only the great staple, but, according to Bancroft, the chief currency of the colony, and in 1622 the product was 60,000 pounds. During the next twenty years it doubled, and amounted to 120,000 pounds, and since 1689 the produce of Virginia alone has increased to twice as many millions of pounds.

The introduction of tobacco culture into the Dutch colony of New York took place as early as 1646, and it sold then at forty cents a pound. The "Company of the West" introduced it into Louisiana in 1718. Previous to the revolutionary war its culture had extended into Maryland, the Carolinas, Georgia, and Louisiana, and nearly all Europe was, at that time, supplied from the American colonies. Since that time the cultivation has greatly extended in this country, not only into new states and territories, but in the aggregate amount raised. The quantity exported has also very largely increased. The amount consumed in Great Britain alone exceeds 35,000,000 pounds, and that, too, with a duty of about seventy-five cents a pound.

The annual export from the colonies for ten years previous to 1709 was 28,868,666 pounds. From 1744 to 1776 the exports of tobacco averaged 40,000,000 pounds a year. The tobacco exported from Virginia in 1758 is said to have been no less than 75,000 hogsheads, and from that time till the Revolution, the amount averaged 55,000 hogsheads a year. About 30,000 hogsheads were shipped from City Point, in Virginia, in 1791, and in 1795 the amount fell to 9,475 hogsheads. There were exported from North Carolina 100 hogsheads in 1753, while from Georgia, in 1722, there were shipped 176,732 hogsheads. South Carolina exported 2,680 hogsheads in 1783, and 4,294 in 1795. The quantity exported from Philadelphia in 1796 was 3,437 hogsheads.

According to the census of 1840, the amount raised in the United States was 219,163,319 pounds. The census of 1850 returned but 199,752,655 pounds, showing a decrease of 19,410,664 pounds. There has, no doubt, been a considerable increase in its production throughout the country, notwithstanding an apparent falling off as shown by the census. The crop is liable to many casualties—to damage by insects, hail, drought, frosts, or an otherwise bad season at harvesting—so that the product of any one year, like that of 1849, on which the returns of the last census were based, cannot be taken as a fair annual average. So great is the demand for home consumption and for foreign exportation, that the profits of tobacco are usually very great, operating as a constant stimulus to a more extended culture.

Of the amount returned by the last census, Virginia raised 56,893,218 pounds, and Kentucky 55,501,196 pounds, making, together, more than half of all that was raised in the United States. But since 1849 the use of guano has become far more extensive than it had previously been, and the yield of this ravenous crop on the lands said to have become exhausted from long-continued culture, has been very greatly enlarged in consequence. In the meantime, its cultivation has gradually been extending northward, and the produce of Connecticut and Massachusetts has been much increased. The produce of the latter state has, probably, been more than quadrupled within the last five years.

Tobacco is usually called an exhausting crop. This depends very much upon the kind and quantity of manure used. If the mineral constituents taken from the soil, and represented in the ash of the plant, are supplied by judicious cultivation, there is little difficulty in cultivating and producing large crops, and it is a common remark of the best farmers along the Connecticut river, that wheat or any other crop will follow tobacco, even better than most other crops, for the reason that the high manuring for tobacco keeps the land in good heart. But the planters in Virginia cultivated it for many years in succession on the same lands, without supplying a sufficiency of manure. The land, of course, must feel the loss in time, and the yield, previous to the introduction of guano, had dwindled down in many localities so as not to pay the producer. Every ton of tobacco, perfectly dried, carries off some three or four hundred weight of these most important mineral substances, and it should be the aim of the farmer to supply them liberally, if he expects a liberal reward in an abundant harvest.

The geographical distribution of the product, the amount of which has already been stated, was nearly as follows: The south raised 185,023,906 pounds, valued at $18,505,390. The west raised 12,358,879 pounds, valued at $1,236,886. The north raised 2,383,208 pounds, valued at $238,320.

In this connection, it would be a matter of no small interest to ascertain, if possible, the number of hands the cultivation, curing, and the various processes of manufacture give employment to. It is, unquestionably, very large in this country, but the census does not appear to state it. In the city of Hamburg (Germany) alone, this manufacture gives employment to upward of 10,000 persons, and it supplies 150,000,000 cigars a year, with a value of $2,000,000 —a matter of no small importance. Hamburg imports from Havana and Manilla about 18,000,000 cigars a year; and, with its own production, the aggregate number is 168,000,000 cigars. 153,000,000 of these are exported, and the remainder, or 15,000,000, are consumed in that city; giving 40,000 as the daily consumption, in a population of 45,000 male adults. The consumption of tobacco in England in 1821, with a population of 21,282,960, was no less than 15,598,152 pounds, or 12 ounces per head of the entire population. In 1831, with a population of 24,410,439, the consumption reached 19,533,841 pounds, or 13 ounces per head. In 1841, with a population of 27,019,672, the consumption was 22,309,360 pounds, or 13½ ounces per head. And in 1851, population 27,452,692, the consumption of tobacco was 28,062,841 pounds, or 17 ounces per head, showing a steady increase. In France the consumption amounts to 18½ ounces per head, nearly half of which is in the form of snuff. The consumption of Denmark, in 1848, amounted to 70 ounces per head, or 4½ pounds. In Belgium, it averages at the present time about 73½ ounces per head. The average consumption of tobacco by the whole human race of 1,000,000,000, is 70 ounces a head, the quantity consumed being 2,000,000 tons, or 4,480,000,000 pounds. "The annual production of tobacco weighs as much," says a popular writer on this subject, "as the wheat consumed by ten millions of Englishmen; and its money value is as great as that of all the wheat consumed in Great Britain."

But as it is estimated that the earth is capable of supporting a thousand times more people than at present exist, the large consumption of this plant need not alarm those who eschew it, especially as the consumption of tea and coffee, thought by some to be equally deleterious, is even greater and more universal.

That the lands of Virginia should have become impoverished from long-continued cropping, without a supply of manure, is not a matter of surprise, when we consider the length of time in which that process was going on, and that, instead of consuming the product on the ground, or in the neighborhood, it was mostly exported for consumption to foreign countries; but it is not the fact that the soils, now said to be impoverished, were ever so rich as the prairies and river bottoms of many sections of the west, with which they are so often compared. Still, the tendency of farming in a sparse population is to deterioration, from the very fact that the bulk of farm produce must be sent off the farm in exchange for other commodities. The most profitable farming, in the long run, is that which combines various kinds of produce, a considerable proportion of which must of necessity be consumed on the farm itself, or at least near home. Where the population is sparse, and there is no demand at home for farm produce, the farmer is compelled to raise such articles as will bear distant transportation, and follow this course year after year. He cannot, if he would, grow the articles which would be the least exhausting to his land. The Virginia tobacco planter of the last century and the early part of the present, had no means of restoring the fertility of his soils by supplying the vast amount of mineral constituents which the constant cropping and removal by transportation took away from his farm. He could not, or would not keep much stock to supply sufficient manure; and if he kept stock, the winters were mild, and they were never housed and so managed as to produce much manure. Cattle allowed constantly to run at large, and browse in the woods summer and winter, would do little to prevent the deterioration of the soil. It would have been better for the land if the planter had been obliged to cultivate and cut grasses for winter fodder, and then keep up his stock to consume it. The Belgian proverb is everywhere true: "No grass, no cattle;

no cattle, no manure; no manure, no crops." The worst effect of a system of exchange of agricultural products with other nations, by which we receive their manufactured goods, which possess great value in proportion to their bulk and the raw material consumed in them, is that we send off annually to them thousands of tons of the highest fertilizing elements, which nature requires should be again returned to the land in the form of manure. But we are sending off $35,000,000 worth of breadstuffs, and other products, like tobacco, in addition, which in themselves must of necessity draw largely upon the fertility of the soil, while we do not pretend to make an adequate return of fertilizing substances to it.

Other nations, like England, for instance, importing thirty millions worth of breadstuffs, have the benefit of their consumption, in addition to which they are constantly importing manures of every description. While we are constantly, and without stint, shipping off a continual stream of the most valuable manures concentrated in the form of our cotton, our tobacco, our wheat, and Indian corn, they, with ceaseless care, are husbanding the fertility which these naturally carry along with them, and adding vast quantities of guano, bones, phosphates, etc. They reap the harvest in soils growing richer and richer. We may make individual profits, which go, for the most part, into the hands of middle men, and leave our farms to reap the shadow.

The inevitable tendency of exchanging the produce of the soil for manufactured articles has always been, and always will be, to impoverish the nation that does it, unless there is care and forethought enough to import an amount of fertilizing substances equal to what we send away; and this cannot be. The farmer himself does not want it so. If he sends wheat enough to half feed a foreign mechanic or operative in the city of Sheffield or Manchester, he would infinitely rather sell him enough to feed him in full nearer home; and it would be better for him and for the nation to have it so.

CULTURE OF HOPS.

Of the crops which still remain to be mentioned, and which help make up the aggregate of the products of American agriculture, that of the hop forms no unimportant item, since, besides the quantity required for export, which, to be sure, is not very large, it enters more or less into the consumption of almost every family in the country.

This plant, like many others, dates its introduction to this country almost back to its first settlement; for we read in the records of the colony of the Massachusetts Bay, that "hop rootes" were ordered by the governor and company as early as 1628 or 1629, and though it was for many years cultivated only on a very limited scale for family consumption, yet no doubt it has continued as one of the cultivated plants of the country from that day to this. It was introduced and cultivated by the Dutch colony of New York as early as 1646, and it is known to have been brought into Virginia previous to 1648. In 1657 its culture was encouraged by legislative enactments.

At the beginning of the present century, the amount cultivated in New England was extremely limited. Thirty thousand pounds, perhaps, comprised the entire crop of that section, increasing some years to fifty thousand. The mode of picking and drying was objectionable and defective. The hops were picked in clusters, with the stems and leaves often thrown in; while the drying was universally done with wood, and when taken from the kiln they were "brown as a leg of bacon and about as much smoked."

The first use of charcoal for drying hops in this country was probably in 1791, when it was tried, only on a very limited scale, at the suggestion of a Scotch brewer, and produced the most beautiful kiln of hops that had ever been dried in America. It was owing to this improvement in the picking and drying that the demand for the article rapidly increased, soon doubled and tripled, and slips or cuttings to form new plantations soon rose to exorbitant prices. It had been the universal custom, previous to that time, to pack the hops in round bags, without any uniformity in length or size, and they were trodden down with the feet in a rude manner. The consequence was that the tops were bruised and broken, causing great loss in the strength and value of the hops by evaporation of the essential juices of the plant, its most valuable properties, to say nothing of the impossibility of packing closely for transportation. The use of square bales was introduced in 1797, or the year after, and the use of screws in packing was then commenced. The superiority of this mode soon became so apparent, that it was generally adopted not long after. Previous to this time, also, difficulties not unfrequently arose between merchants, from the fact that old and refuse hops were found mixed in with the good ones, while no proper distinction was made between the different grades or qualities. Vexatious lawsuits sometimes resulted from these circumstances, and the price of good hops was naturally lower than it otherwise would have been. The legislature of Massachusetts, to remedy these evils so far as they existed in that section of the country, created the office of inspector-general of hops in the year 1806. It was the first movement of the kind in the country, and, so far as I am informed, the first of the kind in the world.

But there were no precedents for classifying hops, and some system was to be adopted. Some hop dealers and many hop growers were opposed to a high standard of inspection. Many difficulties of a personal nature had to be encountered; but, owing to the conscientious use of the "first-sort" brand, the hops raised in that part of the country soon became noted as the best by far in the United States. By adopting a high standard of inspection, the growers were soon brought to improve their hops, in order to bring them up to the "first sort," and the facts and character of such an official inspection becoming immediately known in Europe, those who sent orders from there required hops of Massachusetts inspection, and they in consequence commanded a cent or two on a pound more than those of any other state. It is for the interest both of the grower and the dealer that the truth should be stamped on every bale.

The profit of raising hops must, of course, depend largely upon the foreign demand, and as that is extremely fluctuating, the price of this crop is fluctuating and uncertain. The consequence has been a decline in the cultivation, in some sections of the country, while in others it has largely increased. As an instance of the fluctuation of prices and the foreign demand, it may be stated that the exportation in 1849–50 amounted to 1,275,455 pounds, valued at $142,692; while the very next year, 1850–51, it fell off to 110,360 pounds, valued at $11,636, only.

It may be stated, however, that notwithstanding the great fluctuations, the crop increased from 1,238,502 pounds in 1840, to 3,497,029 pounds in 1850; showing a gain of 2,258,527 pounds.

The geographical distribution of this crop, as returned by the last census, was as follows:—

The south raised 33,780 pounds, valued at $5,067.

The west raised 194,961 pounds, valued at $29,244.

The north raised 3,268,215 pounds, valued at $490,232. New England raised 707,743 pounds, and New York 2,536,299. Balance raised in other states, 252,987 pounds. The crop of 1855 was estimated by the secretary of the treasury as nearly five millions of pounds.

CULTURE OF FLAX AND HEMP.

Like most of the crops already mentioned, both flax and hemp were introduced into the colonies very soon after the settlement of the country. Flax was taken to Holland from the Dutch settlement of Manhattan Island, or New York, as early as 1626. The governor and company of the Massachusetts Bay, in New England, also ordered both flax and hemp seed in 1628, if not, indeed, as was probably the case, at an earlier date. Hemp was very soon abandoned, as the land was not found strong enough for it.

Hemp and flax were raised in Virginia prior to the year 1648, as we read of their being woven and spun there; and bounties were offered for the culture of hemp in 1651, and of flax in 1657; but the culture fell off as soon as the bounties were discontinued.

But flax was pretty generally cultivated in small quantities for home consumption, in most parts of the country. It was not only raised, but manufactured at home, and formed a most important article in the domestic economy of the days of homespun. In 1745, some Irish emigrants arrived in Massachusetts, and established an improved mode of manufacturing linen and other "spinning-work," and they met with some success. Manufactories were established in Salem, Mass., for making sail-cloth, as early as 1790.

In 1751 no less than 14,000 pounds of hemp were exported from New Jersey, and the next year, 1752, the amount of flaxseed exported from Philadelphia was 70,000 bushels. This amount rose, in 1767, to 84,658 bushels; and in 1771 to 110,412 bushels. New York exported 12,528 hogsheads of this seed in the year 1755. The total amount exported from the American colonies in 1770 was 312,612 bushels.

In 1791 the United States exported 292,460 bushels of flax-seed; in 1800 the export was 289,684 bushels, and 240,579 bushels in 1810. The culture of these crops grew up more rapidly at the west, and extensive factories were established for the manufacture of cordage, bagging, etc., in Louisville, Lexington, Frankfort, and other places in Kentucky, as early as 1810. Hemp, in fact, has become a staple crop in the west.

According to the census of 1840, about 97,251 tons of flax and hemp were raised. In 1850 the two products were returned separately as 34,871 tons of hemp, 7,709,676 pounds of flax, and 562,312 bushels of flax-seed. The decrease in the aggregate growth of fibre was thus shown to be about 56,000 tons. The total value of both crops does not vary much from five millions of dollars.

Of the crop returned in 1850, the distribution was as follows:—

The south raised 34,673 tons of hemp, worth about $3,833,376; and 4,768,198 pounds of flax, worth $476,619.

The west raised 150 tons of hemp, and 1,330,859 pounds of flax; worth $133,085.

The north raised 443,370 tons of hemp, worth $22,178; and 1,717,419 pounds of flax, worth $171,742.

THE CULTURE OF SILK.

The cultivation and manufacture of silk has never been extensively carried on in this country, though introduced at a very early date—as early, in fact, as the first settlement of Virginia. James I. showed a desire to favor this branch of industry, equalled only by his antipathy to the growth of tobacco. It did not succeed at first, however, and in 1651 another spasmodic effort was made to revive it, but it was to little effect, and it never prospered there.

Silk culture was commenced in Louisiana by the Company of the West, in 1718. It was introduced into Georgia in 1732. A special act of Parliament was required to keep up the interest in it, in 1749, exempting the producer from paying duties, etc.

Connecticut began the raising of silk in 1760, and in 1783 the legislature of that state passed an act, granting a bounty on mulberry trees and the production of silk.

About the year 1830 an excitement was got up by interested speculators, which was so adroitly managed that it became general over the country, till it died under the name of the "Morus Multicaulis" fever, in 1845. Even under the encouragement of the government, all the raw silk Georgia could export in 1750 was 118 pounds; in 1765 it was only 138 pounds; in 1770, 290 pounds. The census of 1840 returned the amount of silk cocoons at 61,552 pounds; and this quantity had fallen off in 1850 to 10,843 pounds; being a decrease of 46,789 pounds in ten years.

BEE CULTURE.

The production of honey and the management of bees receives comparatively little attention in this country. So little, indeed, as hardly to be worthy of mention among the products of our national agriculture; and yet they form an important item in the domestic economy of many a household, and ought to receive all the attention they deserve.

The amount of beeswax and honey returned by the census of 1850 was 14,853,790 pounds. It is hoped that greater results will appear from this delightful occupation than it is possible at the present time to record.

The distribution of the production of honey and wax, as returned by the last census, was as follows:—

The southern states, including also Kentucky and Missouri, produced 7,964,760 pounds, which were valued at $1,194,714.

The western states produced 3,401,078 pounds, valued at $510,140.

The northern states produced 3,487,290 pounds, valued at $523,093.

POULTRY AND EGGS.

The value of the poultry kept in the United States, and the production of eggs, constitutes a much larger item of our agricultural economy than is generally supposed. The value of poultry, according to the census of 1840, was no less than $12,176,170. This sum, great as it appears, has been increased to some twenty-five millions of dollars. The city of New York alone pays about two millions of dollars a year for eggs. And so the other large cities require a supply in proportion.

The keeping of poultry, therefore, is by no means an insignificant item in the products of our agriculture, though for some reason or other the last census failed to take cognizance of it.

It may be doubted whether the introduction of foreign varieties of fowls effected an improvement in the common stock of the country. The excitement produced by designing men may have had the effect to increase the interest and knowledge in this branch of husbandry, which, so far, may be set down as a positive benefit to the country, but further than that, it is difficult to say what benefit resulted from it. For a time, indeed, the number of fowls was very largely increased, but the product of eggs did not increase in proportion.

The keeping of poultry, like that of bees, may be set down as among the means of making the farm attractive, in addition to the actual profit which may be derived from keeping a limited number of choice fowls, and the production of eggs for family use.

THE LUMBER BUSINESS.

The growth and preparation of lumber does not, perhaps, come strictly within the range of what is understood by agricultural products. But the primary operations involved are to a large extent undertaken by farmers, as a part of winter's work, and lumber forms no unimportant item in the clearing up and the preparation of land for tillage. It is, therefore, proper enough to allude to it in connection with the progress of our agriculture.

Volney represented the surface of this country as one vast forest, diversified, occasionally, by cultivated intervals. Since his time the woodman's axe, guided by a ruthless hand, has reversed the picture to some extent, but still the number and variety of our forest trees abundantly testify the bounty of nature.

Originally, indeed, an almost unbroken forest covered a large proportion, not only of this country, but of the whole continent. The Indian tribes were far less populous than is generally supposed; and if we except the prairie lands of the valley of the Mississippi, but a small portion of the surface of our present territory was destitute of timber trees.

> "Then all this youthful paradise around,
>   And all the broad and boundless mainland, lay
> Cooled by the interminable wood, that frowned
>   O'er mount and vale, where never summer ray
>   Glanced till the strong tornado broke its way
> Through the gray giants of the sylvan wild;
>   Yet many a sheltered glade, with blossoms gay,
> Beneath the showering sky and sunshine mild,
> Within the shaggy arms of that dark forest smiled."

It was stated by Michaux that there were in the United States one hundred and forty species of forest trees which attain a greater height than thirty feet, while in France there were only eighteen of the same description. An English traveller, writing of this country, says: "I was never tired of the forest scenery of America, although I passed through it from day to day. The endless diversity of foliage always prevents it from being monotonous." But the surpassing beauty which the forests add to our natural scenery is not to be compared with the solid advantages which are derived from the immense variety, as well as the quantity of their timber.

The forest scenery of this country beyond the Alleghany mountains, and from them to the Mississippi river, has been invaded to a less extent than in the older settled portions, and there are still vast tracts remaining uncleared. Trees of gigantic height and dimensions, standing in the richest mould, which has been accumulating for ages, and surrounded with a luxuriance of vegetation very rarely seen in the eastern states, carry the mind back to a period long anterior to the discovery of the country, and fill the beholder with awe by their grandeur.

To these forests, as they once stood, over a large portion of the country, we have been indebted for much of our growth and prosperity as a nation! How much do we not owe to one species of these majestic trees—the white pine? Michaux observed that throughout the northern states, except in the large capitals, seven-tenths of the houses are of wood, of which seven-tenths, three-quarters are of white pine. He might have said nine-tenths were built of wood, and come within the truth, though at the time he visited this country, fifty years ago, many houses had been constructed, to a great extent, of hard wood.

The new settlers had to enter and fell the forests, and burn and clear their lands as a preliminary preparation, and thousands of acres were thus brought under culture, the timber being of too little value to pay for saving. It was in vain that statutes were passed a hundred years ago and more, to prevent the cutting of trees suitable for ship timber. Private rights could not be invaded in the colonies, and down the forests came. The value of the forests for timber during the time of limited and scattered population was but little, and it could not be transported to great distances.

The lumber business, therefore, did not grow up to any great magnitude and importance till a comparatively recent period in any part of the country. Not, in fact, till the great centres of population began to feel new life from our growing commerce, creating a more extensive demand for building purposes, and for ship-building. When this period arrived, after the war of 1812 and the conclusion of peace, the lumber business began to extend itself into Maine and other regions then comparatively unsettled, especially in the vicinity of large streams giving easy access to the sea-board or to lake navigation. The mode of proceeding will be more clearly understood from the following description of the details of operations, prepared by a gentleman residing in the lumber regions of Maine. The logging camp is very much the same in all the more northern sections of the United States, from the timber regions of the St. Johns to the pineries of Wisconsin, and a detail of the winter operations of one will apply, with slight modification, to them all. I may remark, in passing, that I have myself lived some winters in the immediate vicinity of extensive logging operations in Maine, and, in fact, been engaged in them to some extent, and am familiar with them.

When a lumberer has concluded to log on a particular tract, the first step is to go with a part of his hands and select suitable situations for building his camps. In making this selection, his object is to be near as possible to the best clumps of timber he intends to haul, and to the streams into which he intends to haul it. He then proceeds to build his camps and to cut out and clear out his principal roads The camps are built of logs, being a kind of log-houses. They are made about three feet high on one side, and eight or nine on the other, with a roof slanting one way. The roof is made of shingles split out of green wood and laid upon rafters. The door is made of such boards as can be manufactured out of a log with an axe. Against the tallest side of the camp is built the chimney—the back being formed by the wall of the camp, and the sides made of green logs, piled up for jams, about eight feet apart. The chimney seldom rises above the roof of the camp; though some who are nice in their architectural notions sometimes carry it up two or three feet higher. It is obvious from the construction that nothing but the greenness of the timber prevents the camp from being burned up immediately; yet the great fires that are kept up make but little impression in the course of the winter upon the back or sides of the chimney. A case, however, happened within a year or two, where a camp took fire in the night and was consumed, and the lumberers in it burned to death. Probably the shingle roof had become dry, in which case a spark would kindle it, and the flames would spread over it in a moment. Parallel to the lower side of the building, and about six feet from it, a stick of timber runs on the ground across the camp. The space between this and the lower wall is appropriated to the bedding, the stick of timber serving to confine it in its place. The bedding consists of a layer of hemlock boughs spread upon the ground, and covered with such old quilts and blankets as the tenants can bring away from their homes. The men camp down together, with their heads to the wall and their feet toward the fire. Before going to bed they replenish their fire—some two or more of them being employed in putting on such logs as with their handspikes they can manage to pile into the chimney. As the walls of the building are not very tight, the cool air plays freely around the head of the sleeper, making a difference of temperature between the head and the feet not altogether agreeable to one unused to sleep in camps. A rough bench and table complete the furniture of the establishment. A camp very similar, though not so large in dimensions, is built near for the oxen; on the top of this the hay is piled up, giving warmth while it is convenient for feeding.

A large logging concern will require a number of camps, which will be distributed over the tracts, so as best to accommodate the timber. One camp serves generally for one or two teams. A team, in ordinary logging parlance, expresses, not only the set of four or six oxen that draw the logs, but likewise a gang of men employed to tend them. It takes from three or four to seven or eight men to keep one team employed—one man being employed in driving the cattle, and the others in cutting down the trees, shaping them into logs, barking them, and cutting and clearing the way to each tree. The number of hands required is inversely to the distance the logs are to be hauled; that is, most hands are required when the distance is shortest, because the oxen, returning more frequently, require their loads to be prepared more expeditiously. Having built their camps, or while building them, the main roads are to be cut out. These run from the camps to the landing places, or some stream of sufficient size to float down the logs on the spring freshet. Other roads are cut to other clumps of timber. They are made by cutting and clearing away the underbrush, and such trees and old logs as may be in the way, to a sufficient width for the team of oxen, with the bob-sled and timber on it, to pass conveniently. The bob-sled is made to carry one end of the timber only, the other drags upon the ground, and the bark is chipped off, that the log may slip along more easily. The teams proceed to the woods, when the first snows come, with the hands who are not already there, and the supplies. The supplies consist principally of pork and flour for the men, and Indian meal for the oxen; some beans, tea, and molasses are added. Formerly hogsheads of rum were considered indispensable, and I have before me a bill of supplies for a logging concern of three teams in 1827–28, in which I find one hundred and eighty gallons of rum charged; but of late very few respectable lumberers take any spirits with them, and the logging business is consequently carried on with much more method, economy, and profit. The pork and flour must be of the first quality. Lumberers are seldom content to take any of an inferior sort; and even now, when flour is twelve dollars a barrel, they are not to be satisfied with the coarser breadstuffs. Hay is procured as near to the camps as possible; but as most of the timber lands are remote from settlements, it is generally necessary to haul it a considerable distance; and as it must be purchased of the nearest settlers, they are enabled to obtain very high prices. From twelve to twenty dollars per ton is usually paid. When the expense of hauling it to the camp is added, the whole cost is frequently as high as thirty dollars a ton, and sometimes much higher. Owners of timber lands at a distance from settlements may make a great saving by clearing up a piece of their land, and raising their own hay. Some one of the hands, who has not so much efficiency in getting timber as skill in kneading bread and frying pork, is appointed to the office of cook. Salt pork and flour bread constitute the regular routine of the meals, varied sometimes with salt fish or salt beef. Potatoes are used when they can be obtained. Now and then, perhaps, when the snow is deep, they catch a deer, and live on venison. The men are employed through the day in cutting the timber and driving the teams. In the evening some take care of the oxen; some cut wood for the fire; then they amuse themselves with stories and singing, or in other ways, until they feel inclined to turn in upon the universal bed. On Sundays the employer claims no control over their time, beyond the taking care of the cattle, the fire, and the cooking. On this day they do their washing and mending; some employ themselves, besides, in seeking timber, and some in hunting partridges, while some remain in the camp and read the Bible. They remain in the woods from the commencement of sledding, some time in December, until some time in March, in the course of which month their labors are usually brought to a close by the snow, it becoming too shallow or too deep. If there are heavy thaws the snow runs off, not leaving enough to make good hauling. If, on the other hand, it gets to be four or five feet deep, the oxen cannot break through it to make the path which it is necessary to form in order to get at each individual tree. The men and teams then leave the woods. Sometimes one or two remain to be at hand when the streams open. I know one who last winter staid by himself in the woods, fifteen or twenty miles from the nearest habitation, for the space of twenty-eight days, during which time he earned $203 by getting in timber with his axe alone, being allowed for it at the same rate per thousand that the lumberers were in getting it in with their teams. He found some berths in the banks of the stream, where all that was necessary was to fell the tree so that it should fall directly upon the water, and there cut it into logs to be ready for running. When the streams are opened, and there is sufficient freshet to float the timber, another gang, called "river drivers," takes charge of it. It is their business to start it from the banks, and follow it down the river, clearing off what lodges against rocks, pursuing and bringing back the sticks that run wild among the bushes and trees that cover the low lands adjoining the river, and breaking up jams that form in narrow or shallow places.

A *jam* is caused by obstacles in the river catching some of the sticks, which in their turn catch others coming down; and so the mass increases until a solid dam is formed, which entirely stops up the river, and prevents the further passage of any logs. These jams are most frequently formed at the top of some fall; and it is often a service that requires much skill and boldness, and is attended with much danger, to break them up. The persons who undertake it must go on the mass of logs, work some out with their pick poles, cut some to pieces, attach ropes to others to be hauled out by the hands on shore, and they must be on the alert to watch the moment of the starting of the timber, and exercise all their activity to get clear of it before they are carried off in its tumultuous rush. Some weeks, more or less, according to the distance, spent in this way, bring the timber to the neighborhood of the saw-mills. A short distance from Oldtown, on the Penobscot, there is a boom established, extending across the river, for the purpose of stopping all the logs that come down. It is made by a floating chain of logs, connected by iron links, and supported at suitable distances by solid piers, built in the river; without this it would be impossible to stop a large part of the logs, and they would be carried on the freshet down the river, and out to sea. The boom is owned by an individual, who derives a large profit from the boomage, which is thirty-five cents per thousand on all logs coming into it. The boom cost the present owner about $40,000. He has offered it for sale for $45,000. It is said the net income from it some years is $15,000. Here all the logs that come down the Penobscot are collected in one immense mass, covering many acres, where is intermingled the property of all the owners of timber lands in all the broad region that is watered by the Penobscot and its branches, from the east line of Canada, above Moosehead Lake, on the one side, to the west line of New Brunswick on the other. Here the timber remains till the logs can be sorted out for each owner, rafted together, and floated to the mills or other places below.

Rafting is the connecting the logs together by cordage, which is secured by pins driven into each log, forming them into bands, like the ranks of a regiment. This operation is performed by the owner of the boom. The ownership of the timber is ascertained by the marks which have been chopped into each log before it left the woods, each owner having a mark, or combination of marks, of his own. When the boom is full, only the logs lowest down can be got at; and the proprietors of other logs must wait weeks, sometimes months, before they can get them out, to their great inconvenience and damage. After the logs are rafted and out of the boom, a great part of them are lodged for convenience in a place called Pen Cove, which is a large and secure basin in the river, about two miles below the boom. From this cove they can be taken out as they are wanted for the mills below. While in the boom and at other places on the river, they are liable to great loss from plunderers. The owners or drivers of logs will frequently smuggle all that come in their way, without regard to marks. The owners or conductors of some of the mills on the river are said to be not above encouraging and practising this species of piracy. Indeed, timber in all its stages seems to be a fair object for plunderers, from the petty pilferer who steals into the woods, fells a tree, cuts it into shingles, and carries it out on his back, to the comparatively rich owner of thousands of dollars.

When the logs have been sawn at the mills, there is another rafting of the boards, which are floated down the river to Bangor, to be embarked on board the coasters for Boston. In this process they are subject to much injury: first, by the mode of catching them as they come from the mill sluices, the rafters making use of a picaroon, or pole, with a spike in the end of it, which is repeatedly and unmercifully driven into the boards, taking out, perhaps, a piece at each time; secondly, by the holes made by the pins driven into the boards in rafting; and, thirdly, by the rocks, and rapids, and shallows in the river, breaking the rafts to pieces and splitting up the boards as they descend. These inconveniences will be partly remedied by the railroad now in operation, unless other inconveniences in the use of it should be found to overbalance them. The kinds of timber brought down our rivers are pine, spruce, hemlock, ash, birch, maple, cedar, and hackmatack. Far the greater part of it is pine. The lumberers make about six kinds of pine, though they do not agree exactly in the classification, or in the use of some of the names. The most common division is into pumpkin-pine, timber-pine, sapling, bull-sapling, Norway, and yellow, or pitch-pine. The pumpkin-pine stands pre-eminent in the estimation of the lumberers, because it is the largest tree, and makes fine, large, clear boards. They are soft, and of a yellowish cast. The timber-pine and saplings are the most common. The former is generally preferred, as being larger and more likely to be sound; yet the saplings are said to make the harder and more durable boards. The common sapling grows in low lands, generally very thick, but much of it is apt to be rotten. The bull-sapling is larger and sounder, grows on high land, and is mixed with hard wood. The Norway pine is a much harder kind of timber than the others. It is seldom sawn into boards, though it makes excellent floor-boards; but it is generally hewn into square timber.

I will conclude with some remarks upon the different modes of operating made use of by owners of timber. There are three. One is for the owner to hire his men by the month, procure teams, and furnish them with equipments and supplies. A second is to agree with some one or more individuals to cut and haul the timber, or cut, haul, and run it, at a certain price per thousand feet. The third way is to sell the *stumpage* outright: that is, to sell the timber standing. The first mode is seldom adopted, unless the owner of the timber is likewise a lumberer, and intends to superintend the business himself. The second mode is very common. It is considered the most saving to the owners, because the lumberer has no inducement to select the best timber, and leave all that is not of the first quality; to cut down trees and take, and leave others to rot that are not quite so good, but may be worth hauling. Its inconveniences are, that, as the object of the lumberer is to get as large a quantity as possible, he will take trees that are not worth so much as the cost of getting them to market, and which, besides being of little value themselves, render the whole lot less saleable by the bad appearance they give it. The owner, too, is subject to all the losses that may happen in running the logs down the river. Very frequently he is obliged to make a contract to have the timber cut and hauled to the landing-places, and another to have it run down; for the river-drivers are a distinct class from the lumberers. Most of them, indeed, are lumberers; yet it is but a small part of the lumberers that are river-drivers. A great part of the lumberers are farmers, who must be on their farms at the season of driving, and, therefore, cannot undertake any thing but the cutting and hauling. They are paid for the number of thousand feet they deposit at the landing-places; and the logs being surveyed, or scaled, as they are hauled, their object is to get as many thousand feet as possible on the landing-places; while the river-drivers may be very careless about getting them all down, and the owner may never receive the whole quantity he has paid for cutting and hauling. In operating in this mode, the owner usually furnishes the supplies, provisions, etc., and the lumberer procures the teams and hires the men. The owner, commonly, does not bind himself to pay before the logs go to market, and he frequently makes a contract for his supplies on the same condition, in which case he has to pay from twenty-five to thirty-three per cent. more for his goods than he would dealing on cash or common credit. Sometimes, when there is no freshet, the logs do not go down until the second year; and then the trader and lumberer both suffer for want of their pay.

The third mode is by far the simplest and easiest for the owner. He avoids all trouble of furnishing supplies, of watching the timber on the river, and of looking out for a market. But he must have a man of some capital to deal with, as he furnishes his own teams and supplies, and pays the men, receiving very heavy advances. The purchaser of it has no interest to cut the timber savingly, and he sometimes makes dreadful havoc among the trees, leaving a great deal of valuable stuff on the ground to rot. And if he selects only the best trees in a berth, much of the timber left standing may be lost, because no one will afterward want to go into that berth from which all the best trees have been culled. It is common now to employ a man to pass the winter in the camps, living alternately at one or another, for the purpose of scaling the logs, keeping a correct account of them, and seeing that the timber is cut according to the contract.

But, after all, there is almost always found to be a considerable difference between timber cut by the thousand and that which is cut on stumpage. Each mode has its troubles; but I think that owners at a distance will manage their concerns with least vexation by selling the stumpage, provided that they have honest men to deal with.

It might be mentioned in connection with the above interesting statement, that the primary object in the settlement of Maine was to engage in the lumber business. Agriculture was originally secondary to that business, and grew up of necessity, in connection with it. The same may be said of some parts of New Hampshire. Mason and Gorges procured their grant, embracing a large tract above Portsmouth, Dover, etc., for the purposes of lumbering and the manufacture of potash. It was common in Maine for a lumberman to work at farming in summer, and cut and haul lumber in the winter.

A brief description of lumbering at Green Bay, in the northern part of Wisconsin, will be interesting in this connection.

"A logging camp in the winter," says a resident of Green Bay, "is an exhilarating scene. The great trees falling here and there, with a thundering sound; the fine, strong teams moving off to the river with their loads, and hurrying back with empty sleds; the songs and shouts of the jolly, red-shirted lumbermen; the majestic forest scenery, standing out so handsomely in the clear air of northern winter, make up a panorama that is worth going a day's journey to see. Finally, the snow fades out before the spring sun. It goes first from the logging road, because there it has been most worn; and then the lumbermen make ready for the 'running,' and wait impatiently for the breaking up of the stream and the coming of the freshet. If they are a long way up the stream, this is a matter of great anxiety, for, perhaps, the rise will not be sufficient, and their logs will lie over till another year. One firm on the Oconto got logs as high up as ninety miles from the mouth. If the water is high, the logs come down by thousands upon thousands, rushing, clogging up, breaking away again, piling upon each other, and requiring the constant efforts of the drivers to keep them on the go. Sometimes, when an obstruction occurs, a few logs form a 'jam,' and those coming after them, with terrific force, are piled up in rude masses, till one not familiar with it would think the whole enterprise hopelessly ended, for there seems no possibility of ever extricating the mass, perhaps, of a thousand logs. But a single man, with an iron-shod handspike, goes upon the jam carefully, looking with a practised eye here and there, until he discovers one log which is the key to the whole problem. Prying cautiously, he loosens it, and then makes his way as quick as possible to the shore again. The confused mass begins to settle, the head logs start; and then, all at once, down stream they go once more, with the old speed, like a herd of countless buffaloes stamping along the prairie. The logs reach the mill in April or May, and the sawing commences on the arrival of the 'head of the drive.'"

In the absence of accurate statistics, which ought to have been furnished by the last census, it is not possible to give a detailed statement of the full extent of the lumber business of the country; and hence, any information on the subject must necessarily come far short of giving an adequate idea of its vastness, and of the progress which the last few years have witnessed in its development. But we know that the export of lumber from the United States has risen from $1,822,077 in 1821 to five millions in 1853; we know that, during the four years from 1850 to 1853 inclusive, the value of lumber exported was nearly twenty millions of dollars; we know that the amount of lumber received at Chicago alone in one year (1857) was no less than 459,639,198 feet, besides upward of eighty millions of laths. Chicago, indeed, as a lumber market, stands pre-eminent, and its rise and progress as such is little less remarkable than its growth as a grain market. The banks of the rivers are loaded for several miles with vast piles of lumber, shipped to that city from the extensive pine forests of Michigan, Wisconsin, and Canada; while the capital invested in this trade is immense. The vessels alone which are engaged in carrying the lumber which finds its market there, did not cost less than a million and a half; and the number of hands employed in one way and another is not less than ten thousand.

Here are some of the receipts of lumber in that city:—

	Lumber.—Feet.	Shingles.	Lath.
1847,	32,118,225	12,148,500	5,655,700
1848,	60,009,250	20,000,000	10,250,109
1849,	73,259,553	39,057,750	19,281,733
1850,	100,364,779	55,423,750	19,809,700
1851,	125,056,437	60,338,250	27,583,475
1852,	147,816,232	77,080,500	19,759,670
1853,	202,101,098	93,483,784	39,133,116
1854,	228,336,783	98,061,250	32,431,550
1855,	306,553,467	158,770,860	46,487,550
1856,	456,673,169	135,876,000	79,235,120
1857,	459,639,198	131,832,250	80,130,000

This, it must be borne in mind, is the business, in this particular trade, of only one city. Many other cities and large towns might be named, which, for extent of operations, would compare favorably with it.

The city of Boston receives from the southern states lumber to the value of a million of dollars a year, to say nothing of the immense quantities which she receives, also, from the north and east, and from Nova Scotia.

In what has been said above, reference has been had exclusively to the procuring of lumber for the purposes of building. The vast amount required for fuel has not been considered, but if that could be taken into account it would form an item of amazing importance, not only as ministering to the comfort of millions of people, but in a commercial and business point of view. There was a time, and that quite recently, when serious apprehensions were felt on account of the rapid disappearance of the woodlands of New England and the older northern states, lest they should, at no distant day, fail altogether to furnish a sufficient supply. The multiplication of railroads, and their great consumption of wood, had raised the prices to such an extent that the farmer could not wait for his young woodlands to grow, and thousands of acres were every year cut off to meet this demand. The introduction of coal into general use in the cities and large towns, and the resort to that by many of the leading lines of railway, has now relieved us from any cause for alarm, and the forests, even of Massachusetts, are now, it is believed, on the increase.

To this is to be added an increasing taste for the cultivation of forest trees, which in time will make a very perceptible improvement in the natural scenery of the country.

PROGRESS OF AGRICULTURAL LITERATURE.

The improvement and increase of the agricultural literature of the country might very properly have been treated of in the early part of this chapter, as among the means or the causes of the progress which has been made in the development of our agricultural wealth, to which it has contributed nearly as much, perhaps, as the agricultural societies themselves. I have, however, preferred to reserve it for this position, for the reason that it may with equal propriety be said to have grown out of a demand for information incident to the general spirit of inquiry which the association of effort produced in the public mind, and especially since it has, for the most part, grown up within the last twenty years, or long subsequent to the formation of many of the agricultural societies.

If we except the "Essays on Field Husbandry," by the Rev. Jared Eliot, of Connecticut, prepared as early as the middle of the last century, and the valuable papers submitted to the Massachusetts, the New York, and the Pennsylvania Agricultural Societies, and published by them about the beginning of the present century, we cannot be said to have had any agricultural literature, till within the memory of many men still living. None, in fact, till within the last twenty or thirty years. The "Essays on Field Husbandry," considering the time when they were written, were certainly a remarkable contribution to the agricultural literature of the country, filled with the most judicious advice, and worthy of republication, both as a part of the history of our agriculture and for their own intrinsic merits. But, as already remarked on a former page, the book was far in advance of the farming community of that time, and it is not probable that it had many readers. The papers published by the Massachusetts Society for Promoting Agriculture, commenced as early as 1796, were among the most valuable that have ever appeared in this country. They are embraced in a series of ten octavo volumes, called the "Agricultural Repository," and extend over a period of thirty years, discussing many questions which agricultural chemistry and other kindred sciences have since definitively settled and explained, but containing much useful information on a great variety of subjects connected with practical agriculture. The agricultural library connected with my office is one of the most valuable and extensive in the country, but I regard the "Agricultural Repository" as among the most valuable series in it.

The farming community gradually "took to reading." The *American Farmer* was commenced in Baltimore, Maryland, in 1819, and is believed to have been the first strictly agricultural periodical started in the country. It was sold in 1829 for twenty thousand dollars, which, at that time, was a very large price for an agricultural paper. It has been regularly published up to this time, and is still in a flourishing condition, with a good circulation.

The *Agricultural Intelligencer* was established in Boston in 1820, but for some reason or other, probably for want of sufficient support, was discontinued, and the *New England Farmer* was begun in 1822 by Thomas G. Fessenden. This journal, an eight page quarto, was continued with a varying fortune till 1846, when it died, but another of the same name, an octavo monthly and folio weekly, sprang up, and is still in the full tide of success. The *New York Farmer* was established soon after the *New England Farmer*, and was continued for several years by Mr. Samuel Fleet, then sold to Mr. D. K. Miner, who engaged the services of Mr. Henry Colman as editor, till the journal died, and is no more. In 1831, Mr. Luther Tucker, one of the oldest agricultural editors of the country, established the *Genesee Farmer*, at Rochester, N. Y. At the end of the first year it had but six hundred subscribers. But Mr. Tucker persevered, until, in 1839, the subscription reached 19,000.

In the meantime, Judge Buel had established the *Cultivator*, at Albany, in 1833, and at his death, in 1839, Mr. Tucker purchased that journal of his heirs, and removed to Albany, uniting the *Genesee Farmer* and the *Cultivator* which is still in a very flourishing condition, having exerted a long-continued and wide-spread influence. The place made vacant by the removal of the *Genesee Farmer* from Rochester was soon filled by the *New Genesee Farmer*, soon after which the first word of the title was dropped, and as the *Genesee Farmer* it is still published, and has a wide circulation. The *American Agriculturist*, established about the year 1842, was continued with some success for some years, till its subscription list became reduced to a few hundreds, when it passed into new hands, felt the infusion of younger blood, and in less than five years the subscription has risen to upward of fifty thousand. The *Farmers' Cabinet* was published some years in New York city, under the editorship of J. S. Skinner, who first established the *American Farmer*, at Baltimore. Mr. Skinner, in 1848, started the *Plough, Loom, and Anvil*, which was continued till quite recently. The *Maine Farmer* was established about the year 1832, and has exerted a good influence.

Many other agricultural journals have been started within the last five or ten years, and have received a generous patronage from the farming community, among which ought to be mentioned the *Rural New Yorker*, with a very wide circulation; the *Country Gentleman*, published in connection with the *Cultivator*, at Albany; the *Ohio Farmer*, of very wide influence and large circulation; the *Michigan Farmer*, at Detroit; the *Valley Farmer*, at St. Louis; the *Wisconsin Farmer*, at Madison; the *North-Western Farmer*, at Dubuque; the *Southern Planter*, at Richmond; the *California Farmer*, at Sacramento; the *Homestead*, at Hartford, Connecticut—all exceedingly valuable and well conducted papers; the *Working Farmer*, in New York city, and many others with which I am less familiar. There are in the northern and western states more than twenty-five journals, most of which are weekly, devoted almost exclusively to agriculture and horticulture, and the aggregate circulation of these is not less than 250,000 copies. There are also in the southern states, some six or eight similar publications devoted to agriculture, whose aggregate circulation is not less than thirty-five thousand copies. These facts are exceedingly important with reference to the present condition of our agriculture, since they indicate a wide-spread spirit of inquiry and intelligence among farmers, which must necessarily have an important influence on the future development of this great interest.

Besides the large number and wide circulation of the journals devoted to agriculture, there is a good demand for agricultural books, and many of the standard works published in Europe have been republished in this country, including Stephens' "Book of the Farm," Thaer's "Principles of Agriculture," Johnston's "Agricultural Chemistry," and many other European works of established reputation. These foreign works were soon followed by American treatises on landscape gardening, fruits, animals, draining, dairy farming, and, in fact, on subjects covering the whole ground of farm economy, more or less perfectly. Many of these treatises and republications have had a wide circulation. The "Modern Horse Doctor" has sold to the extent of more than twenty thousand copies, "Youatt and Martin on Cattle" over ten thousand, "Youatt on the Horse" over twenty-five thousand, and many others in a similar proportion.

In addition to these facilities for information, many of the states have established township and district libraries, by means of which the choicest works on all subjects are brought within the reach of all, the poor as well as the rich. In these libraries are generally included a fair proportion of agricultural works.

This system was initiated by New York in 1837, by making an appropriation of two hundred thousand dollars a year for three years, and subsequent annual grants of over fifty thousand dollars. Massachusetts followed the example of New York in 1839, and more recently Michigan passed a law giving each township the sum of fifty dollars annually for this purpose. Indiana adopted the same policy in 1854, and Ohio in 1857, the former appropriating $300,000 for two years, and the latter $80,000 annually. Illinois and other western states have also adopted a similar course.

These measures are properly regarded as well calculated to diffuse information, and promote not only agricultural improvement, but the general welfare of the community. To this should be added the fact that most states publish annually an abstract of the proceedings of the county agricultural societies for general gratuitous distribution. Many of the states produce volumes of great value. Ohio distributes from twenty to thirty thousand copies. Massachusetts publishes ten thousand copies, and Maine as many more. These various instrumentalities are now in constant activity, and are exerting an immense influence.

Allusion should also be made to the establishment, in some of the states, of agricultural colleges, where special attention is to be given to the various sciences which bear directly or indirectly upon practical agriculture. Michigan was the first to lead off in this direction; a liberal endowment was granted by the state. New York, Maryland, and other states soon followed; but the results of these institutions are not yet attained, nor can they at present be fully appreciated, since time only can prove their value and their efficiency.

This brief survey of the growth of the facilities for information upon agricultural subjects and the appliances brought to bear upon the instruction of the young farmer, will sufficiently indicate the rapidity of the progress which has been made in this particular direction within the last ten or twenty years, and justify the hope and expectation of the most splendid results in the future.

It ought not to be overlooked, in this connection, that there has been a most decided progress within the last twenty years in agricultural chemistry and kindred sciences. This progress has been made not wholly and strictly by scientific men in our own country, but scientific discoveries in agriculture are the property of the intelligent farmer everywhere, and those made abroad have had a material and important influence in promoting the advancement of practical agriculture among us.

The labors of Arthur Young and Sir Humphry Davy were exceedingly valuable, but they bear the same relation to more recent investigations that the labors of the pioneer in the western forest do to those of the sons who till the soil and reap the harvests for which the father had prepared the way. The former did more than any other man to stir up the agricultural mind of his country. The latter was the first to give principles to practice, and he announced the new philosophy in these words: "Vegetables derive their component principles—which are, for the most part, hydrogen, carbon, oxygen, and nitrogen—either from the atmosphere by which they are surrounded, or from the soil in which they grow. The process of vegetation appears to depend upon the perpetual assimilation of various substances to the organs of the plant, in consequence of the exertion of their living and of their chemical affinities."

The conversion of inorganic bodies into gases, and the assimilation of gases by organic structures, formed the basis for a new starting point, and had never before been announced. Carbonic acid had been discovered by Black in 1752. Dr. Rutherford called attention to nitrogen in 1772, and Priestley discovered oxygen in 1774, and obtained it from the leaves of plants; and when Davy appeared with a series of investigations more intimately connected with agriculture, the properties of air and water had not long been known. But little progress had been made in vegetable anatomy. Most of all that is known with regard to the organs of plants—their mode of growth by food taken from the air, from water, from manure, and from the soil by transmuting processes of wonderful delicacy—has been discovered within the last fifty years. Since

Davy's time, the processes of chemical analysis have been vastly improved, and abstract chemistry itself has grown up to a science of inestimable importance, which it had not in his day. The accumulation of scientific facts is the work of time, and it was not till 1840 that Liebig prepared his report on the progress of agriculture for the British Association for the Advancement of Science, and opened a new world of thought and study, awakened the attention of practical farmers to the importance of applying the results of chemical investigations, and, in some respects, essentially modified the practice of all civilized countries.

Liebig said, in his "Organic Chemistry," that "to manure an acre of land with forty pounds of bone dust, is sufficient to supply three crops of wheat, clover, potatoes, turnips, etc., with phosphates, but the form in which they are restored to the soil does not appear to be a matter of indifference. For the more finely the bones are reduced to powder, and the more intimately they are mixed with the soil, the more easily they are assimilated. The most easy and practical mode of effecting their division is to pour over the bones, in the state of fine powder, half of their weight of sulphuric acid, diluted with three or four parts of water." The leading idea in this and other propositions of Liebig opened the way for the whole system of artificial manuring, which has extended so far in modern times. Previous to that time, the farmer had confined himself to the use either of a compost of animal and vegetable materials, or of other simple substitutes, as ashes, salt, soot, or something of the kind; but not in accordance with any fixed principles derived from reasoning or the results of observation, but simply because experience had shown them to be beneficial. Liebig's idea was that sulphuric acid, the vitriol of commerce, would make the neutral phosphate of lime soluble, and give it a powerful action in the soil. For the subsequent discovery and use of mineral phosphates we are indebted to the same source, the development and application of the views first advanced by Liebig.

Immediately after the announcement of his propositions, experiments were instituted with such satisfactory results that manufactories were established in England, and the importation of bones from Germany, the United States, and South America, became of great importance to commerce as well as to agriculture; while the earnest researches of scientific men soon discovered the most approved formulas for the manufacture of superphosphate of lime, and other concentrated artificial manures. The best methods of preparing these substances were thus made known both by scientific and practical men.

The advantage of these discoveries cannot be disputed, for though the farmer may be liable to be deceived in the purchase of a particular kind of superphosphate, yet there is no longer any doubt of its great value as a fertilizer, when properly made; while its introduction rendered substances previously of little worth, easily and quickly available for the nourishment of plants, and hence very valuable.

It was these investigations that made known the value of guano as a fertilizer. This substance has come into use since the year 1840, when twenty casks were landed in England, where it was soon found to be a most valuable manure. So great was the confidence immediately inspired in its value as a means of increasing the products and renovating the soil of the country, that the very next year, 1841, seven vessels were employed to convey 1,733 tons from the Chincha Islands to England, and the number increased in 1842 to forty-one British and three foreign vessels, and the amount imported to 13,094 tons. Before the close of 1844, no less than 29,000 tons were imported into that country from the coast of Peru, to say nothing of the many thousand tons which came from the Ichaboe and other guano islands at that time discovered. In 1855, no less than 210,000 tons were sold in England, being an increase of twenty per cent. on the consumption of 1854, which was at least twenty per cent. over that of 1853. From 1841, the date of the extraction of guano, to any extent, from the Chincha Islands, to the end of 1856, the quantity removed from those islands alone reached the enormous figure of two millions of tons, and the aggregate amount of sales in that time was $100,263,519. From the commencement of 1851 to the end of 1858, there were imported into the United States and used, no less than 673,412 tons. As a means of renovating many of the tobacco and cotton worn lands of the southern states, guano must be regarded as a valuable addition to the sources of fertility made known by modern science.

A thousand other facts might be mentioned to show that science has done much for agriculture, and that there has been no small degree of progress already made, while investigation and experiment are, at the present time, being pushed with such vigor as to promise far more valuable and tangible results in future.

THE PROSPECTS OF AGRICULTURE IN THIS COUNTRY.

Having given some of the features of agricultural progress in the preceding pages, it is proper to say, in conclusion, that the present is but the dawn of a new era—an era of improvements of which we cannot yet form an adequate conception. The scientific discoveries, the mechanical inventions, the general spirit of inquiry, and the wide-spread intelligence which have been alluded to, indicate that a greater application of the mind to the labors of the hand distinguishes the present generation over all preceding times in a manner which those only can appreciate who will look back and consider the past—the slow growth of new ideas and new practices, the struggles with prejudice, ignorance, the want of markets, and the want of means, all of which contributed to depress American agriculture fifty years ago, and to keep it at a point wretchedly low, compared even with what it is at the present time. We have seen not only the calling, but the men who live by it gradually rising in dignity, in self-respect, and the respect of mankind. It is an imperative law of society that educated mind and educated labor will take its position above uneducated; in proportion as the farmer of to-day is better educated and more intelligent than the farmer of half a century ago, the former would naturally stand above the latter in the general estimation of the community. But in many other respects the farmer of the present day is far in advance of his forefathers. His labor is easier, and his mental activity is consequently greater. The same amount of manual labor produces more, and the farmer has time for the culture of the mind and the social virtues, as well as the farm, and agriculture holds a position of pre-eminence unknown at any former period.

These changes we have seen in our own day, and we know that a higher development of our agricultural wealth must go hand in hand with an increase of population, if there were no other stimulus to its growth. Now, if we consider the immense area of the United States, and the facilities for the expansion of our population, the mind itself is incapable of fixing limits to the increase of this grand interest, already involving a greater amount of the wealth of the country than any other, producing annually to the value of more than sixteen hundred millions of dollars, and capable of a hundred-fold greater development than that which it has already attained.

The original area of the country was but 820,680 sq. miles, till the purchase of Louisiana, in 1803, brought an addition of 899,579 more, and the acquisition of Florida, in 1819, an addition of 66,900 square miles. The annexation of Texas gave us 318,000, and that of Oregon 308,052, to which is to be added the territory acquired by the treaty with Mexico, of 522,955 square miles, and we have at the present time the vast extent of nearly three millions of square miles, or 2,936,166.

It is expected that the census of 1860 will show that the population is somewhat over thirty millions; possibly it may be thirty-three millions. The annual increase since 1790 has been four times as great as that of Russia, six times as great as that of Great Britain, nine times as great as that of Austria, and ten times as great as that of France; and if the ratio of increase in our population from 1840 to 1850 should continue to 1890, we shall have a population of one hundred and seven millions. The density of population in 1850 was less than eight persons to the square mile, or, more accurately, 7.90. That of the New England states was less than forty-two (41.94) to the square mile. That of the middle states was about fifty-eight (57.79), while Texas and California had less than one to the square mile. If we had the density of population to be found in Spain, it would give us two hundred millions; if that of France, it would give us five hundred millions; if that of Belgium (402), it would give us eleven hundred and eighty millions.

The area of the Pacific slope of this country is 786,002 square miles, or 26.09 per cent. of the whole territory of the United States. The area of the Atlantic slope, proper, is 514,416 square miles, a ratio of only 17.52 to the whole. The area of the gulf region is 325,537 square miles, or 11.09 per cent. of the whole; that of the northern lake region is 112,649 square miles, or only 3.83 per cent., while that of the Mississippi valley and the region watered and drained by its tributaries is 1,217,562 square miles, or 41.47 per cent. of the whole, or more than two-fifths of our national territory.

The number of farms and plantations in the United States in 1850 was 1,449,075, and the number of acres of improved land in farms, 113,032,614. In 1860 there were over two millions of farms, and the number of acres of improved land was 163,261,389. The unimproved land in farms, in 1850, was 180,528,800 acres, and this had increased, by the taking up of new lands in 1860, to 246,508,244 acres. The cash value of farms, in 1850 amounting to $3,271,575,420, had risen in 1860 to $6,650,872,507; or, in other words, while the farming lands had increased fifty per cent. in average, their value, from the greater density of population, and improved methods of cultivation, had doubled.

The domestic animals of the farm numbered as follows at the dates specified; the last column being estimated by the Agricultural Department:—

	June, 1850.	June, 1860.	Jan., 1866.
Horses	4,336,719	6,115,458	6,691,220
Asses and Mules	559,331	1,129,553	1,054,337
Milch Cows	6,385,094	8,728,862	
Working Oxen	1,700,694	2,240,075	26,935,616
Other Cattle	10,293,069	14,671,400	
Sheep	21,723,220	23,317,756	41,253,652
Swine	30,354,213	32,555,267	28,845,003

The value of all the live stock in 1850 was reckoned at $544,180,516. In 1860 it had a little more than doubled, being $1,107,490,216. In January, 1866, their value had nearly doubled again, though, owing to the extraordinary demand of the war, their numbers had not greatly increased, except sheep, which had risen from twenty-three millions to forty-one millions. The estimated value of the live stock of the country in January, 1866, according to data furnished by the Agricultural Department, was $2,171,283,799.

The value of the crops of any particular year are ascertained with difficulty and only approximately. In 1866, those of twenty-two of the northern states were reported by the Agricultural Department as having been, in 1863, $955,764,322; in 1864, $1,504,543,690; and in 1865, $1,047,360,167. During these years the crops of the southern states were greatly disturbed by the war, and comparatively little of their great staples—cotton, rice, and sugar—were planted. The aggregate value of the crops of an average year for the whole country will certainly not fall below $2,000,000,000.

The agricultural productions of the Pacific slope, though differing somewhat from those of the Atlantic states, are fast rivalling them in proportionate value. The long dry season, while it prohibits some crops, is favorable to others, and, by the very general introduction of irrigation, the production of wheat, of a peculiar but highly nutritious character, of the grape and other fruits, and of immense root crops, is already surpassing that of the farming lands of the east. The vintage of California already supplies a large portion of the wine consumed in the United States, and its wheat is largely exported. The state is also devoting great attention to silk culture.

Texas and the western portion of the Gulf region, on the other hand, proves to be the finest grazing country in the world, and its millions of cattle and sheep will ere long supply the markets of the continent. With a variety of climate which enables its agriculturists to cultivate all the productions of the temperate, and most of those of the semi-tropical zone, there is a boundless future of prosperity for the agriculturist of the United States to look forward to, and he may well hope and expect that his country will, at no distant day, furnish to the world in rich profusion whatever of the products of agriculture they may need.

COTTON CULTURE.

CHAPTER I.

ABUNDANCE OF LAND—HIGH WAGES OF LABOR DEPENDENT ON COTTON AND GOLD.

The high prices of labor in our country, and the large profits of capital, have been remarked from the earliest period of our history. Adam Smith, in his "Wealth of Nations," proposed an explanation of these two peculiarities, and there is no doubt that his keen insight discovered their true cause in the abundance and cheapness of good land. The large products of our rich virgin soil, purchased from the Indians at a mere nominal price, enabled the farmer to offer high wages to the laborer, and large interest to the capitalist. The owner of the land, who was generally a laborer himself, paid no rent, and had made but a small outlay to purchase his farm, so that nearly the whole of his product was the reward of labor. If he could find a poor man who had not means enough to purchase and stock a farm, he could afford to offer him high wages, because he would be himself more than paid by his increased products. These high wages soon enabled the hired laborer to become a land-proprietor himself, and both were then competitors in the market for all the labor that could be hired. This competition forced the rate of wages as high as their abundant crops authorized them to pay. The artisans of the towns were tempted from their shops by the large reward offered for their labor in the country; and the few who remained at their trades asked high prices for their work. These they readily obtained, for their only competitors were across the sea, three thousand miles distant, with slow and irregular communication, so that the foreign mechanics could not force those who were here to reduce their prices to the standard of the old world. Thus, in the town and the country, in mechanical as well as agricultural labor, a high rate of wages was kept up by the abundance and cheapness of good land.

As capital is an aid to labor, by enlarging its products, the rate of interest is high where labor is productive. The distrust of capitalists who were separated from us by the wide Atlantic, and their ignorance of our pursuits, and means, and credit, prevented them from entering into competition with the capitalists here, so that they easily obtained all the borrower was able to pay. This was a very high rate, because the money was of great advantage. Whether the farmer borrowed it to buy more lands, or ploughs, or stock, or the mechanic to enlarge his powers of production by new machines, or tools, or materials, both were able to pay a large per-centage, on account of the profits of their increased business. Thus cheap, rich lands not only advanced the rate of wages, but of interest also.

This explanation was satisfactory during all the period of our colonial history. It was still plausible after the war of Independence, for, although our population had advanced into the interior, and the price of lands along the sea-board had risen so that the products of the soil were charged, before they could be exported, with rent or with the cost of inland transportation, leaving a smaller portion of the proceeds for the share of the laborer, the wars in Europe connected with the French Revolution increased the demand for breadstuffs, and maintained them at high prices. Our neutral position gave us the carrying trade between the belligerents, and this required a large number of American ships. These being built of timber procured from our abundant forests, brought large returns to the laborer. The trees that were felled and converted into ship-timber cost nothing, or but a trifle; so that the whole value of the timber consisted of wages only, and the cost of transportation to the sea-port. As this distance was short, nearly the whole was wages.

Note. It is not supposed people will indorse some of the sentiments advanced in this Article—they are such as should be expected from a Southern source. Professor McCay is one of the most able writers of the South; is not a politician, so far as we know, and has produced a very instructive and valuable Article, it being written before the war, will ever remain one of the most impartial and faithful descriptions of the Cotton interest, and exposition of the views of the people of the South, on the system of labor under which the great staple is cultivated, to be found on record. We think it will be perused with much interest by the general reader.—*Publisher.*

Thus, even to the war of 1812, our rich, cheap lands were the source of our prosperity, and the explanation proposed by Dr. Smith for the high rate of wages and of interest prevailing here was still satisfactory. But when peace was restored, in 1815, and the immense armies of the different states of Europe were returned to their homes to become producers instead of consumers; when the several countries encouraged their own shipping and their own farmers by restoring their usual prohibitions and restrictions, the advantages we possessed before the war were very much lessened. Our country had by this time become more populous. Lands along the sea-board had risen in price; the people had penetrated the interior; the distant transportation had become a heavy burden to the producer; and thus, at the very same time that the European demand was lessened, and the price depressed, our ability to supply the demand with profit was decreased. The money value of our products was diminished, and the laborer's share in this value was at the same time lessened. The usefulness of our cheap lands was decreased, and their advantages were less and less experienced.

If we come down to recent times, our advantages have not improved. Our country has become larger. The region of cheap land is beyond the Alleghanies. We must take a journey of a thousand miles from New York, crossing the Ohio and the Wabash, passing Indiana and Illinois, before we reach the country of cheap lands. The grain that is brought down the Hudson from Albany has been carried more than three hundred miles, in the Erie canal, from Buffalo, and more than a thousand, by vessels on the lakes, from Chicago, and thither from the interior of Illinois by railroad. There the land on which it was produced is worth ten, twenty, fifty dollars per acre. Now, however cheap the transportation by railroad and on the lakes, the canal, and the river, the freight must be a large per-centage of the sales at New York. The rent of land in Illinois is also to be deducted, leaving but a small balance to be finally paid the laborer who has produced it. We must go hundreds of miles further to reach the region of cheap land, and then the increased cost of transportation will neutralize the advantage of procuring land at a dollar and a quarter per acre.

Now, will the cheap lands of Iowa, and Wisconsin, and Nebraska, explain our high rates of wages? In colonial times the product was made along the Atlantic, and nearly the whole price at Philadelphia went to the laborer. Now, a large per-centage must be deducted for the two thousand miles' carriage by land, lake, canal, and river, and the laborer's share is small. The truth is, the pioneer is poorly paid; he is struggling hard for a mere pittance. His receipts are small, and he can give but a small price for the hireling he employs to assist him on his farm. He is no longer the cause of high wages through the whole breadth of the land. His influence and empire have ceased.

Besides, our country has increased in population so largely, that the foreign demand for flour and other products of our lands will not pay for a tithe of our necessary wants, which must be supplied from abroad. Our people have increased in wealth, and their wants for wines, and silks, and other luxuries, cannot be paid for by the export of flour and grain, and the products of our forests. If, besides agricultural productions, we are forced to export manufactures to pay for our foreign supplies, the price of labor, which is the main element in the cost of manufactures, must at once fall to the European standard.

If, then, we had cheap lands even on the Atlantic, we could not pay for our present large supplies of foreign goods, so that these could not maintain our high rates for wages and interest; much less are they able to do it when they are thousands of miles from the coast.

A reference to the history of our foreign commerce will illustrate the principles we have been referring to. When our general government was first formed, our population was less than four millions; of these ninety-five per cent. were along the Atlantic slope, their average distance from the coast being less than a hundred miles. Our average domestic exports for the five years from 1790 to 1794, were less than twenty-two millions of dollars. Of these, flour alone averaged more than 800,000 barrels, and wheat more than 1,200,000 bushels; making a value of more than six millions of dollars. Other products of the farm and the forest made up nearly the whole of the balance. Now when lands were cheap, and near to the seaports; when the forests bordering on the coast were not yet thinned or cut down, the laborer had a rich and abundant harvest, and high wages could be maintained by our cheap lands.

Ten years later, our population had risen to five millions, of which ninety per cent. yet occupied the Atlantic slope. Our domestic exports had risen to forty millions for the five years after 1800; and of these, flour alone amounted to eight millions and a half, its average price being $8.40, and the number of barrels exceeding a million. The demand for our agricultural products was now large and the price high; so that the imports could yet be paid for by the products of our lands and our forests. These were still near the coast, and nearly all their proceeds belonged to the labor that produced them.

In 1810 our population had increased to 7,000,000, of which 80 per cent. were on this side of the Alleghanies. For the next two years which preceded the war, our exports of domestic produce reached $43,000,000, of which flour constituted one-fourth, the number of barrels exceeding 1,100,000, and the average price being $9.66. Other products of our lands, yet cheap and near the coast, made up a large portion of the means we used to pay for our foreign supplies, and up to this time it may be justly said that high wages were sustained by the abundance of our fertile lands.

But what a change in 1820. The people had increased to 10,000,000, 40 per cent. of whom had their homes across the mountains. Our exports of domestic produce were over $50,000,000, and the whole demand for flour did not average, for the five years after 1820, 1,000,000 barrels, and that at only $5.68 per barrel. While the products of our lands had to be brought much further to market, the amount demanded for foreign countries, and the prices they gave for them, had declined. It was the same with the products of the forest. For the ten years after the war they were less than for the ten years before. The first were much nearer the sea, and for the last we gave more labor and received less money. The efficiency of cheap lands to pay for our imports was gone, and their power to keep up prices departed also.

If we come down to 1850, our population had reached 23,000,000, of whom only 54 per cent. were along the Atlantic. The centre of the agricultural population had receded from the seaboard and crossed the mountains. The grain produced along the coast was all wanted at home. New England did not produce her own supplies. The city of New York contained a half million of people, who could not be fed by the surplus of the empire state. The coal and iron districts of Pennsylvania had become better markets for grain and flour than Philadelphia. Populous cities had risen in the west, and all these intercepted the supplies of food that were to be sent abroad for the purchase of our imports. The only flour that could be exported had to be carried from five to fifteen hundred miles. The foreign demand was no greater than it had been fifty years before, and our exports only reached 1,000,000 of barrels, while $163,000,000 were needed to pay for our imports. The other products of the west were small, and so were those of the forest. It is evident, therefore, that cheap lands could no longer furnish the supplies to pay for our imports, much less could they keep up the price of labor above the foreign standard. The advantages furnished by nature in the early history of our country had ceased, and we were thrown on other resources, to keep up the prosperity and progress of our people.

But this prosperity has not ceased. There has been no step backward in our career. The high prices of labor and of capital have been sustained, and the onward progress of our country, in power, wealth, and greatness, has never received the slightest check.

That labor is still higher than in Europe, is abundantly evident. We import a large amount of cotton goods; the importer pays the expenses of transportation across the sea, and a duty of 24 per cent. at the custom-house, and yet sells his goods at the same price with the American manufacturer who has bought his raw material at a lower price than the foreign producer. There is no explanation of this possible, except that labor and capital are higher in this country than in Europe. The iron ore of Pennsylvania is as good and abundant as in England; fuel and limestone are as cheap, and as near to the beds of ore; but the English iron is not only imported under heavy duties, but carried into the interior, and sold in the very neighborhood of the American furnaces. These two manufactures have long been favored by the protection of government. Under the device of specific duties and minimums, the tariff for a while amounted to a prohibition on many of these goods. On all it was very large and burdensome. The manufacturers have had time and opportunity to learn and introduce all the improvements, and skill, and knowledge that would facilitate and cheapen their production; they have had enterprise, and capital, and energy to manage and direct them; and there is no possible explanation of the continued import of these articles to the amount of millions and tens of millions of dollars every year, unless labor and capital were dearer here than in England.

Perhaps a more striking proof that wages are higher here than in Europe may be found in the immense emigration into the United States from foreign countries. The principal motive of these emigrants is to improve their condition. The Irish laborers who rejoiced in the old country at having meat once a week, are here able to place it on their tables three times a day; to whet their appetites with as much whiskey as they may wish; to enjoy comforts and luxuries they never dreamed of abroad; and to send back to the parents, and brothers, and sisters they left behind, millions of dollars every year, that they also may come here and participate in the same prosperity. The Germans bid adieu to their homes and fatherland that they love so well, and come over by tens of thousands to buy land, and build fine barns, and lay up treasures for old age or for their children; while in their own country they would have been poor and humble peasants all their lives.

This high price of wages is of the utmost importance. It is the source of our rapid increase in wealth and greatness, and the exact measure of our prosperity. It belongs not merely to the day laborer who works with his hands, but to the artisan who has skill, and to the man of talent who has brains. The superintendent and the master manufacturer, as well as the weaver, receive high wages; the captain of the ship as well as the sailor; the merchant as well as his porter; and as industry, enterprise, and talent earn higher rewards here than in any other country, the workman is inspired with new zeal, his aims and aspirations are raised, wealth accumulates with greater rapidity, and every thing that makes a country prosperous and powerful is developed with a quicker growth.

If, then, it is a fact that wages are higher here than in Europe; if this is a fact of the utmost importance to the prosperity and greatness of our country, the question recurs, How is this high rate of wages sustained? If not by cheap lands, what other advantage have we? the gift of nature or our own arrangement, by which we are able to have an active commerce with all the world, and a free interchange of commodities with every country, and yet to sustain a higher price for labor and capital than the other nations with whom we trade?

The only way to keep up the rates of wages and of money higher than in Europe, is to produce some articles here that are in large demand abroad, for which we have peculiar advantages, so that we can make them cheaper than other countries, in spite of our high price for labor and our high interest for money.

Such an article we have in cotton. It is of prime necessity, and in large demand abroad, because it furnishes the cheapest material for clothing, and for other purposes of civilized life; it is produced here under such favorable circumstances that we can supply this demand at a fair profit to ourselves; this profitable production being sustained by the favorable circumstances of our soil and climate, and by the use of cheap labor in the midst of a country where labor is dear.

The large demand for cotton in other countries enables us to pay for the imports that we must have, and also for others that we ourselves might supply, were it not that our high rates for labor and capital permit the foreign producers to undersell us in our own market, after paying heavy duties at the seaports, and the cost of transportation across the Atlantic.

It is easy to follow out the course of operations by which these effects are produced: the planter produces the cotton which is sold abroad, and buys the foreign supplies of the north, the south, and the west. The north carries the cotton to the foreign country, and brings back the returns. She delivers to the south her share, and pays for the balance in manufactures. After supplying herself, she buys food from the west with the remainder.

The manufactures of Europe being loaded with the expenses of transport across the seas, and with duties paid to the general government, the northern manufacturer can keep the prices for his goods up to the importing limit, and these the south is able to pay, because of the profit on her great staple, and the monopoly she has of the European market.

Thus are the high prices of labor sustained, and the foreign supplies of the country paid for by the export of cotton, whose cost of production does not depend on the high paid labor of the country, but on the cheap labor of the negro slave.

During the last ten years the gold of California has had precisely the same effect, and its operations have been in every respect similar. The demand abroad for gold is of course unlimited; the cheap and profitable production of it here depends on the abundant gifts of nature. The eastern manufacturers sell their high-priced products to the miners, who are prevented from obtaining them cheaper by the distance from Europe, and the duties of the custom-house, and are able to pay for them by the abundant rewards they receive from their own labor. In this case nature, without any aid, makes the production profitable; in the other nature is aided by the domestic institutions of the south. But the effects are in both cases identical.

These two articles are assisted by rice and tobacco, which are in almost every respect similar to cotton. The demand abroad is not so great, and our advantages in their cultivation over the other producers for the European market are not so marked and decided. They are, however, real, and they may properly be regarded as aids to cotton and gold in producing the effect.

The propriety and correctness of this explanation of our high prices is not affected by the fact that we also export some manufactures. This is done in spite of their high prices, because they are carried, not to England and France, but to Mexico, South America, and the West Indies, where our proximity and trade give us some advantages over the European manufacturer. A few cotton goods are carried to China; these are coarse, so that the superior cheapness of the raw material here partly compensates for the superior cost of manufacturing. This advantage is aided by the influence of fashion, habit, and accident; by the superior adaptedness of our goods to their wants at the commencement of the export, and the good will and good name that were then secured; and by various other inducements which often lead to the purchase of higher-priced commodities even in a free and open market. Some few manufactures are even carried to England, France, and Germany, on account of the temporary superiority of our workmen, or of new improvements in the mode of manufacture not yet introduced abroad, or of new inventions, or discoveries, or patents. The whole amount of these being small, and due to real advantages we have here, or to accident, or fashion, or taste, or prejudice, do not form any objection to the explanation we have proposed, that high prices are maintained in our country chiefly by cotton.

So also with agricultural products; we export some of these to the markets on our own continent, where we have many advantages over the European producer. In some of these, as in the flour to Brazil, these are very considerable. Our import of coffee is large, and our exports in return are very small, and consequently freights are low. We produce a kind of wheat in our southern climate manufactured into flour, which will not readily sour in the voyage across the equator. These two reasons secure a large demand for the brand of southern mills. And there are many other circumstances that induce a few shipments without reference to price, so that even the small influence of our agricultural exports in sustaining prices is not due entirely to cheap lands, but to position, accident, advantages of climate, and other things of this kind.

If we refer to our commercial statistics, it will be seen how small a ratio our manufactures and the products of our cheap lands bear to the whole exports. In 1850 the cotton, rice, and tobacco exported were worth eighty-five millions of dollars, and formed sixty-three per cent. of the whole value; the flour, grain, cheese, butter, lard, tallow, beef, pork, naval stores, and many other animal and agricultural products were less than twenty-four millions, and constituted only eighteen per cent. of the domestic exports; while the manufactures of every kind, including those of cotton, were only fifteen millions, forming but eleven per cent. of the exports. For 1859, the last year of our published returns, the value of cotton, rice, tobacco, and gold was $245,000,000, or seventy-three per cent. of the whole value; all the products of animals and of the field, forty-two millions, or thirteen per cent. of all; and manufactures of every kind (including eight millions of cotton goods) thirty millions of dollars, or nine per cent. of the whole exports. Of cotton alone the exports were $161,000,000.

We repeat, then, that it is cotton almost entirely that keeps up the price of labor and capital in this country above the rates of every other part of the world: that it is aided in this by the gold of California and the rice and tobacco of the Southern states, and, to a very small and insignificant extent, by our cheap lands and abundant forests; that cotton brings about this result because it is in large demand in foreign countries, being the cheapest article of clothing; because our planters produce it in large amounts, and at great profit to themselves; and because we have almost a monopoly of the foreign market, on account of our ability to produce a cheaper and better article than any other country in either of the four quarters of the globe. This cheapness is secured by the advantage of our soil and climate, and by the aid of cheap labor, which does not come into competition with the other labor of the country so as to depress the general standard of wages.

To establish the first of these propositions, we have only to refer to the history of the cotton manufacture of Europe and America, and especially of England, as found in another chapter.

CHAPTER II.

PRODUCTION AND PRICES OF COTTON.

Cotton has been employed as a material for clothing from the earliest times, and at the beginning of the eighteenth century nearly two millions of pounds were imported into England to supply their spinning wheels and looms, and to be used for the other purposes to which it was applied. In 1751 the imports rose to 2,976,610 pounds, in 1764 they were 3,870,392 pounds, and in 1781 they had increased to 5,198,778. At this period they took a sudden rise, and in the next five years increased to nineteen millions, and in the next five to twenty-nine millions of pounds, thus making a more rapid progress in five years than in the preceding hundred.

The cause of this rapid advance was the introduction of machinery for the spinning of cotton. This reduced the price and increased the demand, and led to the exclusion of linen, silk, and wool, and the substitution of cotton in their place.

As early as 1738 Wyatt had taken out a patent for the spinning of cotton by machinery. He was assisted by Paul, who afterward took out a patent for carding the cotton by machinery. But so complex and imperfect were the details of this machinery of Wyatt and Paul that these projects failed. The principle was discovered, but important practical improvements were wanting before it could be made successful.

In 1769, Arkwright took out a patent for his water-frame and throstle, and in 1770, Hargreaves invented his spinning-jenny, both of which were on the same principle as Wyatt's machine, but led to a very different result. Between 1770 and 1780 these machines were fairly tested, and in the next ten years they were rapidly introduced. The patent of Arkwright was broken down in the courts of law in 1785, by the persevering opposition of those who had wrongfully appropriated his discoveries; and the expiration of the other patents in a short time opened the whole manufacture to the free use of the people. In 1800 the imports of cotton had risen to fifty-six millions, an increase of eleven fold in twenty years. In the first eighty years of the eighteenth century the increase had been one hundred and fifty per cent.; in the last twenty years it had been a thousand.

These improvements of Arkwright and Hargreaves were not the end and perfection of the inventions for spinning. These machines were not adapted for the finer numbers, and in 1779 Samuel Crompton invented the mule, which combined the excellences of the two former inventions. No patent was taken out for it, and it was worked for a while in secret. But the high prices Crompton obtained for his yarn soon attracted such attention that he could no longer keep it concealed. For number forty, he received three dollars and a half a pound; and for number sixty, six dollars. These prices were commanded by the superiority of his yarn, and the mule was, therefore, a great improvement on the old machines. At first the invention was quite imperfect, but it was soon improved and brought nearly to its present perfection. In the course of ten years it was everywhere introduced. Under its influence the demand for labor rapidly increased.

The next important invention was the power-loom, first proposed and patented by Cartwright. The patent was issued in 1787, but all efforts failed to introduce it successfully until after the beginning of the present century. The improvements in dressing the warp, which were indispensable to the success of the power-loom, were made in 1803. In 1813 there were twenty-four hundred of these in use in England. In 1820 these had increased to fifty-five thousand, and in 1833 to a hundred thousand.

The steam engine of Watt was not less important to the manufacture of cotton than these improvements in spinning and weaving. The water power of England was limited, irregular, and entirely insufficient for the numerous machines that were soon introduced, and the new motive power was especially adapted to their work. Being cheap on account of the abundance of coal, regular in its operations so as to give a uniform stroke to the loom, not liable to interruptions and strikes as human labor had been, it has contributed very much to the progress of the cotton manufacture. Watt's first patent was taken out in 1769, but it was not until 1785 that steam was applied to the driving of a cotton mill. In 1800 there were thirty engines employed at Manchester, and in 1859 the number in the whole kingdom had risen to twenty-two hundred.

Under the influence of these improvements, the progress in the manufacture of cotton has been of the most rapid description.

It was under the influence of those great inventions that the importations of cotton rose in twenty years—from 1781 to 1801—from five to fifty-six millions of pounds, and the English exports of cottons from two millions of dollars to twenty-seven millions. In all this time the price of the raw material rather advanced than decreased. According to Tooke's "History of Prices," the range for different qualities of West India and Surinam from 1780 to 1785 was from 13 pence per pound to 40; while from 1795 to 1800 it was from 15 to 55 pence. But the cost of yarns was very different. In 1786 and 1787 the price of No. 100 was nine and a half dollars a pound; in 1790, seven and a half dollars; in 1795, four dollars and three quarters; and in 1800, two dollars and thirty-five cents.

We thus see that the effect of the introduction of machinery was to give an immense increase to the consumption of cotton, a large reduction in the price of cotton goods, and a substitution of cotton for wool, silk, and flax, and an increase in the demand for labor.

The improvements which were made after 1800 were not less important than those which preceded it. The importations into England increased from 1800 to 1810 more than a hundred per cent., being from fifty-six to one hundred and thirty-two millions of pounds. The American war interrupted the progress in the next decade, but in 1820 it had risen to one hundred and fifty-two millions. For the next ten years the rate of progress was nearly a hundred per cent., the amount in 1830 being two hundred and sixty-four millions. In 1840 the amount was five hundred and seventeen millions, the increase being nearly a hundred per cent. In 1850 the imports were six hundred and sixty-nine millions; and in 1859 they were eleven hundred and eighty-one millions. In 1860 the amount received from the United States alone reached the enormous sum of eleven hundred millions, to which the East Indies have made an addition of two hundred more, and other countries nearly a hundred, making a total of fourteen hundred millions of pounds.

This increase since 1780, when machinery was first successfully applied to the spinning of cotton, has been two hundred and eighty fold. Since 1800 the increase has been twenty-five times; since 1820 twelve times; and since 1840, three times. During the year 1858 the value of England's manufactured cottons was four hundred and thirty millions, and in 1859 four hundred and eighty millions of dollars.

At the same time the manufacture has been growing rapidly in every other country. The abundance of coal in England, the cheapness of iron and machinery, and the low rate of interest on capital, as well as the enterprise, industry, and skill of her people, have placed her before other countries; but their progress has been rapid, and their demand for cotton large and increasing.

From 1820 to 1840 the French imports of cotton rose from forty-four to one hundred and four millions of pounds, and in 1855 to one hundred and sixty-eight millions. And the recent abolition of the duty on raw cottons has made the increase still more rapid. In some other countries of Europe, the progress has been greater than in France. The comparative magnitude of the manufactures of other countries than England may be seen by our exports in 1860. To England, we sent 2,669,000 bales; to France, 589,000; and to the rest of Europe, 515,000. The average of 1839 and 1840, when compared with the average of 1859 and 1860, is as follows:—

	1839–40. Bales.	1859–60. Bales.	Increase per cent.
Great Britain......	1,022,000	2,344,000	130
The Continent.....	453,000	1,069,000	136
The United States.	336,000	953,000	154
Total	1,811,000	4,366,000	140

As England exports much of the cotton she receives, and all obtain more or less from other countries than the United States, the comparative importance of other countries will be best seen by the consumption of all kinds of cotton. The weekly consumption for the years 1855 and 1856 was as follows:—

	1855. Bales.	1856. Bales.
Great Britain........	37,384	43,518
On the Continent....	26,554	27,524
The United States...	14,822	15,768

In the United States, the increase in the consumption has been more rapid than in any other country:—

Average from	1826 to	1830,	127,000	bales.
"	1831 "	1835,	195,000	"
"	1836 "	1840,	275,000	"
"	1841 "	1845,	363,000	"
"	1846 "	1850,	539,000	"
"	1851 "	1855,	686,000	"
"	1856 "	1860,	818,000	"

This large increase in the manufacture of cotton has been accompanied with a decline in the cost of the raw material, and a still greater decline in the cost of manufactured goods. The price of American cotton, from 1800 to 1820, averaged twenty-two cents per pound; from 1820 to 1840, thirteen cents; and from 1840 to 1860, only ten cents. In the same time the improvements in machinery, and in the art of manufacturing, and in the skill of the workmen, have reduced the price of yarns, and prints, and muslins, and every product of the loom in a much greater ratio. For number 100, the price of yarn in 1786 was nine dollars and a half; in 1796, four dollars and three quarters; in 1806, one dollar and seventy-two cents; in 1812, one dollar and twenty-seven cents; in 1830, eighty cents; and in 1854, fifty-eight cents. In the lower numbers the decrease has been nearly as large. In all kinds of cotton goods the decrease in price is made manifest by the change in the official and declared values of the exports of Great Britain. The official is a fixed nominal price for every article exported, and the declared is the real value. The former may therefore be regarded as representing quantities, and the latter values. Now the official and declared values of all kinds of goods for

1814	were	$88,000,000	and	$100,000,000
1824	"	151,000,000	"	92,000,000
1833	"	232,000,000	"	92,000,000
1840	"	366,000,000	"	123,000,000
1850	"	569,000,000	"	141,000,000
1858	"	846,000,000	"	214,000,000

These numbers show that while the amount has increased nearly tenfold, the value has only doubled, and that therefore the goods are five times cheaper now than in 1814.

We have now followed the cotton manufacture from its rise, a century since, down to the present time. Its immense magnitude in every country of Europe, its rapid progress, its exclusion of other materials for clothing, and the great decrease in the price of manufactured goods, are established facts which show how large and how intense is the foreign demand for our cotton. This is the first proposition we proposed to consider in our explanation of the high prices of labor and capital in our country, and we now pass on to the second, that the production of cotton is very profitable to the American planters.

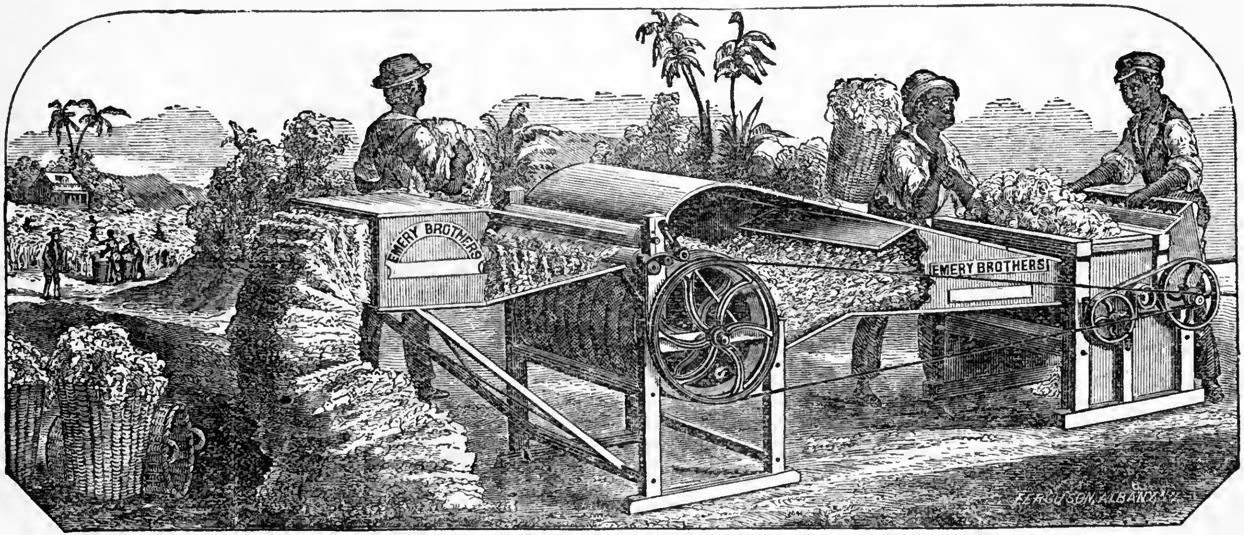
In proof of this, we shall show that the cultivation of cotton has attracted labor and capital from other pursuits in the cotton states, until it has concentrated almost their whole productive power upon this single article; that it has drawn wealth and labor from other sections of the country to be devoted to it, when other employments were inviting their attention; and that these and other facts demonstrate the profitableness of this culture.

The cotton plant of Europe is a native of India, whence it spread very slowly into China and Persia, Africa and Europe. But cotton is a native of this continent, and was diffused here everywhere before the arrival of the Europeans. It was found by Columbus in Cuba, on his first voyage, in 1492, and by Cortes in Mexico, and Magellan in Brazil, on their first visit to those countries in 1519. Pizarro saw it in Peru in 1532, and Cabeça de Vaca in California in 1536. In both divisions of the continent it had spread as far north and as far south as the climate would permit. All the three kinds of cotton were growing here: the herbaceous, or annual; the shrub, which lives three or four years; and the tree, which lasts for twenty years. It is only the annual which is now cultivated in the United States. During our colonial history, it was introduced here from the West Indies and from the Mediterranean, and was extensively cultivated in gardens and small patches for domestic use from New Jersey to Georgia. A few bags were exported before the Revolution; but so little was produced, that a shipment of eight bales from Charleston, in 1784, was seized by the custom-house authorities in England, on the ground that so large an amount could not have been grown in the United States. As it was cultivated to advantage in the West Indies, near to our coast, many attempts were made to extend its culture here. Some seeds were brought from the Bahamas, and successfully cultivated along the coast of South Carolina and Georgia, soon after the war of independence. This was carefully improved from year to year, by selecting the seed of the finest plants, by the application of the most suitable manures, and by choosing the best localities for its cultivation, until the fine, silky variety, known as the sea island cotton, was naturalized in our country, and brought to the greatest perfection of staple. The seed is easily separated from the lint by passing it between rollers, which push back the seed and permit the cotton to pass through. This is a tedious work, but the length and fineness of the fibre secured so high a price for the product, that the cultivation has continued profitable from its first introduction to the present time. It is mixed with the best wool or with silk, or is used by itself for the manufacture of the finest fabrics, and commands a very high price in the market, two, three, or four times more than the short staple cotton. Our country has a monopoly of it; for neither in Egypt, Pernambuco, or the Isle of Bourbon, where the best cottons are grown, can they produce a staple of the same length and fineness. Sometimes a dollar a pound is paid for it; and even higher prices have been offered for favorite crops.

The cultivation of this variety is limited to the islands along the coast and a narrow belt near the sea, though in Florida it may be grown in any part of the peninsula. When planted in the uplands it degenerates quickly and is less productive. The whole value of this crop is now from eight to ten millions of dollars, and varies but little from year to year. For the last three years the crop has averaged 47,000 bales, and for the three preceding, 43,000 bales. The variety of cotton that is planted in the interior is the native Mexican species. It adheres closely to the seed, and cannot be separated by the common roller gin. When first cultivated it was separated by hand, but this operation was slow and tedious, and limited the cultivation for the purposes of commerce. In 1791 the whole exports of the United States of all kinds of cotton were only 189,316 pounds—which is less than the product of many of our single plantations at the present time. In 1792 it was four hundred and nineteen bags, weighing 138,328 pounds; and in 1793 it was 487,600 pounds. At this period it took a sudden start upward, and rose in 1794 to 1,601,000, and in 1795 to more than six millions of pounds. The cause of this sudden increase was the invention, by Whitney, of the saw gin.

This ingenious gentleman was a native of Massachusetts, and had come to Georgia as a private tutor in 1792. While residing as a guest in the family of Mrs. General Greene, near Savannah, he was informed by some of her visitors from the upper country, where the short-staple cotton was cultivated, of the great desirableness of a machine for separating the cotton from the seed. To his inventive turn of mind, this suggestion was enough to attract his attention. He obtained some of the seed cotton from Savannah, and soon devised the saw gin. At first he used bent wires or teeth, like those of the common card, but much larger and stronger, and these were placed in rows on a revolving cylinder. The cotton was separated from this cylinder by a frame of parallel wires. As the cylinder revolved, the teeth extending through the wire frame caught the cotton and drew it through the grating, but the seeds being too large to pass between the wires, were separated from the lint. The teeth being found too weak to pull the cotton from the seed without being bent or broken, he substituted a circular saw in their place. The teeth of the saws being large, and shaped like the beak of a bird, had more strength and were equally efficient. Behind the saw-cylinder, brushes were arranged to remove the cotton from the saws, and thus the object was accomplished. When he had completed his gin, entirely by the labor of his own hands, he invited some farmers to see it tried, and all were satisfied with its work. It differed es-

COTTON CLEANING BEFORE THE INVENTION OF THE COTTON GIN.



COTTON GIN FROM THE WAREHOUSE OF C. V. MAPES.

sentially from the roller gin introduced from the Bahamas, and invented there by Joseph Eve, the son of a Pennsylvania loyalist, and afterward a resident of Georgia. The roller gin had also teeth and a wire frame, and the revolving teeth caught the cotton through the wire frame, but they only delivered it to the rollers which separated the cotton from the seed. In the saw gin the teeth and the wire did the work of separation. Though Eve's was like Whitney's, and may have suggested it, they were on different principles. The one was suited for the sea island, and the other for the upland.

Before Whitney could take out his patent, many of his gins were constructed by the farmers and put to work. His patent was issued in 1793, and having obtained the co-operation of Miller, who furnished the capital, they undertook the manufacture of the gins for sale, and the ginning of cotton by the pound for the planters, and the purchase of the seed cotton, that they might clean it themselves. Although these plans required large capital, Whitney was poor, and Miller had but small means when this project was undertaken. In 1794, when they were preparing several machines for sale, Whitney was taken sick, and his workmen were prostrated by the fevers of the climate. These difficulties prevented the construction of many gins by the patentees; and as the want of them was great, and the machinery very simple, many were built by common mechanics, and thus extensively introduced. In 1795 Whitney's shop and all his machines were destroyed by fire, and this was another hindrance to the sale of the patented gin, and another incentive to those who were trespassing on his rights. To put a stop to these infringements of their patent, suits were instituted by Miller and Whitney. But the patent law had just been passed by Congress, and the general government was little known or respected. The juries were composed of men who were all interested in breaking the patent. The gin makers had strong interests prompting them to resist the suits. Witnesses were found who testified that they had seen the gin in Europe, where it was used for making lint! The suits were postponed and delayed by the ingenuity of lawyers, and as the United States courts only met at long intervals, these delays were the more serious. Under these difficulties, the patentees often failed in their suits, or obtained but small damages, or were engaged in long, vexatious, and expensive litigation, so that the courts became an expense to them instead of a protection. The gins were everywhere introduced, with or without the patent-right. This was the case both in Georgia and South Carolina; but the delay and failure of the suits in Georgia induced the patentees to propose to the legislature of South Carolina to sell the right for that state for $100,000. An offer of $50,000 was made them and accepted, and this was nearly all that was ever received by the inventors. Whitney, unlike Arkwright, only received barren honors for his great invention; for even the purchase money of South Carolina was expended in the prosecution of the suits he had instituted against the trespassers on his rights.

The introduction of Whitney's gin acted like magic on the planting of cotton. In eight years, from 1792 to 1800, the exports of the United States increased more than a hundred-fold. The value rose from $30,000 to $3,000,000, and the amount from 138,000 lbs. to 18,000,000. The whole of this was wanted in England, and the rapid increase in the demand there that followed the general introduction of Arkwright's inventions prevented any decline in price. The population of South Carolina and Georgia, where all of this cotton was raised, was only 507,000 in 1800; so that the amount was $6 to each individual, including the young and the old. This was not enough to purchase the manufactures and the foreign supplies they needed; rice and tobacco being both added to cotton in the exports of Charleston and Savannah. Those of rice alone were larger than cotton, and the production of tobacco was considerable. The immigrants from Virginia and North Carolina brought this cultivation with them, and it formed a large part of the trade at the sea-port towns at this early period. But it was soon to disappear, under the progress of cotton. In the next ten years, from 1801 to 1810, the production increased more than five-fold, from 18,000,000 to 93,000,000 of pounds and the value from $3,000,000 to $15,000,000. As the population had only increased 30 per cent. in these ten years, and as the exports of rice had risen from 94,000 to 119,000 tierces, the great change was in the transfer of labor from tobacco to cotton. The exports of cotton and rice in 1810 were more than $30 to each person, white and black, young and old, male and female; an amount which sufficiently indicates that nearly the whole available labor was devoted to these two staples.

In the next decade the cultivation was interrupted by the war of 1812, and the exports only rose to 128,000,000 in 1820. But the high prices that followed the war stimulated the production to the utmost possible limit. Tobacco was no longer cultivated as an article of export. Rice was still planted in the swamp lands along the coast, because they were not well suited for cotton and because rice was itself a very profitable crop. Emigrants flocked from Virginia to engage in the culture of cotton; new lands were purchased from the Indians; more laborers were brought from Virginia to work in the cotton fields; and every hand that could be spared from other employments, white or colored, was appropriated to this one culture. In consequence of this transfer of labor, the exports rose in the next decade, from 1820 to 1830, more than 100 per cent., from 128,000,000 to 298,000,000 pounds.

For the next ten years the impulse to the cultivation of cotton was greater than ever. It was impossible for the cotton states to transfer any more of their labor to the culture. Some of their population was needed in the towns and cities to attend to the sale and shipment of their cotton, some to provide supplies for the planters, and a few were engaged in those mechanical pursuits which are absolutely indispensable, even in an agricultural country receiving its manufactures from distant places; but all the rest were engaged in the production of cotton. The planter raised enough corn to feed his stock, and provide bread for his family; he supplied generally his own meat, but for the most part his flour was brought from the north or west, and the towns were supplied with pork and flour from the same source. All his labor was appropriated to cotton, because it was more profitable than any other crop. All his profits from year to year were devoted to buying more negroes, that he might enlarge his cultivation of the one great staple of the south. The emigrants from Virginia, and North Carolina, and Tennessee, though at their first arrival they might prefer to plant tobacco or wheat, soon transferred all their hands to cotton. The lawyer, and the doctor, and the school-master, as soon as they earned any money, bought land and negroes, and became planters. The preacher who married an heiress or a rich widow, became the owner of a plantation. The merchant who wished to retire from the perplexities of business, and take his ease in the country, passed his old age in watching the cotton plant spring up from the fresh-ploughed ground, spread its leaves to the gentle showers of spring, stretch its long branches to the summer's sun, open its red blossoms, to be followed by the abundant fruit which showed their white treasures to the autumn sky, gladdening his heart with the abundant rewards of his labor. All the labor, all the capital, all the increase of population and wealth by immigration from more northern climates, all the accumulations of every trade, or business, or pursuit were devoted to this one cultivation; and though it had seemed impossible in 1830 to increase the cultivation to any considerable degree, the production rose in 1840 to 744,000,000 pounds, or six times the product of 1820.

During the next decade this favorite culture received a slight check. The increase in the demand, though outrunning every other business, had been overtaken by the still more rapid increase in the supply. Prices declined, and the capital of the country had an opportunity to look around for other employments. It readily found them in the construction of railroads, the erection of cotton factories for coarse goods, the production of the corn, and meat, and flour for the towns and cities, the cultivation of the sugar cane, and in those other mechanical and manufacturing pursuits which are the first enterprises of an agricultural people.

The south had other employments to which she might have turned her attention with advantage. She had fine shipping timber, and in great abundance, but she did not increase her shipping, because high as wages and interest are at the north, they are still higher at the south, and the competition between the two sections is so easy in shipping, that she could not engage in shipping even her own products, as long as other more profitable pursuits keep up the rate of labor and capital to their present high limits. The low prices of cotton from 1840 to 1850 did not, therefore, divert capital to shipping. The tonnage of Charleston averaged 50,000 tons from 1800 to 1810, nearly 40,000 from 1810 to 1820; 22,000 from 1832 to 1840, and 23,000 from 1840 to 1848.

The culture of rice was susceptible of very slight increase, because the only land suitable for its cultivation is the low, swampy district along the sea, where the crop can be covered with water. From early times this valuable grain had been raised in all favorable localities, and, though a very profitable crop, no increase was practicable. From 1789 to 1798 the exports of the United States averaged 107,000 tierces; from 1799 to 1808 they were 82,000; and from 1809 to 1818 the average was 87,000. From 1820 to 1829 the whole crop, including the shipments to the north and the exports, averaged 120,000 tierces; from 1830 to 1839 they were 148,000; and from 1840 to 1848 the average was 162,000. These figures show little or no transfer of capital to this production, and the reason is that the lands suited to its cultivation are limited. For the year 1858 they were 173,000 tierces, showing the same steady, unchangeable condition of this culture down to the present time.

But although the cultivation of rice could not be increased, and the northern shipping was too easy a competitor with the southern, there were many employments in which the south could engage, before she would reduce the wages and profits down to the northern standard. Tanneries, forges, foundries, the making of shoes, buckets, hardware, furniture, clothing, machinery, and every manufacture where the bulk or the weight is considerable, can be profitably pursued. The negroes make good carpenters, shoemakers, tanners, workers in iron, and there is no employment pursued at the north to which their labor cannot be profitably devoted.

Of all these employments thus attracting her attention, the principal of those which she selected in the depression of 1840 were the construction of railroads, the culture of wheat, the manufacture of coarse cottons, and the planting of the sugar cane.

These railroads have nearly all been profitable. It may seem strange to those who have only heard of Harlem, and Erie, and New Haven, and Hudson River railroads, to be told that every railway of the cotton states has been profitable. The country is sparsely settled, and it cannot be from passengers. They have but little through freight to Tennessee and North Carolina, and it cannot be from the transit of goods. Their only product is cotton, and it is this that pays. Not only does the great staple enrich those who make it, but all who handle it and carry it. It is like the fabled Midas, and turns all things into gold.

Wheat, also, has been a profitable culture, because it is mainly consumed at home, and the price is usually the cost of flour in New York added to the cost of transportation. Even when fine seasons and a large crop enable the farmer to export some of his flour, the early harvest permits him to send it to New York before the new wheat of the north and west can be offered in the market, and thus secure to himself a high price.

So have the cotton factories generally been profitable. All that have been managed skillfully and faithfully have paid good dividends, and several have made fortunes for their owners. The oldest mill in the southern states, near Athens, Georgia, has been profitable from the start, more than thirty years since. Those at Graniteville and Roswell, favored with water power and wise management, have paid large and regular dividends. The one at Macon, though driven by steam, has been alike successful. Many of the others have done well, though the machinery has to be brought from the north, and the expense of labor and superintendence is high. A few have failed from frauds and dishonesty in the projectors or managers, some from carelessness and neglect of their duties by those to whom they were entrusted, and some from ignorance and imprudence. But always when well managed they have succeeded. They make the coarse osnaburgs and heavy shirting for the negroes, and the coarser numbers of yarn for the country looms of the planters. Many of them send their yarns to Philadelphia and New York, and dispose in this way of their surplus production. A few are working on finer unbleached cloth, and they are also doing well.

So, also, has some capital been devoted to sugar. The beautiful lands along the lower Mississippi have been appropriated to this crop. Under the protection of the tariffs of 1824 and 1828 the culture was started, and from 1835 to 1840 the production averaged seventy millions of pounds, worth over four millions of dollars. The low prices of cotton about this time encouraged the producers, and the amount for the next five years averaged one hundred and twenty-five millions of pounds, worth six millions of dollars. In the next five years the product rose to two hundred and eleven millions, valued at ten millions of dollars. From 1850 to 1855 the production still further increased, the amount being three hundred and forty-seven millions, and the value fifteen millions. In the last five years—partly from the disastrous season of 1856, which not only ruined the crop for that year, but destroyed the plants for the next, and partly to the high price of cotton, which has diverted some of the lands to this culture—the average has only been two hundred and sixty-three millions; but the value of this decreased crop has been higher than ever, having reached seventeen millions of dollars.

To these and a few other new enterprises, the accumulating labor and capital of the cotton states have been diverted since the disastrous fall of prices in 1837. But the culture of cotton still went on, and with giant strides, too. The planters were more economical at home, raised more corn and bacon, so as to lessen their purchases from the west and from North Carolina; but, as the price of lands and negroes declined, the inducements to raise cotton were nearly as great as before. The average exports for the five years from 1836 to 1840 were five hundred and twenty-four millions; for the next five, the average was six hundred and eighty-eight millions; and for the next five, seven hundred and eleven millions. Here was an average increase much faster than the natural increase of the population, showing that, in spite of the diversion of labor and capital to new pursuits, emigrants were still arriving from North Carolina and Virginia, and transfers were still being made from the tobacco and wheat fields of Virginia to the cotton lands of the south.

After 1850 prices improved, and in the next five years the average exports rose to one billion and twenty-five millions of pounds, making an increase in the average production of nearly fifty per cent. in five years. For the five succeeding years the exports have not been completed at the treasury department, and the number of bales may be taken to measure the increase of production. From 1850 to 1855 the average crop was 2,882,000 bales, and from 1855 to 1860 it was 3,628,000, an increase which is twice as great as the natural increase of the population, indicating the continuance of the transfers of laborers to the cotton plantations.

And never before has the planting been more profitable than in the last few years. The price has not been so high as in 1819, or 1825, or 1836, when the planters were almost bewildered at the rates offered them for their crops; but by improved methods of cultivation, and greater facilities of reaching the market, their real earnings have been greater than ever. Higher prices have been given for land and for negroes than even in 1836. The wages of hired servants have been larger than ever; and the planters have been everywhere rich, prosperous, and happy.

The immigration into the cotton states, and the purchase of negroes from Missouri, Kentucky, and Virginia, are made manifest by the changes of population. The natural increase of the people of the whole country is less than thirty per cent. for ten years, after deducting the emigrants from Europe and the inhabitants of our purchased territories. Before 1820 it exceeded a little this ratio; but from 1830 to 1840 it was less, and from 1840 to 1850 not over twenty-five per cent. Now the population of the eight cotton states, from South Carolina to Texas, increased in the first decade of the present century fifty per cent., in the second decade fifty-five per cent., in the third fifty per cent., in the fourth fifty-one per cent., and in the fifth forty-one per cent. Thus, in all this period of fifty years, the real increase has been nearly double that of the natural; or, more exactly, in every ten years twenty per cent. of the existing population has been added from the more northern states.

CHAPTER III.

MONOPOLY OF THE MARKET—SLAVE LABOR—COTTON EXCHANGED FOR MANUFACTURES.

The history that has now been given of the great increase in the production of cotton; of the entire devotion of the labor of the cotton states to this single culture, even to the neglect in some places of the corn, flour, and meat necessary for the wants of their immediate neighborhood; of the large increase of the population in these states; of the increasing prices of land and negroes; of the investment of nearly the whole of the annual accumulations of the people in enlarging this one production, when others that are really profitable, for which they have advantages in soil, or in climate, or in position, are rejected—is an irresistible accumulation of proof of the second proposition that we proposed to consider; that the American planters are able to produce large amounts of cotton at great profit to themselves; and we will pass now to the third proposition: that we have almost a monopoly of the foreign market, on account of our ability to produce a better and cheaper article than any other country in the world.

We have already adverted to the superiority of our sea island variety. It is the best cotton in the Liverpool market, and commands the highest price. It has not been produced in larger quantities, because the localities where it can be cultivated are few. But for the amount we make there is no competition. The average value of our exports of this kind was $6,000,000 from 1805 to 1815, including the years of the war and the embargo; $10,000,000 in the next ten years; $10,000,000 in the next; $7,000,000 in the next; and $9,000,000 in the last, from 1845 to 1855. For 1859 the amount was 13,713,000 pounds. It is evident from these figures, that the production of sea-island cotton is stationary.

When we began the production of cotton, the supplies of Great Britain were furnished by the Levant and by America. Of the twenty-three millions received in 1787, seven were from the West Indies, six from Turkey, and ten from the Spanish, Dutch, and Portuguese colonies of South America. None was received from the United States or Egypt, which are now the principal sources of supply. The first imports from the East Indies were in 1798, and from Egypt in 1823. When the demand increased, by the application of machinery to the manufacture, we very soon assumed the first rank in the production and supply of cotton. By the year 1800 the receipts from our country equalled those of any other, and in some of the years before the war of 1812 we surpassed all other countries taken together. After the war of 1812 we immediately resumed the chief place as producers for the European market. In the five years from 1816 to 1820 the average weekly consumption in Great Britain of the different kinds of cotton was 3,800 bales of American, 2,200 from Brazil, 1,100 from the East Indies, and 700 from the West Indies; and as our bags were the heaviest, the 3,800 American were more than the 4,000 from other countries. In the next five years Egyptian made its appearance in the market, and the average was 6,400 bales of American, 2,600 from Brazil, 200 from Egypt, 1,000 from India, and 600 from the West Indies. The decline of the West Indies, which was the only cotton similar to ours, had already begun, and from 1826 to 1830 the decline continued. The average consumption of American was 9,200 bales, 2,400 from Brazil, 700 from Egypt, 700 from India, and only 400 from the West Indies, so that ours was more than two-thirds of the whole. In the next five years the American rose to 13,000, the West Indian declined to 200, and the others had but a slight increase; ours being three-fourths of the whole. From this time forward the United States supplied about eighty per cent. of the whole consumption of England, and also of the rest of Europe. In the last year (1859) the number of bales consumed in Great Britain and on the continent was 700,000, of which the American was eighty per cent., the West Indian one, the Brazilian three, the Egyptian four, and the East Indian twelve. And this ratio has been nearly the same for the last twenty years. The ratio of the supply from Egypt has increased a little faster than from America; while that from the West Indies has almost disappeared. Since the rise in the price of coffee, on account of the stoppage of the slave trade in Brazil, her exports have been stationary or declining. The imports from the East Indies have increased, but their comparative gain on American has been very small. In the eight years from 1840 to 1847, the average importation into England of American cotton was 468,000,000 pounds, and of East Indian 75,000,000; while for the next eight years, from 1848 to 1855, the former averaged 644,000,000 and the latter 115,000,000. The first ratio was 16 and the last 18. Since 1855 the ratio has slightly increased. For the last two years it has declined.

The supplies furnished by the several countries are not, however, rivals of each other. Our sea island is the finest and dearest. The Egyptian and Brazilian are next, and are used for the finer fabrics. Ours is suited for all the common yarns, uniting strength of fibre with smoothness and length of staple. The Indian comes last in price, is coarse, short stapled, and badly cleaned. It is mixed with American in the factories, and used for the coarser goods.

Thus there is little or no competition between the different cottons. They are each used for their particular class of manufactures. The Indian would be of little use without ours to mix with it, so that an increase in the supply would require an increase of American to be worked with it. The dearness of the Egyptian and South American, which are about fifty per cent. higher than ours, prevents them from being substituted in its place.

In a paper read before the Society of Arts, J. B. Smith, Esq., member for Stockport, says:—

"It will be seen, therefore, that while we require for the purposes of our manufacture a limited quantity of the sea island and short-staple qualities of raw cotton, we need and can consume an almost unlimited supply of the medium-staple, or United States quality. In this fact lies our real difficulty; for while several quarters of the world supply the first sort, and India could supply enormous quantities of the short-staple sort, the United States of America alone have hitherto produced the second and most necessary kind."

"The finest long cotton in the world is called the 'sea island.' It is grown on the low-lying lands and small islands on the coast of Georgia. The quantity is small, and the price very high. It is used mostly for muslin thread, and the very finest numbers of yarn—say 100's and upward; and price, in fact, is of little moment to the manufacturers who purchase it. It usually sells at about two shillings per pound. A quality much resembling it, and almost, if not quite as good, has been grown, as a sample article, in Australia. But of this denomination of cotton the consumption is very small. Another species—long, strong, fine, and yellowish—is grown in Egypt, and imported in considerable quantities. An inferior quality—coarse, harsh, bright in color, but strong—is imported from Brazil, and a very small quantity from the West Indies. Doubtless, if the price were adequate, and the demand here very great and steady, the supply from many of these quarters might be largely augmented. But it is not of this sort that we need any considerable increase, nor could we afford the price which probably alone would remunerate the grower.

"2. Our great consumption and demand is for the soft, white, silky, moderately long cotton of America—the quality usually called 'uplands,' 'bowed Georgia,' and 'New Orleans.' This used to be sold at prices varying from 3d. to 6d. per pound (it is now from 6d. to 8d.). It can be consumed in any quantity; for it is available not only for weft, but for warp, except for the finer numbers. We need and consume nine bags of this cotton for one bag of all others put together.

"3. It is the insufficient supply, or the higher price of this cotton, that has driven our manufacturers upon the short-stapled native article of India, commonly called Surat. If the price of the two were equal, scarcely a bag of Surat would be employed. When the price of American cotton rises, owing to an inadequate supply, that of East India cotton follows it at a considerable interval—the usual ratio being two to three—and the import of the latter is greatly stimulated. It is always grown in India in large quantities, and, with improved means of communication and more careful preparation, might be supplied in time, in indefinite and probably ample quantities. But it is its quality that is in fault; and, as far as the past is a guide, it would seem incurably in fault. Many attempts to amend the character of this cotton have been made. American planters and American 'saw gins' have been sent over, and American seed has been planted; and the result has been a sensible amelioration in cleanliness and color, and some slight increase in length of fibre, but scarcely any change in specific character. The dry, fuzzy, woolly characteristics remain. Sometimes the first year's samples nearly resemble the American article, but the resemblance never becomes permanent. Hitherto (we believe we are correct in stating), either from the peculiarity of the soil or of the climate, or, as some say, from adulteration by the air-borne pollen of the inferior native plant, the improved and altered character of the cotton has never been kept up."

"The point we have to bear in mind, then, is this: our desideratum is not simply more cotton, but more cotton of the same character and price as that now imported from the States. If India were to send us two millions of bales of Surat cotton per annum, the desideratum would not be supplied, and our perilous problem would still be unsolved. We should be almost as dependent on America as ever."

These observations of a practical manufacturer bring out conclusively this truth, that for the uses to which our cotton is applied we are without competition. The long-stapled is too dear, and the short too coarse, fuzzy, weak, and rough to be substituted for ours.

It thus appears that we have a monopoly

of the European market, because we furnish a cheaper and better article for the same price. And this excellence is due to our soil and climate, and to the cheapness of the labor by which cotton is cultivated.

The soil is everywhere favorable for cotton in our southern states. Where it is rich enough to produce any thing it will produce cotton. The climate is our main peculiarity. Although we are so near the equator that we have six months of the summer, and sometimes more, without a frost that will kill so tender a plant as cotton, we have in all that time a succession of rain, and sunshine, and dews, and clouds, such as belong to temperate latitudes. The weather is hot enough for cotton, and yet rainy and showery, so as to keep the growth of the plant vigorous, and bring to perfection a succession of fruit on the stalks from July to November. The first pickings begin as early as July at some places, everywhere in August, and during the whole of September and October new blossoms are appearing, new bolls forming, and new pods opening their silky product for the hands of the cultivator. Even after the frost has stopped the growth of the plant and stripped it of its leaves, the bolls still open, and the fields are whitened with a succession of fruit, until January arrives and warns the planter to prepare for another crop.

This succession of rain and sunshine does not occur in India, which, after the United States, produces the principal part of the European supplies. And this is the reason that the American variety of the cotton plant will not grow there, or soon degenerates to the coarse, rough, short-stapled article which is native to the country.

Another advantage we have over India is the length and cost of the voyage. It is worth two and a half or three cents a pound to transport cotton from our sea-ports to Liverpool. The distance from India to England being twice as great, and the voyage more than twice as long, freights and other expenses must increase in a like ratio; and as the best qualities of Bombay and Surat are worth, even now, when prices are high in England, only eight or nine cents, it is evident that almost nothing is left for the interior producer, especially for the inferior qualities. We can produce cotton with profit at much lower rates than we now name. A decline to the Indian planter is ruinous, because freights are stationary, and all, or nearly all the proceeds in England will be consumed in the transportation.

Probably, however, the greatest advantage we have over the Indian producers is in the cheapness of our labor. It is true that wages are very low in India, but the labor is also inefficient. We have the cheapest and most efficient labor in the world.

The African slave in the southern states is well fed with good and substantial food, that gives him strength, endurance, and health. He is well clad in winter, and well lodged, to protect him from the inclemencies of the season. He is cheerful, able to work, and he works faithfully. As the whole cost of this labor to the state is made up of the simplest necessaries of life, the support of the young, and the old, and the feeble, it is evident that the south has the cheapest labor that is possible. It was the doctrine of Malthus, that in every country there is a constant tendency to reduce the wages of labor down to the mere support of the laborer. That limit, however approximated to elsewhere, has never been reached but in the south.

The slave is supplied with all he wants of meal, and with as much meat as is needed for his health and strength. This meal is prepared in many ways, and makes a most palatable bread. His master generally feeds on it in preference to flour. He has a garden, where he can raise potatoes, cabbages, collards, greens, turnips, beans, and such other vegetables as the taste and industry of the family may desire. He has clothing—cheap, it is true, but warm and substantial.

There is a separate dwelling for each family, and an unlimited supply of fuel for the winter. The old, who are unable to labor in the field, find some slight work about the house—the men in the garden, the women in the care of young children whose mothers are out on the usual plantation work. The sick are carefully attended to by regular physicians and good nursing.

All this is essential to the health and strength of the laborer, and to his efficiency on the plantation. The humanity and sympathy of the master, who has often been reared by some of his slaves, are sufficient to secure their comfort; but if these should be wanting, there is an inexorable law securing the necessary wants of the servant. With less meat, or with insufficient food, the slave is unfitted for regular work. With less clothing, he is liable to sickness and disease. Without attention and nursing in sickness, his life is endangered, and his services lost to his master. These demands, united with the influences of humanity and sympathy, secure him the necessaries and some of the comforts of life.

Another element of the cheapness of this labor is that nothing is wasted in vicious indulgences. In other countries, a large part of the wages of labor is expended in strong drink; but the most stringent laws are everywhere passed against selling spirits to slaves; the Maine liquor law is enforced with the most severe penalties, and with the utmost certainty of conviction for the guilty.

Much time is lost in free countries in holidays and shows; in idleness and neglect of work; in seeking employment; in change from one place to another; but all this is saved in the south, for there are no idle hands about the plantation, and, excepting the week between Christmas and New Year's day, when there is a general holiday, there is no lost time, except from sickness, in any part of the year.

The children are all put at work at eleven or twelve years of age, as soon as they are able to guide a plough or pick cotton in the fields. The women and men are both efficient workers, and the division of labor is so complete that the children of many mothers are watched over and cared for by one, and the cooking for many families attended to by a single cook.

This system of labor is thus the cheapest possible. The corn and the meat being, in most cases, raised on the plantation, and not burdened with the cost of transportation, are supplied at the cheapest prices; the work is all light and easy, so that women and boys, as well as men, can engage in it efficiently. Every thing is arranged so that labor is secured at the lowest possible rate.

Some philanthropists, indeed, object to the system on this account: that the slave obtains no wages. But he has food and clothing, a house and fire, proper attention when sick, and support in old age. His children are taken care of, and every necessary want supplied. For an idle and improvident race like the negro, these are more than wages. They are more than his industry would secure. He would not earn as much for himself were he free, as he now receives from his master; and these earnings would be wasted in drink, or in excessive indulgences, or in dress, or in luxuries, leaving for himself and his family times of want and suffering, with nothing laid up for sickness and old age. Now he is industrious and temperate, and receives the necessaries of life in return; then he would be lazy, and wasteful, and destitute. As industry and temperance are great virtues, and the necessaries of life at all seasons and times, in sickness and health, in youth and old age are a great boon to the laboring poor; and as want, and suffering, and neglect when sick or aged are great and real evils, philanthropy surely wastes its sympathy on the slave when it complains that he is denied his wages.

The culture of cotton is specially suited for slave labor, because of its giving full employment for the whole year. January is devoted to fitting up the fences, clearing off the decayed trees that have fallen in the fields, and putting in order the cultivators and all the implements of the farm. The ploughs are also started, and some of the ground broken up for spring planting. February is the main time for ploughing, and in the more southern part of the cotton country, corn is planted in this month. In latitude 31° the time for corn is the 20th of February; above this line it gradually becomes later. About a month after the corn, cotton is planted. In every locality it is desired to have the cotton up as soon as the fear of frost is gone. The season for planting begins as early as the 15th of March in the most southern latitudes, is delayed to the 1st of April at the parallel of 32°, to the 15th in latitude 34°, and later still above this line. As the seed are planted close together in drills, the hands pass along the rows and chop down the weakest and smallest plants, leaving them in bunches, fifteen to twenty inches apart. The ploughs follow or precede the hoes, both being necessary to kill the grass and soften the ground about the plants. The hoes follow again, and thin out the bunches to one or two stalks, and finally they are reduced to one, the rest having perished from the cut-worm or insects, or the blows of the plough and the hoe. For two or three months this hoeing and ploughing, to soften the ground and destroy the grass, gives full employment to the hands. The corn has also to be treated in the same way, and the work is continued on both until the summer has come and the fruit begins to appear on the cotton. There is a little leisure now to the hands before the picking is begun, and this gives time to harvest the wheat that has been sown; to cut the oats, and gather the fodder from the corn. This work fills up the time until the picking begins. At first, but few of the pods are open. The hands pass between the rows —which are from three to four feet wide on the poor lands, and from six to seven on the richest—and as the branches stretch out so as to reach each other, they each gather from two rows as they pass through the field. By September the fields are white with the opening cotton, and every hand, young and old, male and female, that can be of any service, is busied in gathering the cotton, lest the rain should come and beat it out, and scatter it on the ground. In October this picking continues undiminished. At the close of this month, frost usually appears, and stops the growth of the plant and kills the leaves, but the pods keep opening, and new cotton offering itself to the hands until December. The fields are picked over twice or three times if the season is favorable and the crop large, and five or six times if the opening cotton does not hurry the planter. The gathered cotton has now to be sunned, and dried, and ginned, and packed, and delivered at the nearest railway station or river landing, or sold in the neighboring town. Thus is the year completed with unremitting toil, from Christmas to Christmas.

The distribution of labor between the white and black races, so that the former shall have the selection of the products and of the place of labor, of the seeds and the mode of cultivation, and of all the plans and management of the plantation, is another great aid to the cheapness and the efficiency of the labor.

Some political economists have supposed that free is cheaper than slave labor; but though there are pursuits where the watchfulness, foresight, intelligence, and energy of a free man will make his labor so much more productive than that of a slave as to pay the superior cost of his support, it is certain that the want of these qualities in the slave is but a slight drawback to the value of his labor in the production of cotton. The work is so regular, and simple, and easy, that the free man performs it no better than the slave, and as the direction, and management, and skill are in the master, the work is well directed, and wisely managed. The slave works enough, though he does not work as hard as some free men. In fact, it is very doubtful if a free white man, impelled by necessity or the desire of accumulation, would be more efficient in the cotton field than the slave. Certain it is that in the south, where the hot sun breeds disease, and the malarious air brings fevers, the white freeman could not produce as much as the slave, much less could he labor as cheaply. His expenditures being more, his wife and children not working at all, or but little, his waste of time and money in vicious practices and holidays, would require larger wages, and for these he has nothing more to give than the slave.

The slaves marry and are given in marriage as regularly and religiously as the white peasants of any country; and though the marriage has not a legal sanction, it has the religious and moral. They are kept together with their families far more than the white people. On many plantations there are one or two hundred negroes, all descended from three or four families; while the children of the first master have been scattered from Maine to Texas. They have regularly improved since first introduced from Africa, and are now improving, from year to year, in intelligence, in moral culture, in intellectual development, in appearance, in habits, in comfort; and they are as cheerful and faithful, as devoted to the interests of their master, as attached to him and his family, as if they were free hired servants, receiving regular wages. There is no mendicity, no need for poor-houses, asylums, hospitals; for the master's house is the asylum of the slaves; his wife and his daughters their nurses, and his own doctor their physician. Such a set of laborers, able and willing to work, contented and happy, with every want supplied, and yet costing the master the least possible sum needed for their health and their strength, furnish the cheapest and most efficient labor possible.

As the south sends nothing to the north that can be produced there, there is no conflict between the labor of the north and the south. There is no competition, no tendency to equalization in wages, no interference the one with the other. They are, in fact, mutual helps to each other, as town and country, as man and wife, as the limbs, and the head, and the heart of the human body. The high wages at the north cannot be reduced by the labor of the slave. Instead of reduction, it causes an increase. His cheap toil is for their advantage. His labors, under the hot tropical sun, are for the benefit of every mechanic, and artisan, and workman, that now fears the competition of the northern free black. As a slave he benefits them, as a free man he would be in their way.

We have one more point to mention to complete the explanation we suggest of our high prices, and this is the operation of the tariff. By a tax at the sea-ports on any article imported, its price is so raised that the American producer of the same kind of goods is enabled to raise his price. This advance enables him to pay higher rates to his workmen, and to the capitalist, and to all concerned in the manufacture. But it prevents, also, the exportation of his goods, because they are too high for the foreign market. Being thus unable to pay for the supplies he must have from abroad, the cotton planter comes to his aid with a product much wanted abroad, and raised here under favorable circumstances of soil and climate, and with a cheap kind of labor that does not compete with the labor of the manufacturer. This will pay for the foreign supplies of both, and the planter buys them, and takes in return the high-priced manufactures. Thus high prices are sustained, at the expense, indeed, of the planter, but to the great advantage and prosperity of the north and the west.

We have now considered the several points of the explanation we proposed for our high prices, that in cotton we have an article of great profit to the planters, produced by cheap labor, although the other labor of the country is dear; in large and intense demand in Europe and all parts of the world, because it furnishes the cheapest material for clothing, for the production of which there is no competitor with us, as we have almost a monopoly of the market; and that by means of this export we pay for our foreign supplies, and by our tariff raise the price of the imports to our own high limit, and thus sustain the rates of labor and capital, and secure the prosperity of our country.

High prices for labor on iron, on cotton and woollen manufactures, and on all the articles we import from abroad, we could not have without a tariff; this tariff could not be maintained without an export of some product, furnished by nature or made with cheap labor, in intense demand abroad; for otherwise it would be impossible to pay for our imports. Cotton furnishes the desired article, and thus makes prices high both for labor and money, since the rates for the one and the other closely correspond at all times and in all countries.

Precisely the same set of operations has been going on in California for the past ten years. Nature there, as here, furnishes a product which pays well to those who obtain it; the gift of nature there being in the mines, and here in the soil and climate. The miner there and the cultivator here are well paid for their labor. Both productions are in intense demand abroad; and both unite in enabling us to pay for our foreign importations, without reducing to the foreign limit the wages of labor and the interest of capital that supply these products.

It may, perhaps, be proper to confirm the propositions we have been considering by inquiring into the course of our domestic trade. If the true explanation has been given of the anomaly of high prices prevailing in a country engaged in a large commerce with the rest of the world, we will find large transfers to the south of manufactures from the north, and of agricultural products from the west; because cotton being very profitable to the planter, and nearly all the labor of the south being appropriated to this culture, the northern manufacturer will supply all his wants of every kind in which labor is the chief element, and the western farmer will supply him with all those articles of food that are of easy transportation. In fact, we find in the south that any article of necessity, comfort, or luxury comes from the north. If we enter the dwellings, or the shops, or the stores of the cotton states, they tell all the same story—every thing comes from the north.

As I rose from my bed this morning and surveyed the furniture of my chamber, I found nothing made at home. The bedstead, netting, and canopy; the coverlet, sheets, and ticking; the bureau, wardrobe, washstand, and crib; the tables, chairs, mirrors, curtains, carpet, bell-wire, and tassel; the medicine chest, and all its bottles, and mixtures, and quack preparations; all the perfumery, and cosmetics, and jewelry, and brushes, and powders; every article of dress, or clothing, or ornament; even the whitewash on the walls, and the paint on the wood-work, and the glass in the windows were from the north. As I came from the chamber to the library, I found no change. The book-case, curtains, carpet, pictures, tables, sofas, paper, ink-stand, pen, and ink were from the north. There was a northern grate for northern coal; a marble mantel from the north, with vases and photographs; globe and statuary from the same source. I opened the book-cases, and run my eye over the shelves, to see if any could be found with a southern imprimatur; but though some had on them the names of southern authors, it was a long while before I found a southern publishing house. There was "Beulah," but it had not Mobile on its title-page; Dr. Thornwell's "Truth," but it was not published in Columbia; the "Laws of Georgia," but they were printed in New York; "Cobb on Slavery," but it claimed to be from Philadelphia; Stevens' "History of Georgia," but it came from Appleton's, on Broadway; "White's Statistics" had Savannah on its title-page, but I suspected this was a counterfeit stamp, and that it had not been printed in the south; Judge O'Neall's "Historical Sketches of Carolina" claimed to be from Charleston, and this was the first genuine southern print I found in my library. A more diligent search discovered others, but they were few and far between. As I went to the breakfast-room, the exclusion of the south was not so complete. The sideboard, and its glass and silver were from the north, but it had on it a handsome pitcher from our own kaolin; the window-shades, clock, tables, chairs, and crumb-cloth were from the same source; but there was a lounge manufactured here. Albert gave me my coffee in a northern cup, on a northern waiter, sweetened with Stuart's sugar, but the cream was from home; Ziney brought in hot waffles on a northern plate, but the corn, and flour, and eggs of which they were made were produced here; the water was handed in a northern tumbler, and cooled with Boston ice, but the water-cooler had on it a domestic stamp; the butter was southern, though hardened in a New England refrigerator; the cantelopes were raised here, though the salt and pepper which seasoned them were not; the hot biscuits were from southern flour, but the yeast-powders with which they were raised were from New York; the beef-steak was from our own market, but the tongue had been brought a thousand miles from home; the clabber was fresh from our own dairy, but the cheese was from New Jersey; the white, hot, smoking hominy was a domestic product, but the dish in which it was served was not; the bread was from our town bakery, but the ham was from Cincinnati; the knives, and forks, and spoons, and caster, and vinegar, and oil, and mustard were from the north, but the catsup was made here; the fish were from Savannah, but they had been brought up by a northern locomotive, running on English rails; the walls and doors were covered with paint manufactured at the north, but the floor was of Georgia pine; the locks, and keys, and andirons, and shovel, and tongs, and hearth-broom, and rug, and oil-cloth, and table-linen, and napkins were not made here, but the morning newspaper was printed on paper made at home, out of southern rags, and by southern labor.

After breakfast Albert drove me down town in a northern buggy, behind a northern horse, with northern harness, and reins, and whip. I stopped at a furniture shop, and asked how much of their stock was made here; and they said about fifty dollars in a thousand, the southern work being principally of pine; I asked at a book store the same question, and they told me, including law books and the reports of our supreme court, perhaps one dollar in a hundred; I asked at a tin shop, and they said their stoves, and gas fixtures, and lamps, and japanned work, and block tin were from the north, but that their tin ware was made in their own shop, though out of English plate and with northern solder; I enquired at a shoe shop, and they told me they had several hands employed on customers' work, but the great proportion of their sales were from Boston; I stopped at the paper warehouse, and was sure now that I had found a shop with home-made products, but they told me they only manufactured wrapping paper, and supplied the newspaper offices, but their card, and post, and letter paper was from the north; I drove to the cotton mills, and here found a genuine home manufacture, but their machinery, and looms, and spools, and oil were from the same northern hive, whose products swarm over every part of our country.

The south are an agricultural people, devoted to the production of cotton, because it is more profitable than any other employment, and they are able and willing to buy their supplies from the north, because it is their interest to do so. Their labor is employed according to the irresistible laws of trade in the most remunerating pursuit, and they can afford to buy the manufactures they want, because they can be furnished cheaper than they can make them. They might tan their own leather, make their own shoes, weave their own cottons and woollens, put together their own clothing, brew their own ale, distil their own grain, press their own wine, reduce, cast, and refine their iron, mine their coal, build their carriages, print their books, polish their marble, and manufacture their own furniture, and china, and hardware, and carpets, and clothing; but they find it their interest to buy them, and appropriate their labor to the growing of cotton, and the raising of those heavy agricultural products that cannot be brought here cheaply, and the manufacture of the coarser and cheaper goods on which the cost of transportation is large.

The war, of course, made a great change in the production and marketing of cotton, and the expectation that England and France, the great foreign customers for the staple, would interfere, or form an alliance with the states in insurrection, in order to secure their supply, proved futile. The greater part of the crop of 1860 was brought into market; but of that of 1861, which was nearly as large, was withheld, in consequence of the blockade of the ports, to such an extent that only 120,752 cwt., or about 30,000 bales, hardly more than one-sixtieth of the quantity sent the preceding year, was sent to Great Britain, and the entire export to Europe did not reach 50,000 bales, notwithstanding the imperfection of the blockade. Of this quantity about 12,000 bales were shipped from New York. The crop of 1862 was small, orders having been given to plant corn instead of cotton to a large extent; and so stringent was the blockade that Great Britain received but about 11,500 bales of American cotton from blockade runners and all other sources, and the entire export from opened ports, including some re-exportation, was but 28,000 bales. Large quantities of cotton were burned during this and the succeeding year, part of it by the insurgents, to keep it from falling into the hands of the Union army, and part by the Union soldiers, because it was the property of the so-called Confederate government. In 1864 only 27,000 bales, mostly of the crop of 1863, were exported, and the work of destruction went on. The crop of 1863 and that of 1864 must have been very small, and the export of 1864 was only 16,500 bales. At the close of the war there was a very considerable amount, perhaps not less than 1,200,000 bales, on hand of the crops since 1861, which had been stored in out-of-the-way places, much of it awaiting a safe opportunity to ship. Much of this came into market, and was mostly consumed by the American manufactories, which had been short of material for nearly three years. The crop of 1865 was larger than those of the preceding years; but was not all of it gathered in good condition. The export of cotton to Great Britain, in the first seven months of 1866, amounted to 1,017,856 bales, being nearly one-half of all received in that country from all sources. The crop for 1866 will probably not fall short of two millions of bales, southern Illinois, Kentucky, Missouri, and southern Virginia raising considerable amounts each year since 1862. It is obvious, however, that cotton can never attain again the supremacy as a crop for export which it held before the war. In favorable years, as much, and perhaps more, may be raised than ever before; for the better culture and more frugal habits of free labor will give a better yield to the acre than the slovenly and wasteful culture by slave labor; but when the crop shall have attained to or surpassed its old amounts, a much larger portion of it will be consumed in our own country, and very considerable quantities in the region where it is grown, in the manufacture of goods for home consumption. Other crops and products have also, during the war, found a market abroad which they will not readily relinquish; and the export of cereals, and of beef, pork, butter, cheese, tobacco, and hops, will henceforth in the aggregate largely exceed the export of cotton.

PICKING COTTON.

The season of cotton picking commences in the latter part of July, and continues without intermission to the Christmas holidays. The work is not heavy, but becomes tedious from its sameness. The field hands are each supplied with a basket and bag. The basket is left at the head of the "cotton-rows;" the bag is suspended from the "picker's" neck by a strap, and is used to hold the cotton as it is taken from the boll. When the bag is filled it is emptied into the basket, and this routine is continued through the day. Each hand picks from two hundred and fifty to three hundred pounds of "seed cotton" each day, though some negroes of extraordinary ability go beyond this amount.

If the weather be very fine, the cotton is carried from the field direct to the packing-house; but generally it is first spread out on scaffolds, where it is left to dry, and picked clean of any "trash" that may be perceived mixed up with the cotton. Among the most characteristic scenes of plantation life is the returning of the hands at nightfall from the field, with their well-filled baskets of cotton upon their heads. Falling unconsciously "into line," the stoutest leading the way, they move along in the dim twilight of a winter day, with the quietness of spirits rather than human beings.—*Harper's Magazine.*

GATHERING THE CANE.

And now may be seen the field-hands, armed with huge knives, entering the harvest field. The cane is in the perfection of its beauty, and snaps and rattles its wiry-textured leaves as if they were ribbons, and towers over the head of the overseer as he rides between the rows on his good-sized horse. Suddenly, you perceive an unusual motion among the foliage—a crackling noise, a blow—and the long rows of growing vegetation are broken, and every moment it disappears under the operation of the knife. The cane is stripped by the negroes of its leaves, decapitated of its unripe joints, and cut off from the root with a rapidity of execution that is almost marvellous. The stalks lie scattered along on the ground, soon to be gathered up and placed in the cane-wagons, which with their four gigantic mule-teams have just come rattling on to the scene of action with a noise and manner that would do honor to a park of flying artillery.

We have already alluded to the fact that the sugar crop has to be gathered in Louisiana within ninety days, or else it will be destroyed by the cold; as a consequence, from the moment the first blow is struck, every thing is inspired with energy. The teams, the negroes, the vegetation, the very air, in fact, that has been for months dragging out a quiescent existence, as if the only object of life was to consume time, now start as if touched by fire. The negro becomes supple, the mules throw up their heads and paw the earth with impatience, the sluggish air frolics in swift currents and threatening storms, while the once silent sugar house is open, windows and doors. The carrier shed is full of children and women, the tall chimneys are belching out smoke, and the huge engine, as if waking from a benumbing nap, has stretched out its long arms, given one long-drawn respiration, and is alive.—*Harper's Magazine.*

SUGAR—CULTIVATION AND CONSUMPTION.

THE cultivation of cane sugar in the United States has become of considerable importance only in the last ten years. While it has in that time occupied an increasing proportion of the attention of the planters of Texas and Louisiana, it has rather declined in other portions of the Southern states. The cane itself is more nearly associated with Indian corn in the general character of its climatic requirements than any other staple. It differs from corn in this respect only in degree, each condition, or the principal condition of temperature, at least, being required in similar, but greater tropical excess for the period of its growth. In the southern parts of the United States the great heat of summer gives this plant a range it attains in no other country of the same mean annual temperature; and it is restrained only by the limit of its safe endurance of the winter. The cane may be cultivated east of the high plains and deserts of Texas, and south of 34° north latitude. The area now occupied by the cane is quite limited, a part of Texas, the lower parishes of Louisiana, a portion of Florida, in the latitude of Tallahassee to Cedar Keys, and the Atlantic coast of Georgia, comprising its extent. The considerable capital required to conduct the culture makes it a larger interest than might be inferred from this limited extent of area.

The cane was first introduced into Louisiana in 1751, and the first plantation was established by Mr. Dubreul in 1758, a little more than a century since. The progress was not rapid, however, until 1794, when the revolution of St. Domingo drove some few Frenchmen to fly for refuge from their burning houses and their frantic pursuers on board American vessels, with such of their faithful slaves as would follow them. When there, they naturally turned their hopes to Louisiana, where they might find a home for themselves and their servants among kindred French. To these unhappy men Louisiana owes the introduction of the Creole cane, a small yellow kind, which only was then grown in the French islands. About the same period the cane culture was introduced into Georgia. There had been there growing and flourishing from the time of the first settlement of the country by General Oglethorpe, luxurious orange trees. As similar trees in Louisiana had been destroyed by the frost, while those in Georgia flourished uninjured, the idea was suggested to an enterprising planter that if under such circumstances cane would grow in Louisiana it would also grow in Georgia. In 1805 he procured 100 plants of the Otaheite cane that had been sent by Lieutenant Bligh from Otaheite. These 100 canes multiplied to 2000, and from these most of the plantations in Georgia and Florida were propagated. The question of labor in the English West Indies was then sufficiently discussed to induce many planters to leave Jamaica for new settlements, and many were attracted to Georgia by the luxuriant growth of the cane. The price of sugar was then, under the embargo, about ten cents per pound, and many plantations were established. The canes spread up the Altamaha, the Oconee, and the Oemulgee, and luxuriated in the fine lands of Florida and Georgia to a distance of 150 miles from sea. Nevertheless, the manufacture was not many years after mostly abandoned in that region on a large scale or for export, but it is still conducted to a considerable extent for plantation and home use. It did not there pay so well as rice or cotton, since the product per acre was less than half what it had risen to be in Louisiana. In the rich lands of that state and Texas the product per acre is 2400 pounds against 1000 pounds even in the richest river lands of Georgia.

There are five kinds of cane in use by the planters of Louisiana, viz., the *Bourbon*, which has large eyes, a dark purple color, and is very hardy; the *green ribbon* is of a bright yellow color, with delicate green stripes; the eye is small, elongated, and delicate in its structure; the *red ribbon* has purple stripes of an inch or less in width, and can resist light frost; the *Otaheite* has large joints, does not grow high, and has a comparatively thin skin, and is easily affected by the frost, yet its juice is rich and abundant; the *Creole cane* yields a superior kind of sugar, but it has been less used than the Bourbon on account of its less hardy nature. It is now getting more into favor again. These are the varieties mostly used in Louisiana. The mode of culture is simple and allied to that of Indian corn. The canes are propagated by cuttings, and these are planted in the fall, seldom as early as October, since the planters have no time until the grinding season is over. The riper portion of the stalk is generally used for cane seed; others cut the cane in the middle and use the green tops for planting. The land is well ploughed, harrowed, and marked off in rows three to five and even eight feet apart. As the cane must reach its full growth in nine months, a good distance apart is thought necessary to promote access of the sun and the circulation of air. A double-mould-board plough follows the marker, opening a clear furrow for planting. In the furrow the canes are laid straight in such a manner that the eyes may freely throw out their shoots. They are covered from four to six inches. The young plants are cultivated much as Indian corn, in rows. The planting is done in some parts of Louisiana once in three years. The first year it is called "plant cane," and the subsequent growths are called rattoons. But sometimes, as on the prairies of Attakapas and Opelousas and the higher northern range of its cultivation, it requires to be replanted every year. Within the tropics, as in the West Indies and elsewhere, the rattoons frequently continue to yield abundantly for twelve, fifteen, and even twenty-four years from the same roots. In Louisiana in the fourth year the land is put in corn and peas. After the corn is gathered the stalks and peas are ploughed in, and the land is ready for cane again.

In Louisiana the cane never ripens, and therefore is allowed to grow as long as it can be done with safety from frost. In the latter part of October, they commence by saving their seed, that is, by cutting the cane they need for planting, and securing it by placing it in mats, so called, on the ground, say twenty feet by forty, resting it on an embankment, with the buts on the ground at an angle of about twenty degrees, and leaving a mass of tops on the surface, a foot deep and forming a perfect protection from frost.

Next they commence taking off the crops. Every negro has at all times in his possession a cane knife, like a butcher's cleaver, and kept very sharp. With the back of the knife he knocks off the dry leaves, and cuts off the stalk as of no value where the leaves are green. Should a frost come whilst they are making sugar, the work is stopped, and all hands are employed winnowing the cane in the fields, as a fermentation commences immediately, if it is allowed to stand.

The cane is as certain as any large crop we have. When the cane is gathered it is prepared for the mill. These are some twelve feet from the ground, in order that the juice may flow from the rollers into the juice boxes, and from them into the kettles. The mills are composed of three iron rollers from twenty-five to twenty-eight inches in diameter, and from four to five and a half feet long. There are a great number of inventions that have been patented within a few years. The cane carrier is an endless belt, fifty to ninety feet long, formed of chains, with slats inserted and placed at an angle of thirty to thirty-five degrees to the ground. The lower end is about two feet from the ground. On this the canes are spread evenly, and by its revolution they are carried up to the rollers which express their juice as they pass through. The juice thus obtained is collected in large reservoirs, to go through a process of boiling which has been greatly varied by improvements upon the old Creole plan. The juice, by boiling and evaporation, is reduced to the state of muscovado, which is placed in hogsheads with holes bored in the bottom, to permit the molasses to pass off. In the course of the boiling, lime is added in prepared portions to "defecate" the sugar, and the juice is bleached by passing through a filter of bone-black. Very many inventions have been patented for kettles, vacuum pans, etc., to facilitate the boiling process, and others to promote the discharge of the molasses. One of these is by centrifugal force. The sugar is placed in a cylinder of iron net-work, which, revolving with great rapidity, imparts to the molasses a centrifugal motion that drains it from the sugar through the net, when it is collected in proper vessels.

The introduction of bisulphate of lime of late years has added greatly to the quantity of sugar that may be obtained from a given quantity of cane, and also to its quality.

The quantity of sugar produced on an acre varies from 500 lbs. to 3000 lbs.; the average may be 1000 lbs. A well-cultivated plantation in Louisiana produces 2400 lbs. sugar and 2000 lbs. or 160 gallons molasses per acre. Some mills will turn out 1000 gallons juice per hour, twenty hours in a day, giving ten hogsheads of sugar, or 12,000 lbs. and 20 bbls. molasses, or 800 gallons, 12 lbs. to the gallon. The expenses and products of a plantation in Louisiana have been given as follows in official documents:—

Household expenses		$1000
Overseer's salary		400
Food and clothing—15 working hands at $30		450
" " 15 old hands and children, $15		225
Repairs, 1½ per cent. on capital ($40,000)		600
		$2675
50 hhds. sugar at 4 cents per lb.	$2500	
25 " " " 3 " "	862	
25 " " " 2 " "	575	
4000 galls. molasses, 10 cents	400	— 4137
Balance		$1462

There are many other products raised by the hands besides sugar. Thus there are in Louisiana 200,000 hands, and these produced in 1859, 362,296 hhds. of sugar, worth with the molasses $31,399,241; and in addition they raised 6,327,882 bushels of corn, or 31 bushels per head; and 4,911,680 lbs. of rice, or 24½ lbs. per head. There are in Louisiana 1298 sugar houses, 987 worked by steam and 311 by horse power. The hogshead of sugar is a very variable measure, but the average weight, by the best authorities, is 1150 lbs.

With the progress of the country, a great dependence has been had upon Louisiana for a supply of sugar. In 1815, the banks of the Mississippi gave 10,000,000 lbs., and in 1818, 25,000,000 lbs. In 1858, it had risen to 414,796,000 lbs. The census of 1850 gave the quantity of cane sugar raised in the United States as follows:—

	Lbs.
South Carolina	671,000
Georgia	1,642,000
Florida	2,750,000
Alabama	8,242,000
Mississippi	388,000
Kentucky	284,000
Tennessee	248,000
Texas	7,351,000
Louisiana	226,201,000
Total	247,577,000

These figures show that already in 1850 the manufacture of cane sugar had concentrated in Louisiana, but had become important in Texas. The production of sugar varies greatly from year to year as affected by the season. In 1853, the product in Louisiana rose to 495,156,000 lbs., in 1856 it fell to 81,373,000 lbs., and in 1858 it had recovered to 414,796,000 lbs. This fluctuation has an important influence upon the exchanges of the country, since when the Louisiana crop fails, the price of sugar rises very high and the importation from abroad becomes excessive. The following table will show the quantity of sugar consumed in the United States, and whence it is derived:—

CONSUMPTION OF SUGAR IN THE UNITED STATES.

Year.	Imported.	Louisiana.	Total in tons.	Lbs. per head.	Cts. per lb.
1801,	21,376	..	..	..	..
1811,	24,791	4,000	28,791	..	..
1821,	26,672	14,000	40,672	6	..
1831,	44,178	35,000	79,178	13⅓	..
1841,	65,601	38,000	103,601	13¼	4½
1842,	69,474	39,200	108,674	13½	3½
1843,	28,854	64,360	93,214	12⅛	3⅝
1844,	83,801	44,400	128,201	15	3¾
1845,	88,336	45,000	133,336	15⅛	4½
1846,	44,974	83,028	128,002	14⅛	4⅛
1847,	98,410	71,040	169,450	18⅓	4⅛
1848,	104,214	107,000	211,214	22⅛	3⅝
1849,	103,121	99,180	202,301	20½	3⅛
1850,	160,210	144,600	304,810	29½	3⅜
1851,	201,493	120,331	321,824	30	3½
1852,	196,558	118,659	315,217	29	3¼
1853,	200,610	172,379	372,989	30¼	3¼
1854,	150,854	234,444	385,298	34	3
1855,	192,607	185,145	377,752	31½	3¼
1856,	255,292	123,468	378,760	33¾	4⅛
1857,	241,765	39,000	280,765	23⅓	5½
1858,	244,758	143,734	388,492	31	6½
1859,	239,034	192,150	431,184	29½	6¾
1860,	296,950	118,331	415,281	30	7¼

The small crop of Louisiana in 1856, induced a rise in prices that brought a large quantity of foreign into the country. The consumption per head seems to have been sustained at the higher prices. The consumption per head is larger than in other countries. The ratio for the same year has been as follows:—France, 9 lbs. per head; Great Britain, 28½ lbs. per head; and in the United States, 31 lbs. per head. This French consumption includes cane and beet-root sugar. The United States figures embrace only the cane. The maple sugar made would, with molasses, swell the total figures for 1860 to 464,673 tons; as thus—cane sugar, 415,281 tons; molasses refined, 60,000 hhds., giving 13,392 tons sugar; of maple sugar 28,000 tons. California consumption, 8000 tons.

The weight of the Louisiana sugar hhds. is taken at 1,150 lbs. for the crop of 1860, and the total crop for that year, or that which commenced in 1860, was 302,205 hhds., weighing 347,535,750 lbs. The number of sugar houses worked by steam is 1,090, and by horse power 283. The product of molasses was 25,516,699 gallons.

MAPLE SUGAR.

It is but a few years since the highest reach of art in this manufacture produced only a fine muscovado-like sugar; but now, by improved processes, specimens are annually exhibited at the fairs, vieing with the most beautiful loaf sugar. By the improved mode the sap is boiled in a potash or cauldron kettle to a thick syrup, which is strained when warm. It is then allowed to stand twenty-four hours, and is then poured off. To clarify a quantity of 50 lbs., a mixture of one quart of milk, one ounce of saleratus, and two whites of eggs well mixed, is boiled into the sugar until it has become thick. For draining, a tube is employed fifteen inches square at the top, and coming to a point at the bottom. The sugar is put in cold and the bottom tapped, while the top is covered with a wet flannel cloth of two or three thicknesses.

The quantity of maple sugar made per annum cannot be ascertained with as much accuracy as that of the cane, and the estimates of the dealers are founded upon the returns of the census of 1860, which were as follows:—

UNITED STATES MAPLE SUGAR PRODUCTIONS.

	Lbs.
Maine	306,742
New Hampshire	2,255,012
Vermont	9,819,939
Massachusetts	1,006,078
Rhode Island	....
Connecticut	44,259
New York	10,816,458
New Jersey	3,455
Pennsylvania	2,768,965
Maryland	63,281
District of Columbia	....
Virginia	937,643
North Carolina	30,845
South Carolina	205
Georgia	991
Alabama	543
Texas	69
Arkansas	3,097
Tennessee	117,359
Kentucky	380,941
Missouri	142,430
Illinois	131,751
Indiana	1,515,594
Ohio	3,323,942
Michigan	2,988,018
Wisconsin	1,584,406
Iowa	248,951
Minnesota	370,947
Kansas and Nebraska	1,864
Total	38,863,884

Besides this amount of sugar, 1,944,594 gallons of maple molasses were reported in the census of 1860. In 1863, 1864, and 1865, the great advance in the price of cane sugar led to a very considerable increase in the production of maple sugar and syrup. Probably not less than 30,000 tons were manufactured in 1864.

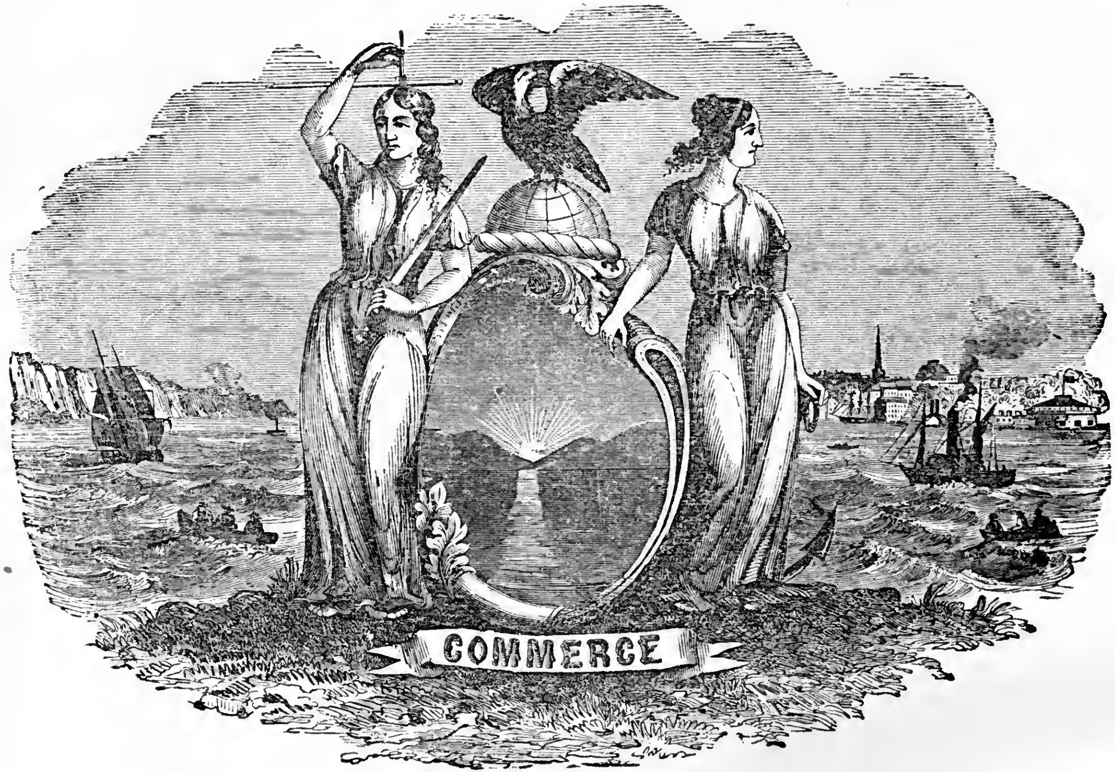
A great deal is made, as of cane sugar in Georgia, for home use; it does not come upon the market, but prevents, to a certain extent, a demand that would exist without it.

SORGHUM SYRUP AND SUGAR.

The production of a syrup from the juice of the stalks of the sorgho and imphee, two plants of the maize family, as a substitute for molasses, was first attempted to any considerable extent during the decade, 1850–1860. Efforts were also made to produce a sugar from this syrup; but with only moderate success, as it did not crystallize readily, being more analogous to grape sugar, or glucose, than to cane sugar in its character. In 1860, the production reported was 7,235,025 gallons, and this was doubtless much below the actual production, as many farmers made from fifty to a hundred gallons, which they did not report. During the war, the high price of sugar and molasses greatly stimulated the production of this syrup, both at the north and at the south. The annual yield in 1863, 1864, and 1865, could hardly have been less than fifty or sixty millions of gallons.

SUGAR FROM OTHER SOURCES.

Experiments on a large scale, and resulting in a good degree of success, have been made for producing sugar from the white sugar beet of France, in Illinois. The amount thus produced in the past two years, 1865 and 1866, cannot be definitely stated, but must amount to several hundred tons, and it is likely to increase. Sugar and molasses are also produced at Buffalo and some other points from corn, by a chemical process. This is probably *glucose*, or grape sugar.


COMMERCE

COMMERCE OF THE UNITED STATES.

CHAPTER I.

COLONIAL TRADE — IMPERIAL RESTRICTIONS—EMANCIPATION OF INHABITANTS.

THE history of the commerce and trade of a people is a record of their industry and productive powers, since all trade is but an interchange of the products of labor, and wealth but an accumulation of those products beyond the necessary annual consumption, and wear and tear from use. In the United States, since the date of their settlement, the development of trade and the accumulation of property have been more rapid than in any other country. This has been the case, chiefly, for five leading reasons: 1. The ample supply of fertile land free to the cultivator. 2. The persevering and intelligent industry of the people, combined with an inventive genius that has constantly smoothed the way of labor by devising the means of producing greater results with the same manual force. 3. The rapid increase of the numbers of the people, not only by reason of the healthiness of the climate and the general morality of their habits, but also in consequence of the great immigration from abroad, induced by the desire of the most enterprising Europeans to avail themselves of the benefits of our institutions. The stream of natural births in excess of deaths has mingled with the broad current of immigration to swell the numbers in a surprising ratio. 4. The accumulation of capital applicable to reproductive industries, as well through the frugal habits of the people, who have consumed far less than they have produced, as by the influx of capital from abroad, not only in the hands of immigrants, but for investments, that will yield larger revenue to European holders than they can there obtain. And, fifth, and perhaps more important than all, the control that the people have kept of their own funds. They have had no absolute rulers or dynasties to involve them in devastating wars, destroying wantonly what was not exhausted in military expenses, and leaving the people deprived of their all. On this continent comparatively nothing has been wasted in strife, while countless sums have been swallowed by Europe in offerings to the god of war. Thus, industrious and frugal habits, abundance of fertile land, morality of character, and freedom of institutions, have combined, with fertility of invention in machinery, and means of communication, to build up a nation that attracts the cream of the European people and their capital—these elements, in fifty years of undisturbed peace, produce an example of the highest national happiness. It is true that some other nations have more aggregate wealth, but that in the United States is more equally divided among the people. These causes have operated to a greater or less extent since the settlement of the country, but with increasing force as the present century has advanced. We may illustrate by a few figures, showing the general state of affairs at three periods, viz.: in 1700, eighty years after the time of first settlement; secondly, the time of separation from the mother country; and thirdly, the date of the census of 1850:—

	Population.	Annual agricultural products.	Manufactures.	Assessed wealth.
1700,	262,000			
1790,	3,929,872	$150,000,000		479,293,263
1850,	23,191,876	1,070,000,000	$1,019,000,000	2,275,730,124
1860,	31,429,891			$9,318,292,265

In nearly two hundred years up to 1790, the population had increased to less than 4,000,000, including the blacks; and the taxable valuation to $479,293,263, including the land. In the succeeding sixty years the population rose sixfold, and the taxable property fivefold. Of that population, over 5,000,000 immigrated into this country. The white population, however, increased by census 16,800,000 persons: of these, 11,600,000 were the native increase in sixty years; hence, nearly 50 per cent. of the increase was from immigration. The great increase in manufactures, of which none had been allowed under the imperial government, is very remarkable. It indicates only the force with which industry acted as soon as the inhibition of the mother country was removed. The population for 1860 is the current estimate. The valuation is, however, the official state returns, and shows an amazing result—nearly fourfold, in ten years!

The early settlers in all the colonies had to depend mostly upon agricultural products, first for their own maintenance, and then as a means of procuring, by a sale of the surplus, those manufactured articles which, under the rigorous rule of the mother country, they were not allowed to produce themselves. The early policy of the imperial government was to make the colonies a source of profit to the mother country, and this was sought by restraining the colonists from any pursuit that came in conflict with the industry of the mother country, and to confine them to the production of such articles as she stood most in need of. Those articles they were allowed to sell only to the mother country, and were to buy what they stood in need of only of her. Under those general restrictions the colonists, with little capital, and a barren soil at the north, were to prosper as they could. Their genius and restless energy, however, stood them in stead. But they were compelled to encounter new restrictions at every turn. The provinces were in some cases grants to individuals, and in others to companies. This involved, of course, their own government. But soon the Crown claimed the right of confirming the governor. They were forbidden to coin money, to sell lands to any but British subjects, to cut down pine-trees on any pretence, to send wool to any place out of the king's dominions, to export any produce except in English vessels, of which the master and three-fourths of the crew were English. Thus every new progress of the colonies, even in settling and working the land, was followed by a new restraint. But when they began to manufacture, new anxieties seized the home government. Early in the eighteenth century an act of parliament forbade the manufacture of hats; and Massachusetts Bay gave offence by undertaking the manufacture of paper. New York incurred displeasure by taxing slaves imported from Africa, five ounces of silver each; and the ire of the government was further aroused by the rebellious disposition that prompted the New England people to work up their own wool and flax into home-spun goods. They also attempted to start banks, which parliament prohibited; and they forbade the manufacture of iron beyond the state of pig, and interdicted foreign-built vessels from the colonial trade. In spite of all these continually multiplying vexations, the colonists contrived to find something to do, and the fact that they did so kept the home government continually upon the "anxious seat." A parliamentary committee was finally appointed to look into the manner in which those colonists employed their time, and the committee of parliament reported as follows:—

"The governor of Massachusetts Bay informed us that in some parts of this province the inhabitants worked up their wool and flax into an ordinary coarse cloth for their own use, but did not export any. That the greatest part of the woollen and linen clothing worn in this province was imported from Great Britain, and sometimes from Ireland; but, considering the excessive price of labor in New England, the merchants could afford what was imported cheaper than what was made in that country. That there were also a few hat-makers in the maritime towns; and that the greater part of the leather used in that country was manufactured among themselves. That there had been for many years some iron works in that province, which had afforded the people iron for some of their necessary occasions; but that the iron imported from Great Britain was esteemed much the best, and wholly used by the shipping. And that the iron works of that province were not able to supply the twentieth part of what was necessary for the use of the country. They had no manufactures in the province of New York that deserved mentioning; their trade consisted chiefly in furs, whalebone, oil, pitch, tar, and provisions. No manufactures in New Jersey that deserve mentioning, their trade being chiefly in provisions shipped from New York and Pennsylvania. The chief trade of Pennsylvania lay in the exportation of provisions and lumber, no manufactures being established, and their clothing and utensils for their houses being all imported from Great Britain. By further advices from New Hampshire, the woollen manufacture appears to have decreased, the common lands, on which the sheep used to feed, being now appropriated, and the people almost wholly clothed with woollen from Great Britain.

The manufacture of flax into linen, some coarser, some finer, daily increased by the great resort of people from Ireland thither, who are well skilled in that business; and the chief trade of this province continued, as for many years past, in the exportation of naval stores, lumber, and fish. By later accounts from Massachusetts Bay, in New England, the assembly have voted a bounty of 30s. for every piece of duck or canvas made in the province. Some other manufactures are carried on there, as brown Hollands for women's wear, which lessens the importation of calicos, and some other sorts of East India goods. They also make some small quantities of cloth made of linen and cotton, for ordinary shirting and sheeting. By a paper-mill set up three years ago, they make to the value of £200 sterling yearly. There are also several forges for making bar-iron, and some furnaces for cast-iron or hollow ware, and one sitting-mill, and a manufactory of nails. The governor writes concerning the woollen manufacture, that the country people, who used formerly to make most of their clothing out of their own wool, do not now make a third part of what they wear, but are mostly clothed with British manufactures. The same governor (Belcher), by some of his letters of an older date, in answer to our annual queries, writes, that there are some few copper mines in this province, but so far distant from water-carriage, and the ore so poor, that it is not worth the digging. The surveyor-general of his Majesty's woods writes, that they have in New England six furnaces and nineteen forges for making iron, and that in this province many ships are built for the French and Spaniards in return for rum, molasses, wines, and silks, which they truck there by connivance. Great quantities of hats are made in New England, of which the company of hatters of London have likewise lately complained to us, that great quantities of those hats are exported to Spain, Portugal, and our West India islands. They also make all sorts of iron work for shipping. There are several still-houses and sugar-bakers established in New England. By later advices from New York, there are no manufactures there that can affect those of Great Britain. There is yearly imported into New York a very large quantity of the woollen manufactures of this kingdom for their clothing, which they would be rendered incapable to pay for, and would be reduced to the necessity of making for themselves, if they were prohibited from receiving from the foreign sugar colonies the money, rum, sugar, molasses, cocoa, indigo, cotton, wool, etc., which they at present take in return for provisions, horses, and lumber, the produce of that province and of New Jersey, of which he affirms, the British sugar colonies do not take off above one-half. But the company of hatters of London have since informed us, that hats are manufactured in great quantities in this province. By the last letters from the deputy-governor of Pennsylvania, he does not know of any trade carried on in that province that can be injurious to this kingdom. They do not export any woollen or linen manufactures, all that they make, which are of a coarser sort, being for their own use. We are further informed that in this province are built many brigantines and small sloops, which they sell to the West Indies. The governor of Rhode Island informs us, in answer to our queries, that there are iron mines there, but not a fourth part iron enough to serve their own use; but he takes no notice of any sort of manufacture set up there. No return from the governor of Connecticut; but we find, by some accounts, that the produce of this colony is timber, boards, all sorts of English grain, hemp, flax, sheep, black cattle, swine, horses, goats, and tobacco; that they export horses and lumber to the West Indies, and receive in return sugar, salt, molasses, and rum. We likewise find that their manufactures are very inconsiderable, the people there being generally employed in tillage, some few in tanning, shoemaking, and other handicrafts; others in the building, and joiners', tailors', and smiths' work, without which they could not subsist."

The old northern colonies in America had, it is well known, very few articles fit for the British market, and yet they every year took off large quantities of merchandise from Great Britain, for which they made payments with tolerable regularity. Although they could not, like the Spanish colonists, dig the money out of their own soil, yet they found means to make a great part of their remittances in gold and silver dug out of the Spanish mines. This they effected by being general carriers, and by a circuitous commerce carried on in small vessels, chiefly with the foreign West India settlements, to which they carried lumber of all sorts, fish of an inferior quality, beef, pork, butter, horses, poultry and other live stock, an inferior kind of tobacco, corn, flour, bread, cider, and even apples, cabbages, onions, etc., and also vessels built at a small expense, the materials being almost all within themselves; for which they received in return silver and gold, some of which remained as current coin among themselves, but the greatest part was remitted home to Britain, and, together with bills of exchange, generally remitted to London, for the proceeds of their best fish, sold in the Roman Catholic countries of Europe, served to pay for the goods they received from the mother country. This trade united all the advantages which the wisest and most philanthropic philosopher, or the most enlightened legislator, could wish to derive from commerce. It gave bread to the industrious in North America by carrying off their lumber, which must otherwise rot on their hands, and their fish, great part of which without it would be absolutely unsaleable, together with their spare produce, and stock of every kind. It furnished the West India planters with those articles without which the operations of their plantations must be at a stand, and it produced a fund for employing a great number of industrious manufacturers in Great Britain: thus taking off the superfluities, providing for the necessities, and promoting the happiness of all concerned. This trade, however, was almost entirely ruined by the rigorous execution of the orders against smuggling and the collection of the duties in hard silver, which soon drained the country of any little real money circulating in it. And, as if government had intended to prevent the colonists from having even the shadow of money, another act was passed in a few days after that for the new duties, declaring that no paper bills to be henceforth issued should be made a legal tender in payment, and enjoining those in circulation to be sunk (that is, paid off in hard money) at the limited time. That vast quantities of goods were imported, in direct violation of the letter and spirit of the law and of the commercial system of the mother country, there is no doubt. But it could not well be otherwise in a country so remote from the government to which it professed allegiance, and possessing an extent of coast which no chain of revenue cruisers that could be supported by government would be sufficient to guard with any kind of effect. The soil of the New England provinces scarcely furnished provisions sufficient to support the inhabitants. Their industry had therefore been chiefly directed to the sea—to fishing, navigation, and the various branches of business subservient to them. The cod, salmon, mackerel, sturgeon, and other species of fish which frequented the coasts and rivers in prodigious shoals, afforded employment to great numbers in taking, curing, and packing them. The New Englanders also frequented the banks and coasts of Newfoundland, and the fishing grounds in the Gulf of St. Lawrence as far as the coasts of Labrador. Besides their own fishing, they procured from the Newfoundland fishermen a part of the fish taken by them in exchange for rum of their own manufacture, and other articles of American and West India produce. The following record of rum exported from the colonies now forming the United States (chiefly from New England) to the provinces of Nova Scotia, Quebec, and Newfoundland, affords a specimen of the extent of that trade during a few years preceding the revolution:—

		1770.	1771.	1772.	1773.
West India rum,	gallons	52,712	36,873	47,736	50,716
American rum,	"	590,748	550,514	520,525	608,025
		643,460	587,387	568,261	658,741

The fish, after being sorted in the harbors, were shipped off to the countries for which each quality was best adapted. The best were carried to the southern parts of Europe, and the proceeds were generally remitted to Great Britain in bills of exchange to pay for the goods they had occasion for. A small quantity of the best fish was also sent to Britain, and the inferior sorts were destined to give a relish to the plantains and yams which constituted the principal part of the food of the negro slaves in the West Indies. After the peace of 1763, the whale fishery increased in the seas between the New England coasts and Labrador, in consequence of the encouragement given to it by the great reduction of the duties on the oil and whale fins, so much, that instead of eighty or ninety sloops, which had gone upon the whale fishery, they employed 160 in that business before the year 1775, and the other branches of their fishery increased in the same proportion. In addition to the commerce supported by the produce of their fisheries, they drove a very profitable circuitous carrying trade, which greatly enriched them, and supplied most of the money in circulation. Besides building vessels for the service of their own commerce, they built great numbers, but of no very good quality of wood or workmanship, for sale; and from the molasses, which they brought in great quantities from the West Indies (chiefly from the French islands), they distilled rum, which, though much inferior to that of the West Indies, was very acceptable to the Indians, who readily received it in exchange for their furs and peltry. They also found a great sale for it among the fishermen; considerable quantities of it were shipped to Africa, and exchanged for slaves, or sold to the resident European slave merchants for gold dust, ivory, woods, wax, and gums. The candles made of spermaceti, furnished by the whale fishery, formed also an article of export to the amount of three or four hundred thousand pounds weight in a year, besides what were consumed upon the continent. Their exports to Great Britain consisted chiefly of fish-oil, whalebone (or fins), masts and other spars, to which were added several raw materials for manufactures collected in their circuitous trading voyages, and a balance paid in foreign gold and silver coins. In short, their earnest application to fisheries and the carrying trade, together with their unremitting attention to the most minute article which could be made to yield a profit, obtained them the appellation of the Dutchmen of America. New York, New Jersey, Pennsylvania, and Delaware have a much better soil than that of the New England provinces, and they then, as now, produced corn and cattle of all kinds in great abundance, and also hemp, flax, and lumber; to which may be added iron, potashes, and pearlashes. Their exports were corn of all kinds, flour and bread in great quantities, salted provisions of all sorts, live stock, including horses, horned cattle, hogs and sheep, and all kinds of poultry in great numbers, flax and hemp, boards, scantling, staves, shingles, and wooden houses framed and ready to fit up, iron in pigs and bars, and vessels, superior in workmanship to those of New England. Their chief markets for these commodities were the British and foreign West Indies, Spain, Portugal, the Western islands, Madeira and the Canary islands, whence they carried home the produce of each country and bullion. Great Britain and Ireland received from them iron, hemp, flax, feed, some lumber, and skins and furs, the produce of their trade with the Indians, together with some articles of their imports from other provinces and from foreign countries, which were raw materials for British manufactures and bullion. Maryland and Virginia almost from their first settlement made tobacco the principal object of their culture, and it long continued to constitute the most valuable export of British America; but the quantity of tobacco was diminishing in these provinces for many years before the revolution, owing to the soil being exhausted by it, and the planters had turned much of their tobacco land to the cultivation of wheat and other grain. Their tobacco could by law be exported only to Great Britain; but their corn, flour, lumber, etc., were carried to the West Indies and elsewhere. North Carolina produced also some tobacco, and it furnished pitch, tar, and turpentine, of which about 130,000 barrels were annually exported, whereof the greatest part came to Britain. The following accounts, copied from those of the custom-house, for the year nearly preceding the revolution, show the exports of the then colonies of America:—

AN ACCOUNT OF THE VALUE, IN STERLING MONEY, OF THE EXPORTS OF THE SEVERAL PROVINCES UNDERMENTIONED, IN THE YEAR 1770.

	To Great Britain.			To South of Europe.			To West Indies.			To Africa.			Total.		
	£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
New Hampshire	142,775	12	9	464	0	5	40,431	8	4	96	11	3	550,089	19	2
Massachusetts				76,702	0	4	123,394	0	6	9,801	9	10			
Rhode Island				1,440	11	0	65,206	13	2	7,814	19	8			
Connecticut				2,567	4	5	79,395	7	6						
New York.......	113,382	8	8	50,885	13	0	66.324	17	5	1,313	2	6	231,906	1	7
New Jersey......							2,531	16	5				2,531	16	5
Pennsylvania.....	28,112	6	9	203,952	11	11	178,331	7	8	560	9	9	410,756	16	1
Maryland	759,961	5	0	66,555	11	11	22,303	9	2				991,401	18	6
Virginia				73,635	3	4	68,946	9	1						
North Carolina	405,014	13	1	3,238	3	7	27,944	7	9	71	15	4	569,584	17	3
South Carolina				72,881	9	3	59,814	11	6	619	10	9			
Georgia	82,270	2	3	614	2	0	13,285	15	1				96,169	19	4
Total.....	£1,531,516	8	6	£552,937	11	2	£747,910	3	7	£20,277	19	1	£2,852,441	8	4

The exports of North Carolina to the West Indies consisted mostly of salt pork, Indian corn, peas, etc. But its foreign trade was very trifling in proportion to its great extent, and even to the quantity of its productions, and was mostly in the hands of the merchants of the adjacent provinces of Virginia and South Carolina, and of the New Englanders. In South Carolina and Georgia rice and indigo were the staple articles. The former grows on the marshy grounds near the coast, and the latter on the dry soil of the inland country. The planters had for some time applied themselves to the culture of tobacco; it was not until later that the cultivation of cotton was introduced. They made then considerable quantities of lumber. Their exports consisted of these articles; and the merchants of Charleston also shipped some skins obtained by trade with the neighboring Indians, and part of the produce of North Carolina.

The chief dependence of the colonies for the means of turning their industry to account, was thus apparently the West India trade. Every interest in England had been protected at the expense of the colonies, and the united restrictions had resulted in a larger West India trade. The government now came in to protect itself, and, to raise a revenue, laid a heavy tax upon the West India trade in 1764.

The burdens of the colonists were getting rather too many and heavy, and the people more and more disposed to question the utility of a connection which was enforced avowedly that the colonists might be hewers of wood and drawers of water for the service of the mother country. The first movement in view of the fact that the cutting off of their trade would prevent them from buying of the mother country, was to enter into an association to abstain from British goods, and to manufacture for themselves. Then commenced an active struggle. Surveyors-general were sent to America, stamp duties levied, and all the stamped paper sent out from England was burnt up by the colonists as soon as it arrived. The merchants entered into an agreement to import no more goods from Great Britain, and a manufacturing society was established. Woollen factoring became the rage, and so far was it carried, that resolutions were passed not to eat lamb, and not to patronise any butcher who killed lambs. They resolved to send no more tobacco to England. These resolutions caused a great revulsion in England among those who could get no remittance and those who had made goods for the American market. The government felt the force of this pressure, and the stamp act was repealed; but, at the same time, the moral effect of the repeal was destroyed by the declaration that the acts of parliament bound the colonies. Then followed more duties, more regulations, more resistance, increasing anger on both sides, until, in the year 1775, parliament prohibited all trade with America, and the united colonies opened their ports to all nations. During the war which ensued, the business of the country of course suffered; but a very extensive illegal trade was carried on by some of the high officers of the English government, who, under licenses granted to carry stores and provisions for the army, cleared vessels for Boston, Halifax, or Quebec, *with liberty to go to any other port*, and sent cargoes of general merchandise for sale at great profits.

These events closed colonial trade. The high profits to be derived from the sale of goods and produce during the war were too tempting to permit trade altogether to cease, notwithstanding the acts of Congress. Lord Sheffield states that one ship in particular cleared from London for New York, but went directly to Boston, where her cargo sold at 270 per cent. profit. Many cargoes were paid for in cash before they left England, on account of the risk. The cities in the United States in the power of the British were crowded with the faithful; at the same time the surrounding back country did not sympathise with them, and, as a consequence, provisions were very scarce and high. This gave rise to a clandestine trade, by which a vessel would be loaded with produce and sent to a particular spot, where, through connivance, she would be "captured," and her cargo sold as a prize, at very high prices, to the profit of both captors and owners. American produce also found its way to Europe.

With the year 1783 came peace, and with it a new era opened in the world's commerce. Britain had always treated the colonies as having no rights, and she was now required to treat with them as equals, not only in a political and commercial sense, but as rivals on the ocean, which she had hitherto affected to rule. The United States were then in by no means a prosperous condition. Their commerce had been ruined by the war; the few manufactures which had been forced into being during the difficulties had to encounter ruinous competition from imports with the return of peace; the country was flooded with depreciated paper money, of which over

$360,000,000 had been issued. The states were in debt $20,000,000, and the federal government $42,000,375; specie had mostly disappeared from circulation, and the country was without a mint, or a regular system of finance. Private credit was greatly impaired. The collection of debts had been suspended during the war, and with the return of peace the courts were filled with suits; while the markets were flooded with goods beyond the power of purchase. The several states exercised the power of issuing paper money, and making it a legal tender for debts, and each exercised the right of imposing duties upon imports and exports. All these evils were producing the most disastrous results, and in Massachusetts an open insurrection, known as Shays's rebellion, threatened not only the peace of that state, but the existence of the Union, which, indeed, was very feeble under the confederation. In September, 1787, the present constitution was finally adopted, and the work of construction commenced. The leading measures adopted did not come fully into operation until 1791, when the custom-houses, the mint, the bank, the post-office, commercial treaties, and duties on imports, with the restrictions upon the states as to levying duties, coining money, making paper a legal tender, and minor regulations, were put in force.

The power granted to Congress by the new constitution, of levying duties upon goods imported into the country, met the exigencies of the case. The states had been repeatedly and vigorously called upon to provide the means of meeting the public debt and expenses, and it was urged upon them that independent means granted to it was the only way by which the federal government could sustain its position. This power, with that to levy direct taxes, was finally obtained by Congress under the constitution of 1787. In the meantime the exports of the country were actively resumed with the cessation of hostilities. There were, however, no means of knowing the actual state of trade until the adoption of the regulations under the constitution of 1791. The trade was, however, very active. The desire to trade on both sides was great; and no sooner was peace declared, than the king by proclamation removed all legal restraints upon intercourse with the United States, dispensing for a limited time with a manifest, certificate, or other legal document on the arrival of any vessel belonging to the United States in Great Britain. American vessels generally were placed upon the footing of colonial vessels. Although there were no United States official returns, the English custom-house returns show the trade between the two countries for that period as follows:—

	Exports to Great Britain.	Imports from Great Britain.
1784,	£743,345	£3,670,467
1785,	893,594	2,308,023
1786,	843,119	1,603,465
1787,	893,637	2,009,111
1788,	1,023,789	1.886,142
1789,	1,050,198	2,525,298
1790,	1,191,071	3,431,778

The imports from Great Britain alone, in the two first years of peace, must have been nearly $30,000,000, or $10 per head of the people against an export of $9,000,000, and were sufficient cause for much distress. This was, however, of a nature which would naturally cure itself, since it involved a fall in prices that would promote exports and check imports, and these were more nearly equalized in 1788.

In that year, however, a new event gave a great impulse to American exports. The French government had previously made a free trade treaty with England; and in 1787, under the liberal sentiments which that government espoused, they issued a decree, placing American citizens commercially on the same footing as Frenchmen, and admitting American produce free of duty. Under this regulation, the United States exported in 1788, 246,480 tierces of rice, 140,959 barrels of flour, 3,664,176 bushels of wheat, 558,891 bushels of rye, 520,262 bushels of barley. These figures represent very large exports for the state of the country at that time, when the population was small, and the farm produce drawn altogether from the Atlantic states of the country. The farms of the Hudson river and its milling powers were then in great requisition. The fisheries had large sales, and the south exported freely its rice. The enjoyment of the French and English trade gave a great impulse to the shipping interest, and the United States were rapidly growing into a power whose influence was felt in all the commercial relations of England. The political difficulties of Europe were also taking a new shape. The failure of the harvests hastened the march of affairs, and a new war between France and England left in the hands of the United States the carrying trade of the world. While American shipping was called upon to supply raw materials and food for England and western Europe, it was also called upon to carry between European countries and their colonies. French ships could no longer safely trade with the West Indies, the Spanish merchants and government depended upon neutral flags to convey their merchandise and treasures, and even the English preferred the safety of third bottoms for the transport of their goods. The insurrection in St. Domingo, and the events in other islands, drove great numbers of persons to the United States, and many fortunes were founded. That of Stephen Girard received a great accession from the wealth placed on board his ships by persons who were slaughtered in the attempt to follow. The activity with which American shipping was employed in those years did not prevent them from seeking new trade in the east, and an American ship made its appearance in the China seas, in a commerce which has not ceased to grow to the present day. The period was marked by the development of the most enterprising genius in mercantile adventure. The fame of William Gray, of Boston, soon became world-wide, and was as honored in the east as it was in the west. His ships navigated every sea, and employed hundreds of hardy men. The skilful and bold seamen who commanded his ships were not of the later class of "dandy captains," who came in with the "liners," but it was his saying that the best captains would sail with a load of fish to the West Indies, hang up a stocking in the cabin and put therein the hard dollars as they sold the fish, and pay out from it as they bought the rum, or molasses, or sugar, tie up the balance, and hand it into the counting-house on their arrival home, in lieu of all accounts. The honesty and judgment of their proceedings were beyond question; and the problem of profits between the fish sent and the cargo and stocking returned, was for the clerks to solve. The genius for plotting long and intricate voyages belonged to the head of the house. New York, in John Jacob Astor, had still a more extensive operator. He first projected the enterprises to the north-west coast, and laid out schemes which required ten years to ripen, with profound skill, and his name was known throughout the world. Philadelphia had an exponent of her commercial power in Stephen Girard, whose enterprises belonged to the same period of large operations and bold conduct. The Patersons of Baltimore led the commerce of that city; and behind these leading names came a crowd of great merchants—for the mercantile intellect seemed as active in that day as was military, political, and literary genius both on this continent and throughout the world.

With the year 1791 the new government of the United States, under the constitution adopted 1787, came into operation, and from that date regular official figures of the annual progress of the national commerce have been published. The leading changes produced by that event were the abolishment of all state laws imposing duties upon imports and exports; the creation of a tariff by Congress; the establishment of a mint, a national bank, a post-office; the funding of the government circulating paper, the withdrawal of all state issues, and the enactment of a navigation law in retaliation of the English law. The general course of trade proceeded, however, much as before, until it encountered the interruption that grew out of the European war. A few years of this prosperity excited the ire of the belligerents, and England could no longer refrain from treating the Americans still as colonists. In 1793 she issued an order to prevent food from being carried to any port occupied by French troops, and also to prevent American vessels from trading between France and her colonies. She also exercised the right of impressing American seamen to man her navy. Under these and other orders, American merchants had been robbed of large amounts of property. The complaints thus created threatened war; but it was arrested by a treaty concluded by Mr. Jay, under which $10,000,000 indemnity was paid. This treaty gave umbrage to France, which also seized American vessels; but the first consul put an end to the complaints in 1800. England had, however, in view of the apparently progressive difficulties in Europe, revived the principle she had laid down in 1756, viz.: that neutrals could carry on no trade in time of war that they had not pursued in time of peace: in other words, that American ships should not do the French carrying trade. Her next step, in May, 1806, was to promulgate the unheard-of and absurd edict, that Europe was in a state of blockade from the Elbe to Brest. The import of this was, that American ships should visit none of those ports. This monstrous pretension, in addition to some minor orders, drew from Napoleon, November, 1806, his Berlin decree in retaliation, prohibiting all intercourse with the British islands. This was replied to, by Great Britain declaring France and her colonies in a state of blockade. To these insane edicts on both sides succeeded others, which so multiplied the difficulties of commerce that the United States government, to avoid war, laid an embargo upon commerce in 1808. It was not to be expected, however, that when the chief interests of the country were commercial, that such a measure should be otherwise than very unpopular, and the government changed it, in 1809, to non-intercourse with France and Great Britain. Notwithstanding all the troubles thrown in the way of commerce by the edicts of France and England, the American merchants contrived to carry on a large traffic. Under Bonaparte's continental system, which sought to exclude colonial and British productions, produce was very scarce and high in Europe. The emperor, to remedy the matter, offered high premiums for the invention of substitutes for many articles, such as indigo, cane sugar, coffee, etc. To those premiums are due the large use now made of chicory-root as a substitute for coffee. It originated in Germany, but has since spread to England and the United States. Beet-root sugar, which has become so large an industry in France and Germany, being equal in consumption to cane, originated in the same manner. Nevertheless, all commodities were very high, and when a cargo could be got in, it realized a fortune. To get them in was the problem; and this was usually done by fees, or *pots de vin*, which were mostly appropriated by Talleyrand and Fouché, and afterward rights were openly sold by the emperor to raise money. Jerome Bonaparte, who died so recently, had married, in 1803, Miss Paterson, of Baltimore, a direct descendant of "Old Mortality," immortalized by Scott in a novel. The Paterson interest with Jerome was the means of procuring admission for many a valuable cargo. Interest and enterprise effected much, and few merchants desired to lose all chance through the intervention of their own government. Nevertheless, the embargo took place in 1808. The progress of trade from 1790 to 1808, was as follows:—

IMPORTS AND EXPORTS OF THE UNITED STATES, AND TONNAGE IN THE FOREIGN TRADE.

	Tonnage.	Dom. exports.	For. exports.	Total exports.	Imports.
1790,	474,374	$19,666,000	$539,156	$20,205,156	$23,000,000
1791,	502,146	18,500,000	512,041	19.012 041	29,200,000
1792,	564,457	19,000,000	1,753,098	20,753,098	31,500,000
1793,	520,764	24,000,000	2,109,572	26,109,572	31,100,000
1794,	628,618	26,500,000	6,526,233	33,026,233	34,600,000
1795,	747,965	39.500,000	8,489,472	47,989,472	69,756,268
1796,	831,899	40,764,097	26,300,000	67,064,097	81,436,164
1797,	876,913	29,850,026	27,000,000	56,850,206	75,379,406
1798,	898,328	28,527,097	33,000,000	61,527,097	68,551,700
1799,	939,400	33,142,522	45,523,000	78,665,522	79,069,148
1800,	972,492	31,840,903	39,130,877	70,971,780	91,252,768
1801,	947,577	47,473,204	46,642,721	94,115,925	111,363,511
1802,	892,104	36,708,189	35,774,971	72,483,160	76,333,333
1803,	949,172	42,205,961	13,594,072	55,800,033	64,666,666
1804,	1,042,404	41,467,477	36,231,597	77,699,074	85,000,000
1805,	1,140.368	42,387,002	53,179,019	95,566,021	120,600,000
1806,	1,208,716	41,253,727	60,283,236	101,536,963	129,410,000
1807,	1,268,548	48,699,592	59,643,558	108,343,150	138,500,000

In the period here embraced there occurred many events which had a very lasting and important bearing upon the future of the United States. The temporary free trade with France had imparted a sudden impulse to the export of farm produce. The wars that succeeded greatly enlarged the sphere of action for the shipping, and we find in the table that the imports of goods rose year by year from 23,000,000 in 1790 to 138,000,000 in 1807. Of these large imports, however, it appears, from the column of exports of foreign merchandise, a large portion was re-exported, forming the carrying trade between the countries of Europe and their colonies, that the war threw into the American bottoms, and which passed through American ports. A large portion of this trade was paid in money in England, forming those credits which were transferred by the Americans to the English, in payment of merchandise thence imported. Thus the trade was generally in favor of England with the United States, and in favor of the latter with Europe. Now, as England could have no direct trade with Europe during the war, and yet was compelled to send funds thither for political purposes, the credits she received from the Americans were of vast service to her. It was in the conduct of that trade that the tonnage multiplied to the extent seen in the column. The amount increased from 474,374 tons in 1790, to over 1,260,000 tons in 1807, or an increase in capital so employed from $15,-000,000 to $50,000,000 The wealth of the country was thus rapidly increasing in a foreign trade, which formed one-half of the whole commerce. The fisheries were very active and flourishing; the agricultural interest prospered under the large exports and high prices, and manufactures began to be actively developed. The Secretary of the Treasury, Mr. Hamilton, in his celebrated report upon manufactures in 1791, says: "It is certain that several important branches have grown up and flourished with a rapidity that surprises, affording an encouraging assurance of successive future attempts." Among those enumerated as then flourishing are leather, iron, wood, flax, bricks, paper, hats, carriages, etc. It was computed that four-fifths of all the clothing of the inhabitants was made by themselves, and that great quantities of coarse cloths for table and bedding were manufactured in households. All these industries pertained mostly to the north, and their surplus formed at that time most of the exports of the whole country. The southern states were possessed of 600,-000 blacks, for whom there was no adequate employment. They were mostly engaged upon the production of tobacco and rice, but the market for them was not such as to afford much encouragement for the future. The increase of blacks who were not earning their support was not regarded with favor by southern statesmen under such circumstances: hence the incorporation into the federal constitution of the inhibition of the slave trade after 1808. That provision was resisted by the New England shipowners, of whose business the transportation of blacks, as a return cargo, after carrying produce to England, formed an important part. An event occurred in 1793, however, which wrought an entire change in the business of the country and the prospects of the south. Up to that time a little cotton had been raised, but the difficulty of freeing it from the seed was such that one hand could clean but 1 lb. per day, and even at 30 cents per lb. it was not profitable, under such conditions. The mode of carding and spinning it was also laborious and slow. At about that period the steam-engine in England was introduced as a motive power, and such inventions were made in the process of carding and spinning cotton as to enable one man to do the work that required 2,200 by old methods. These were the conditions of an immense demand for the raw material. Providentially, precisely at that juncture, 1793, Eli Whitney, of Massachusetts, invented the cotton-gin, by which one hand, instead of only 1 lb., could clean 360 lbs. per day. Thus the market for cotton, and the means of preparing it, were both provided at once, and they were thenceforth to furnish the chief employment for American ships. The items of domestic exports in the above table were therefore varied as follows:—

	Cotton.	Tobacco.	Flour & provisions.	Rice.	Manufactures.	Total.
1700,	$42,285	$4,349,567	$5,991,171	$1,753,796		$12,136,819
1803,	7,920,000	6,209,000	15,050,000	2,455,000	2,000,000	31,179,000
1807,	14,232,000	5,470,000	15,706,000	2,307,000	2,309,000	44,002,400

Thus cotton in a few years came to form nearly one-third of the whole exports, thereby supplying to the shipping in 1808 a compensating freight for the blacks, who were no longer to be imported. That cotton trade has not ceased to grow to the present day, and with ever increasing importance. It has supplied not only the manufacturers of Europe with raw material, but also those of the northern states. The impulse thus given to the cotton culture produced a vital change in the condition of the south, and this change is well indicated in the charge made by Judge Johnson, of Savannah, in 1807, in the case of a suit brought by Whitney to make good his claim to his patent.

"The whole of the interior," said Judge Johnson, "was languishing, and its inhabitants were emigrating, for want of some object to engage their attention and employ their industry, when the invention of this machine (the gin) at once opened views to them which set the whole country in active motion. From childhood to age it has presented to us a lucrative employment. Individuals who were depressed with poverty and sunk in idleness have suddenly risen to wealth and respectability. Our debts have been paid off, our capitals have increased, and our lands doubled in value. We cannot express the weight of obligation which the country owes to this invention. The extent of it cannot now be seen."

In these words we have the proof of the utter depression that then existed at the south, affording a strong contrast to the immense wealth that has since been developed.

The kinds and quantities of goods imported into the country were adapted to the wants of the people at that time, when luxuries had by no means so large a share of the public taste as is now the case. The homespun goods of the country were to be gradually supplanted by machine goods as these improved and cheapened, and they did so rapidly under the influence of larger supplies of raw material, operated upon by the most astonishing inventions in new machines, and the improved scientific processes applied to the manufacture. The American manufacturers were required to withstand not only the competition of the large capital and cheap labor of England, but the constant effects of new inventions, of which the first-fruits were manifest in imported goods. They therefore grew but slowly, and hardware, dry goods, and other leading branches of merchandise, continued to be imported. The aggregate amount retained in the country for consumption did not materially increase in the ten years up to 1807.

All branches of industry were in a high state of prosperity, when the course of events brought on the embargo, which produced an immense change in the course of affairs. All those interests that had thriven so well since the peace of 1783, became suddenly depressed by the circumstances which gave an impulse to manufacture. The raw material and farm produce which had been so actively exported now accumulated on hand at falling prices, tempting the manufacturer to employ the labor no longer occupied with commercial interests, and a new order of industry sprang into being. Trade was, however, not entirely interrupted; many coasting vessels, with suitable cargoes, were by pretended stress of weather driven into foreign ports, and the United States courts were filled with suits brought for breaches of the embargo acts. Under the non-intercourse act of 1809, business recovered to some extent, only to encounter those new vexations which brought on the war of 1812. That event rather changed the course of trade than interrupted it, and was succeeded by a greater degree of activity than ever. The imports and exports were as follows:—

	Tonnage.	Domestic exports.	Foreign exports.	Total exports.	Total imports.
1808,	1,247,596	$9,433,546	$12,997,414	$22,430,960	$56,990,000
1809,	1,350,281	31,405,700	20,797,531	52,203,231	59,400,000
1810,	1,424,784	42,366,679	24,391,295	66,757,974	85,400,000
1811,	1,232,502	45,294,041	16,022,790	61,316,831	83,400,000
1812,	1,269,997	30,032,109	8,495,127	38,527,236	77,030,000
1813,	1,166,629	25,008,152	2,847,845	27,855,997	22,005,000
1814,	1,159,210	6,782,272	145,169	6,927,441	12,965,000
1815,	1,368,127	45,974,403	6,583,350	52,557,753	113,041,274
1816,	1,372,218	64,781,896	17,138,556	81,920,452	147,103,700
1817,	1,399,911	68,313,500	19,358,069	87,671,569	99,250,373
1818,	1,225,184	73,854,437	19,426,096	93,280,533	121,750,000
1819,	1,260,751	50,976,838	19,165,683	70,142,521	87,125,000
1820,	1,280,166	51,683,640	18,008,029	69,691,669	74,450,000
		$545,907,213	$185,376,954	$731,284,167	$1,039,910,347

The large carrying trade that had existed in foreign produce gradually perished on the return of peace in Europe, throwing much tonnage out of employ; and domestic produce, although it found its way abroad to some extent, still fell in value, and accumulated in quantity in the home ports. Cotton in particular felt the want of the foreign market, although its presence in New Orleans became an instrument in the great triumph of our American troops over the British veterans who had just driven the French out of Spain. The same men who had routed the legions of Napoleon embarked at Bordeaux for New Orleans, to fall before the cotton bags defended by Jackson and his gallant band.

The course of events that had been productive of so much prosperity from 1783 to 1808, was followed in the next seven years by commercial disasters, it is true, but those disasters were relieved by the brilliant position assumed by the United States among the nations of the earth as a naval power.

The American tonnage, which increased to over 1,000,000 in 1807, had given employment to large numbers of hardy and skilful seamen, men whose professional skill and nautical daring had already made them famous, and had incited Great Britain to those impressments by which she sought to obtain the services of such able men. When her conduct drove the American government to embargo commerce, the employment of ships and men became restrained, and their daring manifested itself in infractions of the law. Non-intercourse and war drove them altogether out of employment, and they crowded into the navy and privateers. Up to that time England was the admitted mistress of the seas. Every nation in Europe had been driven from the contest. The best fleets of Napoleon, invincible upon land, had invariably struck to the British flag, and the feeble nation upon this continent, just formed out of revolted colonies, was hardly worth considering at all as a power. The proof of the contempt in which it was held was given in the conduct of the nations that forced non-intercourse and war upon the United States. It came very hard for all the thriving interests here to face ruin in the shape of war, but it became inevitable. So distrustful, however, was even Congress of the ability of the country to resist England, that it was determined, on the declaration of war, to send the government ships up the rivers, where they would be out of the reach of the dreadful English cruisers. It was only at the earnest solicitation of the leading officers of the navy that permission was finally given for the ships to go to sea. The astonishment in Europe, the dismay in England, and delight in the United States, could scarcely be equalled when the encounter on the seas resulted in the unprecedented spectacle of a series of triumphs over the tyrant of the ocean. In the short period of twenty years a power had arisen that was thenceforth to know no master upon the ocean, and submit to no insults, and this power had been born of commerce. The war closing with the defeat of the best troops of England, the "liberators of Spain," before the lines of New Orleans, left the United States no longer in the position of merely liberated colonies, but in that of a victorious power among the nations of the earth. It had cost much to win that position, but it was worth the struggle, since it ensured continued peace thereafter. The nations of Europe have not since thought it worth while to provoke new hostilities, but have, on the other hand, from time to time, settled up for the injuries they then committed upon American commerce.

The intervention of war had paralyzed every industry. The farm products that had been raised for export no longer had an outlet for the surplus; cotton, rice, and tobacco accumulated idly in warehouses. The ships were freightless at the docks, and all the earnings of industry were at their *minimum*. It was an advantage to manufacturers, indeed, to have no competition from abroad; but, on the other hand, the general depression of all other industries destroyed the home market for goods. The general depression of trade and the depreciation of property undermined all credits. Those who had contracted obligations to pay when merchandise was saleable and property convertible, could not pay when all values were paralyzed. In order to remedy this state of affairs to some extent, which was ascribed by certain parties to the want of a United States bank, new state banks were multiplied, under the erroneous notion that these could supply capital. Inasmuch, however, as the radical evil was inability to pay, increase of promises did not help the matter, and a general suspension of the banks took place. The country was filled with irredeemable paper; and the federal debt, which had been $75,463,476 on the consolidation of the revolutionary debt in 1790, had risen to $127,334,934 when peace took place in 1815. In such a state of affairs the return of peace brought with it a flood of imported goods, which amounted to $147,000,000 in 1816, giving the government a customs revenue equal to $36,306,874 in the year. The new United States Bank went into operation at the same time, causing for the moment additional pressure; but the sale of its stock, and of the federal government stock, subscribed to its capital, abroad, helped to correct the exchanges. The produce that had accumulated during the war also went forward in great quantities, giving a considerable impulse to the aggregate of domestic exports, which rose to $73,854,000 in 1818. Of this amount 40 per cent. was cotton. In some sort, the trade which had lain dormant during the war was forced into the first three years of peace. In the five years that ended with 1820 there was, consequently, great activity of trade, demanding greater banking facilities, thus promoting a restoration of confidence, and aiding the United States Bank in restoring order to the currency. The year 1820 brought with it new regulations in regard to the taking of the census, and a law of Congress was enacted for correctly keeping the import, export, and tonnage returns, which has since been done, and annually reported. The revenues of the government, which depended upon duties on imports, suffered interruption during the war, and a resort to taxation became necessary. This had been done in 1791 by a tax on houses and lands. A new valuation took place in 1815; and this, compared with the valuation of 1791, gives the progress of real property in all the states during that period. The census of 1820 comprised, in addition to the population, some items of the industry of the people. Comparing the leading aggregates at the two periods, the results are as follows:—

	1791.	1820.	Increase.
Population Estimated.	4,049,600	9,638,131	5,588,531
Taxable land, acres..	163,746,686	188,286,480	24,539,794
Valuation...........	479.293,263	2,275,730,124	1,796,436,861
Imports	23,000,000	74,450,000	51,450,000
Exports	20,205,156	69,691,669	40,486,513
Tonnage	474,374	1,280,166	805,792
Bank capital.......	3,000,000	137,110,611	134,110,611
Manufactures.......	5 600,000	52,776,530	47,176,530
U. S. debt	75,463,476	91,015,566	15,552,090
" revenue	4,399,473	16,779,331	12,379,858
Post offices, No......	75	4,500	4,425
Post roads, miles....	1,905	67,586	65,681
Postal receipts	46,294	1,111,927	1,064,733

Such was the progress of the country in the first thirty years of its existence. Its population had increased 125 per cent. It had added five states to the Union, and 24,539,794 acres to its taxable property, the value of which had risen nearly fivefold. Its tonnage had increased threefold, its manufactures tenfold, and the capital employed in banking had been increased $134,-000,000. This great prosperity had manifested itself in face of a war with the greatest naval power the world had ever seen, and over which a decisive victory had been won. Commerce, under favorable circumstances, had been the basis of this great growth of wealth.

CHAPTER II.

CHANGED INTERESTS—MANUFACTURES—COURSE OF TRADE—SPECULATION—REVULSION—BANKRUPT LAW—ENGLISH FREE TRADE—REVOLUTION IN FRANCE—FARMERS—GOLD.

THE events of the war of 1812 had brought with them much experience. Up to that period great dependence upon foreign manufactures had existed. It is no doubt true that most of the common wearing apparel and similar goods were made in families, but iron ware, and most articles that enter into the materials of daily avocations, came from abroad. With the war came great deprivation, and many necessary goods, that had been abundant, were no longer to be had. Materials for the army and navy, of all sorts, particularly blankets for the men, were with difficulty obtained. This necessity gave a great spur to individual enterprise, and at the same time forced upon the government the idea of fostering home industry. This necessity was also apparent from the nature of the government. The federal Constitution had given to Congress the power to levy duties upon imports, and also direct taxes for its support. The former right was exercised up to the war, and the government finances were independent and flourishing. When, however, the war put an end to commerce, the government revenues also ceased, since, there being no imports, there could be no duties. Resort to taxation was then the alternative. The mode adopted by Congress was to apportion the amount required upon each state, and let the respective governments collect it. It was soon found that this was a very inefficient mode of proceeding, since the states could not be coerced, and the federal government was in danger of falling to pieces. The statesmen of the day saw the necessity of strengthening the government on the return of peace, and this was done by the same means as it was sought to encourage home manufacture, viz., by raising the duties upon imported goods. A new tariff was therefore enacted in 1816, increasing the duties, particularly upon cotton goods, in taxing which the *minimum* principle was introduced—that is, that the goods should pay 20 per cent. duty, but that the cost on which it was calculated should not be less than a fixed *minimum*. Thus, cotton cloth was to pay 30 per cent., but the cost must not be under 20 cents per yard, or 6 cents per square yard duty. The new duties, falling upon the large importations that followed the peace, rapidly swelled the revenues beyond the current wants of the government; at the same time, notwithstanding that the navy had so well discharged its duties in time of war, and the merchant marine had so well vindicated its ability to furnish sailors, Congress saw fit to pass a navigation act, by which the officers and three-fourths of the crews of American vessels should be American citizens. The act is of itself mostly a dead letter, since naturalization is carried on to an extent which makes the phrase "American citizen" a very ambiguous one. The object is desirable, but the means hampers trade, and does not effect the object. With the operation of the higher duties during the four years that ended with 1820, the imports diminished; the currency was contracted and restored to a specie basis; the exports of the country, that accumulated during the war, passed off; the proceeds had cancelled obligations, bringing the country into a better condition; and the federal government had been enabled to pay off a considerable amount of its debt. The countries of Europe had also become settled after the convulsion of war and the effects of peace. The Bank of England, that had been suspended for a quarter of a century, resumed payments, and trade generally began to resume its accustomed channels. Many currents of business had, as a matter of course, been disturbed. The large foreign carrying trade that had been enjoyed by American vessels was now resumed by the nations of Europe, and new currents of enterprise were to grow up, under new appliances. The capital of New England, that before the war had been exclusively employed in navigation and agriculture, was, by the events of the war, diverted to banking and manufactures, and was now growing in the last direction, banking having proved disastrous. The tariff of 1816 had been meant to aid them, and in 1818 and 1819 additions were made to the protective character of the duties. Cotton manufacture grew, and the great staple culture of the south—cotton—was developed, while Europe, no longer wanting so much food, the agriculturists became depressed. The manufacturing interest was therefore the favorite, and in 1824 a new tariff of higher duties was demanded and passed, to be succeeded by one of a higher grade of protection in 1828. The effect of these changes, with the steady nature of the demand for produce abroad, was to keep the imports and exports at moderate figures up to 1831, when a reduction of duties took place. In all that period, under the action of the United States Bank, and the annual payments of an average of some $7,000,000 by the government on its public debt, the currency was very steady, and commerce regular. The exports and imports for the ten years under those rising tariffs, were as follows:—

	Dom. exports.	For. exports.	Total exports.	Imports.	Ex. specie.	Im. specie.
1821,	43,671,894	21,302,488	64,974,382	62,585,724	10,478,059	8,064,890
1822,	49,874,185	22,286,202	72,160,387	83,241,511	10,810,180	3,369.846
1823,	47,155,408	27.543,622	74,699,030	77,579.267	6,372,987	5,097,896
1824,	50 649,500	25,337,157	75,986.657	80,549,007	7,014,552	8,379,835
1825,	66,944,745	32,590,643	99,535,388	96,340,075	8,932,034	6,150,765
1826,	53,055,710	24,539,612	77,595,322	84,974,477	4,704,533	6,880,966
1827,	58,921,691	23,403,136	82,324,827	79,484,068	8,014,880	8,151,130
1828,	50,669,669	21,595,017	72,264,686	88,509,824	8,243,476	7,489,741
1829,	55,700,193	16,658,478	72,358,671	74,492,527	4,924,020	7,403,612
1830,	59,462,029	14,387,479	73,849,508	70,876,920	2,178,773	8,155,964
	$536,105,024	$229,643,834	$765,748,858	$798,633,400	$71,673,494	$69,144,645

If we compare this period of ten years with the ten years of comparative quiet immediately preceding the war, we shall find the following aggregate results:—

	Imports.	Re-exports of foreign goods.	Domestic exports.	Total exports.
1798—1808,	$956,470,000	$422,500.000	$393.700,000	$816.200,000
1821—1831,	798,633,427	229,643,831	536,104,918	765,748,752
Decrease	$157,836,573	$192,856,166		$50,451,246
Increase			$142,404,918	

The decrease was altogether in the foreign goods, or colonial produce brought into the country during the European war for reshipment to Europe; while the increase in domestic exports was mostly cotton, that article forming three-fifths of the whole value exported. The exports of flour and provisions were limited, but manufactures began to form an item in the exports. It is to be borne in mind that Great Britain had made great efforts after the war, when her navigation laws were modified, to concentrate the trade of the world in her warehouses. Inducements were held out by facilities of entry and advances on merchandise to attract thither the produce of all nations, because, under such circumstances, not only did the British manufacturers have within their reach the raw materials of all manufactures, but trading vessels had, in those ample warehouses, every variety of goods to make up an assorted cargo for any voyage in the world, and make of them the medium of selling British goods. Thus, all the new countries of America, Africa, and Asia offered markets which would absorb small quantities of a great variety of articles, but a cargo of any one description would glut them. To make a profitable voyage, therefore, the cargo should be composed of such a variety of wares as would all sell to advantage. If Virginia was to send a whole cargo of tobacco to Africa, a portion of it would sell, and the remainder be a dead stock, and the voyage a losing one. The same thing would happen to a cargo of rum, or calicoes, or gunpowder, or hardware, or the infinite variety of articles that make up the wants of a small community. If a vessel's cargo should be composed, in proper proportions, of all these articles, the whole would sell well, and the voyage pay; but for a vessel to go round to places where each of these articles is to be had, and so collect a cargo, is expensive, and would still result in loss. The English warehouse system sought to supply a want here by attracting into them all possible descriptions of tropical and other produce. A ship might then make up her cargo for any part of the world at the smallest average expense, and every cargo was sure to be completed with British manufactures. Under such circumstances, they could compete with any other nation. The advantage was so manifest, that American ships would go out in ballast to England, to fit them out for Asiatic markets. It resulted from this that England continued to be the recipient of most American produce, not only for her own use, but for re-export elsewhere. With her large capital she advanced on the produce, and so controlled it, becoming the banker for the Americans. The nations of the continent, slowly recovering from the effects of the long wars, began to manufacture such articles as found sale in the United States, while they did not purchase largely in return. China furnished teas and silks, and got its pay by bills drawn against American credits in London. The new bank of the United States operated the credit, giving the China merchant a six months' bill on London, which he took in preference to silver, which he before remitted. These bills were paid out for the tea, and by the Hong merchant, who received them, were paid to the British East India merchant for opium or raw cotton. By the latter it was remitted to London, where it was met by the funds already provided through the United States Bank, by sales of American produce. This centralization of trade in England became, however, inconvenient. The American ships that now began to carry cotton, tobacco, rice, and some breadstuffs to Europe, had thence no adequate return freights, because those countries did not as yet offer a good supply of merchandise. Soon, however, there sprang up an increasing migration to the United States from Germany across France *via* Havre, and these passengers became a desirable return freight, causing a change in the model of the ships engaged in the trade. By this means the freight was reduced, or rather the ship could carry cotton out cheaper, since she was no longer compelled to return empty. The result was, therefore, cheapened transportation, in the same manner that the modification of the navigation laws, enabling ships to carry cargoes both ways, had cheapened freight. The increasing exports, and the weight of the tariff of 1828 upon imports, had so operated upon exchanges as to cause an excess of specie to be imported to the extent of some $15,000,000 in the last few years. This influx accumulated in banks, and disposed them to inflate the currency, thereby inducing imports at a moment when reductions in duties were made by the tariff of 1831; and this inflation was aided by the conflict which then began between the United States Bank and the government in relation to the recharter of the institution. These circumstances laid the foundation for the great speculation which followed. The high tariff of 1828 had produced much agitation, that promised serious difficulties. The northern, or New England states, whose interests were originally commercial, opposed the war, because it was destructive of those interests. Their capital was turned by it into manufactures, and they demanded protection for that interest. This was acceded to, because all parties had witnessed the evils of a dependence upon foreign nations for manufactures, and also because the federal government needed strengthening by the support which high duties would give it. In 1830 the manufactures had enjoyed fifteen years of protection, and should be firmly rooted. The federal government, from being too weak, had become too strong. The public, who consumed goods foreign and domestic, were paying too high a tribute for the support of the manufacturers, and the states felt their rights encroached upon by the growing power of centralization. A change of policy in respect of the tariff was insisted upon, and a reduction took place in 1831, many goods being made free. In 1832 Mr. Clay's compromise was passed, by which biennial reductions were to take place, until, in 1842, all the duties should be reduced to a general level of 20 per cent. ad valorem. These reductions in duties, at a time of bank inflation and speculation, eminently promoted those imports which, under such circumstances, were carried to excess.

The manufactures of the country had largely increased during the ten years up to 1830. The capital employed in cotton manufacture at that date was $40,614,984. There were 795 mills, working 1,246,503 spindles and 33,506 looms. They produced 230,461,000 yards of cloth, that weighed 59,604,926 lbs., and was worth $26,000,000. These mills employed 117,626 persons, whose wages were $10,294,944 per annum. This was a large interest grown up in cotton. The progress of manufactures generally was given by the census, as follows:—

	1820.	1830.
Cotton	4,834,157	40,614,984
Wool	4,113,068	14,528,166
Pig iron and castings	2,230,276	4.757,403
Wrought iron	4,640,669	16,737,251
Brewers and distillers	4,876.486	3,434,808
Salt	1,852,258	935,173
Other articles	29,919,621	46,077,092
Total	$52,466,535	$127,084,877

In the considerable increase of interests, here apparent, many of the factories suffered by home competition, when too much capital had been induced, by hope of protection, to go into the business. The operations of these manufactures no doubt produced a local demand for materials and food; but this did not suffice, however, in the absence of a foreign demand, to support prices of farm produce, in face of the large development given to agriculture by the increasing immigration and settlement of the western lands.

The season of speculation which now seized the public mind was one of the most remarkable in the history of commerce. There is no doubt that it had its origin in the great success which had hitherto been manifest in the progress of the country. Those who had seen but thirty years of active life had witnessed the most extraordinary growth of numbers and wealth in the whole country, and in cities particularly. The highest prizes had attended those who had held land at the points favorable to trade, which trade was the foundation of cities. There seemed hardly any limit to the rise that might take place in the value of property, and so liberal were bank accommodations, there was very little difficulty in procuring the means to hold land. In almost all cities, the early settlers had become possessed of land cheap. The rapid growth of trade, bringing in numbers to occupy those lands for stores and dwellings, caused a competition that raised rents and values rapidly in price. The effort was then to become possessed of land for speculation, and this effort was attended with the wildest excitement; a few hours sufficed to place a moderate fortune in the hands of the buyer, and prices rose to a fabulous extent in a short time. From the cities, the excitement spread all over the Union, and productive employments were neglected to trade in lands; at the same time, the fictitious fortunes made by these means stimulated expense, and the wealth of the country was diminished by a double process—by lessened production, and increased consumption—"the candle was burned at both ends," and there could be little surprise that it was speedily consumed. The course of the trade for the ten years up to 1840 was as follows:—

	Dom. exports.	For. exports.	Total exports.	Imports.	Ex. specie.	Im. specie.
1831,	$61,277,057	$20,033,526	$81,310.583	$103,191,124	$9,014,971	$7,305,945
1832,	63,137,470	24,039,473	87,176,943	101,029,266	5,656,340	5,907,304
1833,	70,317.698	19,822,735	90,140,433	108,118,311	2,611,701	7,070,368
1834,	81,034,162	23,312,811	104,346,973	126,521,332	2,076,758	17,911,632
1835,	101,189,082	20,504,495	121,693,577	149,895,742	6,477,775	13,131,447
1836,	106,916,680	21,746,360	128,663,040	189,980,035	4,324,336	13,400,881
1837,	95,564,414	21,854,962	117,419,376	140,989,217	5,976,249	10,516,414
1838,	96,033,821	12,452,795	108,486,616	113,717,404	3,508,046	17,747,116
1839,	103,533,891	17,494,525	121,028,416	162,092,132	8,776,743	5,595,176
1840,	113,895,634	18,190,312	132,085,946	107,141,519	8,417,014	8,882,813
	$892,899,909	$199,451,994	$1,092,351,903	$1,302,676,082	$56,839,933	$107,469,096

This period of commerce shows remarkable results, since it illustrates the nature of the pure speculation that possessed the country. In the period up to 1830, the imports had exceeded the exports $32,884,675, or 5 per cent. in the whole ten years, an amount which was not more than healthy. In the succeeding ten years, the excess of imports over the exports was $210,334,181, or 20 per cent., and this took place although the exports were valued at inflated prices, which were not realized abroad. The course of business at that period required shipments of American produce, mostly cotton, to firms abroad, who made advances on the consignment at a certain ratio, less than the face of the invoices. The produce was then afterward sold for the account of the owner, and not unfrequently did not bring the amount of advances. Thus, if cotton was shipped at 16 cts. per lb., and 12 cts. advanced, the amount realized might be only 11 cts. Hence, the real exports of the country were not always measured by the export value. On the other hand, the goods imported were mostly ordered by importers here, and purchased on credits in the manufacturing districts. These credits were operated through large London houses connected with the American trade, and whose ability to extend credits depended upon the indulgence of the Bank of England, and that institution itself was subject to pressure whenever the harvests should fail. The system of credits was open, however, up to 1836, in England, under apparently favorable circumstances. The United States and rival banks here favored the extension of credits in every possible way; and the goods bought on credit in Europe were sold on credit here, and consumed by those who held fortunes based upon the apparent rise in lands bought on speculation, for promises. The numbers so engaged diminished production, while luxuries were imported more rapidly than ever. The returns of certain articles of domestic exports and imports, indicate the extent of this process as follows:—

	Imports.			Imports.	Exports.	
	Silks.	Wines.	Spirits.	Sugar.	Flour.	Provisions.
1831,	$5,932,243	$1,673,058	$1,037,737	$4,910,877	$10,461,728	$17,538,227
1832,	9,248,907	2,397,479	1,365,018	2,933,688	4,974,121	12,424,703
1833,	9,498,366	2,601,455	1,537,226	4,755,856	5,642,602	14,209,128
1834,	10,998,064	2,944,388	1,319,245	5,538,097	4,560,379	11,524,024
1835,	16,677,547	3,750,608	1,632,681	6,806,425	4,394,777	12,009,399
1836,	22,980,212	4,332,034	1,917,381	12,514,718	3,572,599	10,614.130
1837,	14,352,823	4,105,741	1,470,802	7,203,206	2,987,269	9,588,359
1838,	9,812,338	2,318,282	1,476,918	7,586,825	3,603,299	9,636.650
1839,	21,752,369			9,929,502		14,147,779
1840,	9,835,757			5,580,950		19,067,535

Thus, while the import of silk rose from less than $6,000,000 to nearly $23,000,000, and the four articles, including wine, spirits, and sugar, from $13,550,000 in 1831, to $41,850,000 in 1836, the export of provisions, notwithstanding the high prices, fell from $17,538,227 to $10,614,130. So great had been the decline in production, that in the last-named year, 1836, wheat was actually imported at $2 per bushel, from Russia, on credit, to feed land speculators in the west. The mania for land speculation was fed by bank bubbles, and large sums were drawn from the east as well as Europe, for the creation of banks west and south-west. The transmission of these sums was the means of credits by which goods were consumed. There were created in the period from 1830 to 1840, 577 banks, having an aggregate capital of $218,000,000. These banks were mostly started west and south-west, with eastern capital paid in subscription to the bank stock, and with state bonds issued in aid of the banks. Thus a stream of credit issued from London, which, aided by circumstances, poured over the Union, checking industry, exhausting capital, and raising prices. The harvests of England had been good for some years, and the importation of corn had ceased. As a consequence, exchanges were in favor of England, and the bank disposed to be liberal. It was so to the American houses in London. These houses were thus enabled to grant credits to United States importers of goods who made their purchases in Lancashire. The goods arriving in the United States, were sold to jobbers and through the auction houses at long credits, and these were payable at the local banks started all over the country. The quantity of goods thus sold was increased by the large fire in New York in December, 1835, by which it was estimated $18,000,000 worth of property was consumed. These

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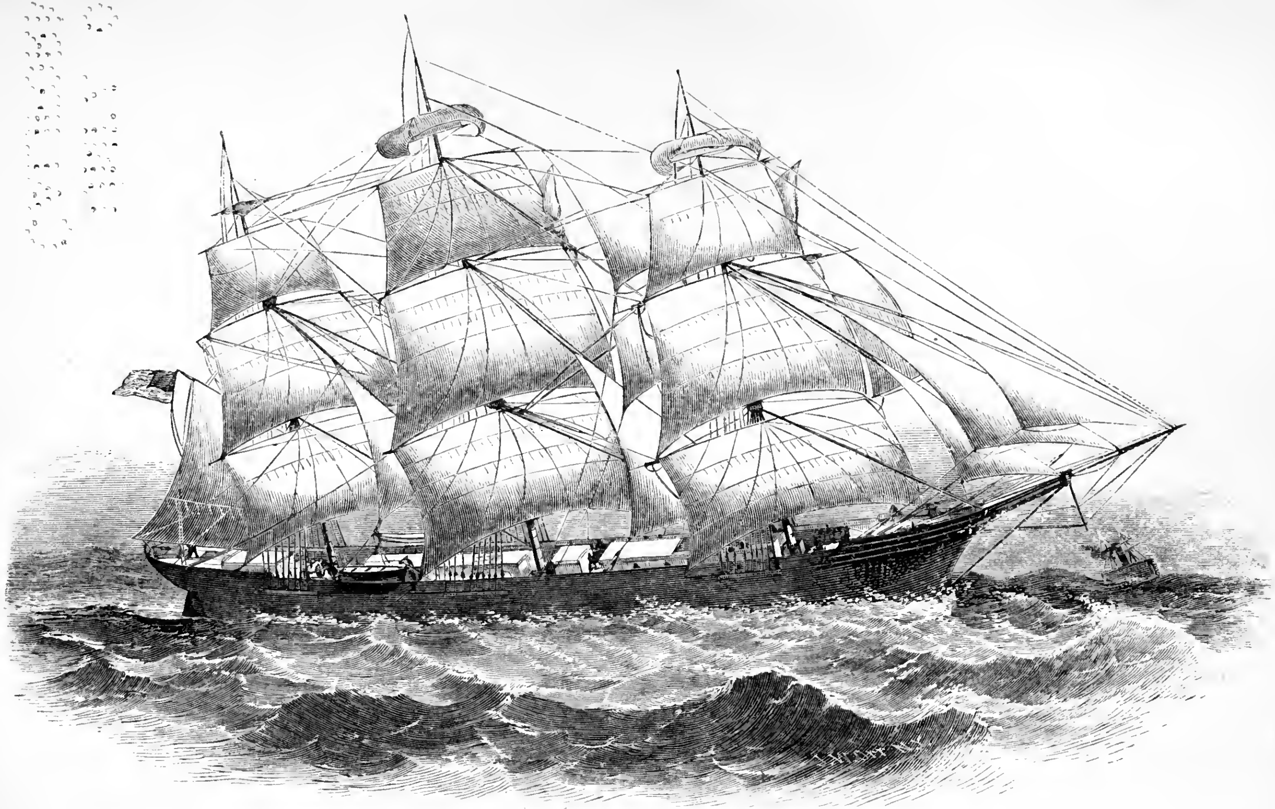

CLIPPER SHIP.

goods were replaced on credit, and the city rapidly rebuilt by the same means, adding much to the accumulating liabilities. At the same time, as we have seen, $200,000,000 were sent from the east to the west to start banks. These banks were also authorized to issue paper to circulate as money; and capital and circulation were loaned to those who purchased and consumed goods. Thus, while the city merchants were selling their goods to the dealers of the interior, on credit, the capitalists were sending money in the same direction, with which to start banks; these were to lend the dealers the means of taking up their notes. As long as this lasted, business was brisk; but it soon came to an end. The federal government had also been a party to the excitement, by selling its lands on credits to speculators, and the amount of these sales became enormous, when suddenly the government issued its famous "specie circular," by which the lands were to be paid cash in specie. This was the first blow to the credits. The government, determined to curtail all credits, had made peremptory demand upon France to pay the indemnity long since due. This payment took place, and was received at this juncture very opportunely in gold. The capital of England, which had been loaned so freely all over the world, began to run short. The harvests, also, which for so many years had sufficed for the national wants, suddenly failed, in 1836, and it became necessary to import corn for cash. This circumstance caused exchanges to run higher against England, and the bank began to contract. Its first notice was in August, 1836, to the American houses to curtail their credits. This was the signal for payment through the whole line of credits from the Bank of England to the western consumer of goods. The pressure became intense, and in May, 1837, every bank in the Union had suspended their payments. The three large American houses in London, known as the "three W's," Wildes, Wiggins, and Wilson, failed for many millions, and their assets consisted of the credits they had granted American importers. The latter stopped in great numbers, with assets due from dealers all over the country; and the latter stopped with large assets due from speculators who held land at paper prices, and who insisted that a return of paper inflation would enable them to pay. The banks of the interior had large sums due them from speculators who held land, as well as from shopkeepers who had trusted consumers. The shopkeepers had bought of the merchants in eastern markets, and had given notes payable at their local banks. Those notes were generally sent for collection through the city bank to its country corresponding bank, and on their maturity were met by a discount of the maker's note by the local bank. This mode of payment only transferred the debt from the merchants to the bank, and was possible only as long as the eastern bank did not claim the balance due it. When that was done, failure took place. A great struggle was made to restore that inflation, particularly by the United States Bank, which, with its southern and western dependents, felt that unless the debts contracted all over the country in an inflated currency, could be paid in a similar currency, they could not be paid at all. Public opinion was, however, bent on resumption, and January, 1839, it took place. The United States Bank sought to create foreign credits by obtaining state stocks on credit, and, by selling them in Europe, aid the exchanges. It also entered the cotton market as a monopolizing buyer. The institution, on the expiration of its United States charter, had obtained a new one from Pennsylvania. When it went into operation as a state institution, its old bills had been called in, and new ones issued. When it struggled to maintain its resumption in 1839, it had the boldness to exhume its old bills and pay them out for cotton at almost any price, which cotton was sent to its agents in Liverpool for sale, and against which to draw sterling bills, which it sold in New York for cash; thus forming a kiting operation. At the same time, it had obtained some $15,000,000 of state stocks from Mississippi, Michigan, Indiana, Illinois, and other states, on similar terms, and these were sent to London for sale; but not selling readily, they were pledged to cover bills drawn by the bank. All these plans were insufficient to sustain the institution under its load of debt, and it became evident that nothing short of a second general suspension of the banks could save it. This it undertook to bring about by selling in the New York market its bills on France and England to any amount, and drawing the proceeds from the New York banks in specie. This course was pursued through August, 1839; when, early in October, the news came that the bills so sold in New York on France had been protested. The bank then finally failed, and went into liquidation, when it was found that more than its whole capital had been lost. This event carried with it most of the banks in the country that had followed a similar policy. Liquidation then became general, and went on up to 1843, when the lowest point of credits was reached. The short harvests of England, that were the immediate cause of the explosion in 1837, were also the cause of a gradual restoration of sound prosperity in the United States, by reviving a demand for the products of land. This was the more readily done that the fictitious paper prices that prevented American farmers from competing with those of Europe, had disappeared with the bank stoppages. The farmers had nominally sold their produce well, but they had taken pay in bank paper, which the revulsion left valueless in their hands. The process of liquidation swept several hundred banks out of existence, but there remained an immense load of debt due by individuals, to relieve whom Congress, in 1841, passed a bankrupt law. The operation of the law relieved 39,000 persons, from debts to the amount of $441,000,000. The disasters involved the failure of several states, with an aggregate debt of $100,000,000. The banks that were liquidated had an aggregate capital of $200,000,000. Thus, the recorded losses were as follows:—

States	$100,000.000
Bankrupt debts	441,000.000
Bank capital	200,000,000
	$741,000,000

The debts that were settled without the intervention of the law, were supposed to be equal to those legally discharged, but the amount recorded is an enormous sum. In consequence of those disasters, many states, in revising their constitutions, forbade the authorization of more bank charters.

While speculation had thus run riot, during the ten years up to 1840, consuming the available capital of the country, the population had not failed to increase and extend itself over the face of the country. Many of the states had projected large works, for the construction of which they had contracted debts; and the expenditure upon the works had attracted laborers, who ultimately became settlers. The sales of public lands had been very large, but these had to a great extent been taken up by speculators, and this operation in some degree prevented actual settlement. All these lands were now pressing upon the market, and the distress in cities attending the subsidence of building and other employments, drove crowds upon farming lands, laying the foundation of future prosperity. During the speculative years, the commercial cities increased most rapidly; and with the revulsion, the agricultural states took the lead. The cotton culture had received a great impulse during the same period, by means of the banking credits. The old lands of the Atlantic states were capable of producing cotton at 6 cts. per lb., but it was found that the new lands of the Mississippi valley would produce it at a much less rate. The migration of planters with their hands then took place to the new lands of the west, and the means of so doing were supplied to a great extent by the state bonds issued in aid of banking capital. These institutions made loans to the planters on security of the crops. Under this spur, large tracts of land were got under cultivation, disastrously to the banks, but favorable to a large supply of cotton, of which the export became large.

The ten years, 1841 to 1850, thus opened under great depression. The receipts of the federal government, in consequence of the revulsion of trade in 1837, had fallen far behind its expenses, while the duties under the biennial reductions of the compromise tariff were approaching their lowest grade of 20 per cent., and it became necessary to restore the duties, in order to procure revenue. The utter failure of the United States Bank, of which a large portion of the stock was sent abroad; the failure of so many states, some of which repudiated their debts altogether; and the bankrupt law, which had expunged so large a volume of private debts, had produced so much discredit abroad, that a 6 per cent. stock of the federal government was utterly unsaleable, notwithstanding that in 1835 the last dollar of the old national debt had been paid in full. Congress, therefore, in 1841, passed an act levying 20 per cent. duties on a long list of articles before free, and in 1842 raised the general level of duties. At this juncture there had been no plan of settling the state debts, and efforts to restore the national bank failed. Amid these adverse circumstances, however, industry revived from the ruins of speculation, and the foreign commerce was placed upon a more liberal footing. The English government, taught by the experience of the past, had decided to relieve commerce from many restrictions, and in 1842 modified her corn laws, and admitted provisions, which had previously been prohibited, to entry, at comparatively low duties. The first opening of the trade to provisions—cheese, butter, etc.—was not at once successful; many attempts were required, and much perseverance, before the American articles became properly prepared for and appreciated in the English markets. Success, however, ultimately attended the trade, and a large opening to western produce was made, that has proved of a permanent nature. This circumstance gave an impulse to commerce, which was greatly accelerated by the failure of the potato crops in 1845 and 1846. That event was of so grave a nature as to lead to the abrogation of the corn laws altogether, and also to a suspension of the navigation laws in England, France, Holland, and Belgium, for the reason that the shipping was inadequate to the transportation of food. The course of commerce during the ten years, 1841 to 1850, was as follows:—

	Exports.		Total.	Imports.	Of those amounts. Specie.	
	Domestic.	Foreign.			Exports.	Imports.
1841,	$106,382,723	$15,469,081	$121,851,804	$127,946,177	$10,034,332	$4,988,633
1842,	92,969,996	11,721,538	104,691,534	100,162,087	4,813,539	4,087,016
1843,	77,793,783	6,552,697	84,346,480	64,753,799	1,520,791	22,390,559
1844,	99,715,179	11,484,867	111,200,046	108,435,035	5,454,214	5,830,429
1845,	99,299,776	15,346,830	114,646,606	117,254,564	8,608,495	4,070,242
1846,	102,141,893	11,346,623	113,488,516	121,691,797	3,905,268	3,777,732
1847,	150,637,464	8,011,158	158,648,622	146,545,638	1,907,024	24,121,289
1848,	132,904,121	21,132,315	154,036,436	154,998,928	15,841,616	6,360,224
1849,	132,666,955	15,088,865	147,755,820	147,857,439	5,404,648	6,651.240
1850,	136,946,912	14,951,806	151,898,718	178,138,318	7,522,994	4,628,792
	$1,131,458,802	$131,105,780	$1,262,564,582	$1,267,783,782	$65,012,921	$86,906,156

In these aggregates we have the reverse of the trade during the ten years to 1840, since the imports scarcely exceeded the exports, including specie; and exclusive of specie, there was an excess of $14,677,036 exports over imports. The exports of domestic produce had become very considerable. The large breadth of land that had been brought under cotton, and the rapid settlement of farm lands after the revulsion, had laid the foundation for an extended production, while the means of transportation had been so much increased, as to equalize prices at a lower level on the seaboard, and supply a far larger quantity for shipment than had been possible before. Nevertheless, the demand became so urgent in the three years ending with 1847, as to tax every means of transportation to its utmost capacity, and to carry freights to an inordinate height, notwithstanding the suspension of the navigation laws in England.

The demand for food abroad had superseded that for all others to a considerable extent. The necessity of carrying food raised the freights so high, that other materials would not pay to carry; the more so, that it is a well-known effect of dear food, to lessen the purchase of clothing and other articles. Hence, when the market for cloths was lowest, the freight on the materials was highest. The condition of Ireland made it necessary to introduce Indian corn as a substitute for potatoes. This was by great efforts accomplished in a degree, and thereby a permanent market made for corn. That article of food is, however, very far from being popular with the people. The effect of the famine, joined to the general influence of the change of English policy, was to carry up the domestic exports from $106,000,000 in 1841 to $150,000,000 in 1847. This increase was almost entirely due to breadstuffs and provisions, which reached a value of $68,761,921 in 1847, being nearly one-half the whole domestic exports for that year. The large sale of western produce so inaugurated gave an unusual stimulus to the activity of internal trade, and to the value of western lands and credits; and the foundation was thus laid for the movement which so singularly culminated in 1857.

While the famine demand of 1846 caused so large an export of American produce, in return for which merchandise was necessarily to be received, the federal government recovered from the embarrassments induced by the revulsion. It was, however, still embarrassed, but this time with a surplus, rather than a revenue; and in 1846 the tariff was again revised, so as to reduce the general average of duties some 7 per cent. The principle of protection was finally disavowed, and that of revenue only admitted as a rule of action. This reduction of duties naturally gave a spur to importation, at a moment when the exports were very large. There was at that time, however, no speculative action in this country, nor much inflation of credit, by which large quantities of goods could be suddenly placed; and the sales of produce were so prompt, as to throw a large cash balance in favor of the country: hence, of the imports of 1847, $24,121,289 were in specie—the largest amount ever imported from abroad in one year—a fact which imparted much activity to trade; and in the following year, when the exports of farm produce declined, $15,841,616 of that specie returned whence it came. That re-export was, however, much stimulated by the extraordinary political convulsions that overtook Europe in February, 1848. The peculiar theories avowed by the successful revolutionists in relation to property, which was declared to be "robbery," greatly alarmed the public mind, and tended to make French property utterly unsaleable for the moment. The consequence was the most active shipment of money, silver particularly, with which to purchase the cheap goods of France. The panic soon passed, but depression continued under the provisional government, which, in order to encourage industry and employ workpeople, gave the manufacturers orders for goods, and allowed a drawback of 10 per cent. on merchandise exported out of France. This state of affairs caused the importation thence into the United States to be larger. Among the goods so imported was a quantity of Lyons silk, which had been ordered by the government with the view to employ the operatives. As the government had given no directions as to colors, the whole was made up, to the extent of 10,000,000f., in tricolor. A large portion of this was bought by a New York house, and gentlemen's coats for a long time had tricolor sleeve linings. With the institution of the new government in France, confidence returned, and new branches of trade were opened with France, as well as other countries of the continent, which began to be rivals for the American trade. The Germans and Belgians had so far advanced in the production of certain manufactures, as to dispute the French and English pretensions to supply the United States, and credits began once more to form the medium of extended sales of foreign merchandise. The competition was now, however, far more severe with the home manufactures, which were so far advanced as not only to maintain themselves against new competition, but to drive out those which had long held the field in particular goods. The balance of the ten years' business was, notwithstanding, very small. The period closed, however, with one of the most remarkable discoveries of modern times. We allude to the gold discoveries in California. The war, which carried Americans to California, gave them the opportunity to discover, and the "dust" was soon detected in the neighborhood of Captain Sutter's fort. The intelligence was received with great incredulity. The learned said the location and character of the gold was contrary to all precedent; but soon the metal came, and was satisfactorily assayed. Each successive arrival brought stronger confirmation, and about $9,000,000 worth was received in 1850. Since then, the amount received has been nearly $50,000,000 worth per annum.

The decade ending with 1860 was one of the most extraordinary in the history of commerce. It commenced with a confirmation of the astounding gold discoveries in California, followed by as important a discovery of the same nature in Australia. These events deeply stirred the commercial mind throughout the world, coming, as they did, at the moment when the political difficulties of Europe had settled down in a manner to win public confidence in continued peace and security. The discovery of such large supplies of gold induced the general belief that the metal would depreciate, as compared with commodities and silver, and that the depreciation would manifest itself in a rise in prices of all industrial products. Serious apprehensions were entertained through this superficial view of the case, particularly in Europe, where a large class are rich on fixed annuities, or in the receipt of a fixed amount of money per annum. If all property was to rise in value, leaving the amount of rents the same in money, it would be equivalent to ruining creditors for the benefit of debtors. Thus, if a farmer had mortgaged his farm for say $5,000, the annual interest at 6 per ct. would be $300; at an average price of $1 per bushel for wheat, it would require 300 bushels per annum to pay the interest, and ultimately 5,000 bushels to pay the principal. If the mortgage run five years, he would be required to give, altogether, 1,500 bushels for interest, and 5,000 bushels for principal—together, 6,500 bushels. If, through the influx of gold, prices came permanently to be $2 for wheat, it would at once reduce the quantity per annum that he would have to pay to 150 bushels, and the ultimate amount for principal to 2,500: in other words, he would save half his grain, at the expense of his creditor, and the money value of his farm would be doubled. This would be of no benefit to him, beyond the discharge of his debt, because the value of all that he had to purchase would rise in the same proportion. All creditors would lose half that was due them. This was an important consideration for the debt-covered countries of Europe, where so large a portion of the people are creditors of the governments. In Holland, to avoid this, they passed a law doing away with gold as a legal tender, and making silver the only medium of payment, under the impression that silver would rise in the same proportion as other commodities. In the United States, the same impressions were entertained, but the event showed that the fears were groundless. But this view naturally stimulated the production of commodities that were to rise in value, and industry became unusually active, since all classes wished to profit by the anticipated rise. Above all, commercial enterprise and migration tended strongly to the gold countries, the direct source of the anticipated benefits. A vast amount of capital was sent to both California and Australia. The United States shipped to the latter country, in 1853, a large amount of goods; and to California the drain continued on a very extensive scale, with small remuneration to the shippers. The production of California gold has been $600,000,000, and it has cost an equal amount of capital. In other words, there has been no profit on the production. The capital that it cost exists in the gold itself, and in the cities and property of California. From nearly all nations the capital that now constitutes the wealth of California, flowed thither in exchange for the gold. While this great enterprise of gold digging has been in direct prosecution, another equally as extensive was undertaken, viz.: the construction of 20,000 miles of railroads, at a cost of $720,000,000. The capital for the enterprise was drawn from Europe, in the shape of money and iron, and from the eastern states, in subscriptions to stocks and bonds. These have not all turned out well, but the capital expended remains in the shape of railroads that are now ready and efficient means of developing future trade. The speculative investments in lands and western property also ran to an inordinate extent in the same period, and nearly $500,000,000, on the best estimates, took this direction, following the trail of American migration, from the eastern to the western states, impelled by the large immigration from Europe. As we have seen elsewhere, 2,518,054 persons arrived from abroad in the period here mentioned. These persons brought with them, at the usual estimate of $100 per head, $251,805,400 in capital, as money and goods. A large portion of this was expended in transportation expenses and in settling new homes. We have, then, the following estimated items of extraordinary expenditures in the ten years, 1850 to 1860:—

Capital sent to California	$600,000,000
" spent in 20,000 miles of railroad	720,000,000
" expended in land operations	500,000,000
" expended by newly-arrived immigrants at fifty dollars each	125,900,000
Total extraordinary expenditures	$1,945,900,000

The 300,000 persons who went to California to consume the capital sent thither, returned $600,000,000 worth of gold, of which a large portion went to Europe, whence goods came. The railroad expenditure results in effective investments in trade. The land investments are not "active," for the present, but are not entirely lost. The immigrants are mostly at work, producing capital in new states.

While these large expenditures took place in the United States, Europe incurred a heavy loss in the failure of her corn harvests, that she was obliged to make good from the corn crops of the United States. She also incurred a heavy expense in the Russian war, which returned very little for the investment, but which required a larger supply of American produce, particularly pork, whiskey, but of gold, above all. The loss of her vine crops, also, brought American whiskey in demand, as a substitute, and thereby, possibly, cut off permanently a supply of genuine grape liquors for the United States. Those events caused a larger demand for produce, at a time when the expenditures for gold, rails, and land were so active. It is not a matter of surprise, under all these circumstances, that the gold diggers, road builders, speculators, and emigrants, so well supplied with money, should require a larger quantity of goods, both manufactured and imported, while similar activity in Europe, in addition to war and short crops, demanded more raw materials. The import and export table, therefore, shows higher figures than ever before, as follows:—

	Exports.		Total.	Imports.	Of these amounts. Specie.	
	Domestic.	Foreign.			Exports.	Imports.
1851,	$196,689,718	$21,698,293	$218,388,011	$216,224,932	$29,472,752	$5,453,592
1852,	192,368,984	17,289,382	209,658,366	212,945,442	42,674,135	5,505,044
1853,	213,417,697	17,558,460	230,976,157	267,978,647	27,486,875	4,201,382
1854,	253,390,870	24,850,194	278,241,064	304,562,381	41,422,423	6,958,184
1855,	246,708,553	28,448,293	275,156,846	261,468,520	56,347,343	3,659,812
1856,	310,586,330	16,378,578	326,964,908	314,639,942	45,745,485	4,207,632
1857,	338,985,065	23,975,617	362,960,682	360,890,141	69,136,922	12,461,799
1858,	293,758,279	30,886,142	324,644,421	282,613,150	52,633,147	19,274,496
1859,	335,894,385	20,865,077	356,759,462	338,768,130	63,887,411	7,434,789
1860,	385,000,000	25,000,000	410,000,000	444,500,000	78,500,000	7,000,000
	$2,766,799,881	$226,950,036	$2,993,749,917	$3,004,591,285	$507,306,493	$76,156,730

The imports rose steadily to over $300,000,000 in 1854, under the first Australian and Californian excitement, and took larger dimensions as the railroad operations progressed. Railroad iron figured largely in the amount in exchange for bonds. The imports of silks rose from $13,731,000, in 1850, to $30,636,000. The most remarkable rise in the importation was, however, in sugar, which, from $11,000,000, rose to nearly $55,000,000, in 1857, in consequence of the failure of the Louisiana crop, at a moment of very active demand. So high a figure to be paid for sugar at a critical moment went far to disturb the exchanges, and aid the panic of 1857. We find that the whole amount of importations for the ten years reached $3,004,591,285, exceeding, by $1,736,807,503, the importations of the previous ten years. This excess of expenditure corresponds with the estimated amount of capital expended for extraordinary purposes, since a considerable portion of the expenditures was applied to domestic manufactures. The operation of the treaty with Canada produced a somewhat larger receipt of foreign goods. These also swelled proportionately the aggregate imports. The excitement manifest in the United States in regard to gold and railroads, was also present in England and Europe. The production of manufactured wares to send to the gold countries, and to avail of the local demand for goods, required more raw material, at a moment when the short harvests and war enterprise enhanced general wants. The effect of these was equivalent to a large transfer of capital to the west, not only from Europe, but also from those eastern states that are usually buyers of food. Thus the wheat crop of the United States in 1850, by census, was equal to 22,000,000 bbls of flour. The average export price in that year was $5, giving to the crop a value of $110,000,000. In 1855, the average price was $10, giving a value of $110,000,000 greater. This sum was taken out of the pockets of the food buyers, to the profit of the food sellers, at the moment when the latter were enjoying so large an expenditure for other purposes. The export value of agriculture rose from $24,309,210, in 1850, to $77,686,455, in 1856. The great activity of the years ending with 1857 was, then, due to heavy expenditure of capital at the west simultaneously with profitable sales of its crops. The panic of that year caused not only a total cessation of the expenditure, but an earnest desire to recover capital invested at the west. Railroad building stopped, migration ceased, speculation was at an end, and, at the same moment, European crops being good, prices of produce fell in face of very poor western harvests. With this combination of circumstances, the decade closed under a sort of paralysis. There was no exhaustion of capital, since it was apparently more abundant and cheaper at the great eastern reservoirs than ever before; but the stimulus to its employment was gone, and it accumulated in first hands. The broad lands of the west are well settled; they are well supplied with means of communication, and are ready to throw out limitless supplies of capital, when the wheel is once more in motion.

If we bring together by recapitulation the aggregates of the seven decades since the formation of the government, we shall have a very interesting synopsis of the national progress in respect of commerce. The treasury department has also caused to be prepared, with great care, the annual value of agricultural products and manufacturing industry at corresponding periods. If we add them to the table, it will be so much the more complete, as follows:—

	Exports for periods of ten years. Domestic.	Foreign.	Total.	Imports.	Manufactures. Annual value.	Agriculture. Annual value.
1800,	$293,634,645	$191,344,293	$484,968,938	$591,845,454	..	..
1810,	383,401,077	372,536,294	755,937,371	927,663,500	$145,385,906	..
1820,	462,701,288	127,190,714	589,892,002	688,120,347	62,766,385	..
1830,	536,104,918	229,643,834	765,748,752	798,633,427	111,645,466	..
1840,	892,889,909	199,451,994	1,092,351,903	1,302,476,084	483,278,215	$621,163,977
1850,	1,131,458,801	129,105,782	1,260,564,583	1,267,783,782	1,055,595,899	994,093,842
1860,	2,766,799,881	226,950,036	2,993,749,917	3,004,591,285	2,000,000,000	1,910,000,000
	$6,466,990,519	$1,476,222,947	$7,943,203,466	$8,581,113,879		

This table, mostly official, gives the extraordinary results of a nation's industry and commerce in a period of seventy years. The growth has such an accumulative force, as to be very surprising. In the item of re-exports of foreign goods, the trade never recovered the figures they touched at the period when American vessels did the carrying trade for fighting Europe. Latterly, however, under the warehouse system of the United States, and the reciprocity treaty with the British provinces, some increase in that respect has taken place, the more so that steam and extended relations are opening to the United States a larger share of the South American trade, tending ultimately to give the United States the preponderating influence. The exports of domestic goods grow rapidly under the more extended demand for cotton throughout the world, and of which the United States is the only source of supply. All other cotton countries, India particularly, require more cotton in the shape of goods than they supply in the raw state. The demand for cotton clothing increases in the double ratio of greater numbers and greater wealth throughout the world. Cotton is, however, not the only article which increases in export value. The tables show us that gold has figured in ten years for $507,000,000 as an article of export, and will probably never be less. The agricultural resources of this country have just begun to be developed. Up to 1842 there was, under the restrictive systems of Europe, comparatively no market for American farm produce. In that year the statesmen of England recognized the fact that the demands of English workpeople for food had outgrown the ability of the British islands to supply it on terms as low as it could be bought elsewhere. They therefore removed the prohibition upon the import of cattle and provisions, and reduced the duty on grain. This opened a market for American produce, which grew rapidly. The circumstances of the famine of 1846 justified the wisdom of the English government, and led to the entire removal of the corn duties in 1849. That example was followed by France and her neighbors. France, however, restored the duties in 1859. The liberal legislation of England, the famine, the wars, and speculations of Europe, have gradually extended the demand for American produce, at the time when a very broad field had been opened to supply that demand. This we may illustrate. The area of Great Britain's industry—hills, lakes, vales, and valleys—is 53,760,000 acres; and the population in 1812, when she made war on us, was 11,991,107. Now we find from the table of land sales, elsewhere given, that the federal government has sold in the last twenty years selected farm lands to the extent of 68,655,203 acres, and has given to railroads 42,000,000 acres more of selected lands, making 110,000,000 acres that have mostly passed into the hands of settlers. This is a surface double the whole area of Great Britain; and the population on that area has increased, in the same time, 11,374,595, or a number nearly as large as that of Great Britain in 1812. There have been built on that area in the last ten years, and are now in operation, 20,000 miles of railroads, crossing every part of it, and bringing every farm within reach of a market. The speculators and road builders, who ate up the produce of that area, during the process of road construction, have vanished, and the whole is now offered by a hundred channels to the best bidders of Europe. We have said that corn is the settler's capital, and that corn, in the shape of grain, pork, and whiskey, is the staple export of a new country. The corn product of 1855, per state reports, was 600,000,000 bushels. The number of hogs packed that year was 2,489,050, averaging 200 lbs. each, and giving a total weight of 497,900,000 lbs. of pork. In that year the weight of pork exported was 164,374,681 lbs. Of this amount, 58,526,683 lbs. went to England, or 12 per cent. of the whole production, as the result of her more liberal policy of 1842.

QUANTITIES OF CORN AND PORK EXPORTED TO GREAT BRITAIN.

	Pork. barrels.	Hams and bacon. lbs.	Lard. lbs.	Corn. bushels.	Wheat. bushels.	Flour. barrels.
1840,	..	1,061	..	104,341	615,972	620,919
1841,	4,769	26,394	444,305	12,548	119,854	208,984
1842,	6,900	160,274	3,430,732	123,665	143,300	208,024
1847,	73,940	14,367,105	17,798,770	15,526,525	4,399,951	2,457,076
1848,	87,760	29,218,462	27,283,741	5,062,220	2,034,704	958,744
1849,	111,385	53,150,465	21,388,265	12,392,242	608,661	953,815
1855,	64,663	30,240,161	15,349,922	5,935,284	8,036,665	2,026,121
1858,	13,578	15,365,524	10,288,474	3,215,198	8,926,196	3,512,169

The cotton, tobacco, and rice of the south, the farm produce of the west, and the gold of California, each contributed an increasing proportion to the general exports; but manufactures have also come to figure largely in the general aggregate.

The following table gives the proportions in which the general heads of exports have contributed from time to time to the result, since the formation of the government; and also the total exports, including all articles:—

HEADS OF EXPORTS.

	Cotton.	Tobacco and rice.	Flour and provisions.	Manufactures.	United States specie.	Total of all domestic exports.
1790,	$42,285	$6,103,363	$5,991,171	..	..	$19,666,000
1803,	7,920,000	8,664,000	15,050,000	$2,000,000	..	42,205,961
1807,	14,232,000	7,783,000	15,706,000	2,309,000	..	48,699,592
1816,	24,106,000	15,187,880	20,587,376	2,331,000	..	64,781,896
1821,	20,157,484	7,143,349	12,341,360	2,752,631	$10,478,059	43,671,894
1831,	31,724,682	6,908,655	12,424,701	5,086,890	9,014,931	61,277,057
1836,	71,284,925	12,607,390	9,588,359	6,107,528	345,738	106,916,680
1842,	47,593,464	11,448,142	16,902,876	7,102,101	1,172,077	92,969,996
1847,	53,415,848	10,848,982	68,701,921	10,351,364	2,620	150,637,464
1851,	112,315,317	11,390,148	21,948,651	20,136,967	18,069,580	196,689,718
1854,	93,596,220	12,182,204	65,941,323	26,849,411	38,234,566	253,390,870
1859,	161,434,923	23,281,186	37,987,395	32,471,927	60,110,000	335,894,385

These general heads represent all parts of the Union—cotton and tobacco in the south, flour and provisions in the west, manufactures in the east, and gold in the Pacific states. It is difficult to see any great difference in the prosperity which may attend each in the future. The south is most secure in its market, holding, as it does, an absolute monopoly of a raw material, which is indispensable to the industry of 5,000,000 people at home and abroad, without which $500,000,000 employed in manufactures would be valueless, and without which a large portion of the clothing of civilized man would fall short. The peril of this position to manufacturers, operatives, and merchants is apparent to statesmen, and the utmost efforts are vainly made to find a remedy. The greater the exertion used, the more dependent are the manufacturers on the south. India was long the hope of England, but there are 120,000,000 persons in India whose scanty hand-spun clothing is composed of cotton. Every effort to improve their condition, and to induce a larger culture of cotton, has but one result—viz.: to create a larger demand for cotton *machine* clothing from them; and the dependence upon the United States is the greater. The import of cotton from India has been the cry for thirty years. What is the result? English official returns give the following figures for 1859:—

		lbs.
Import of raw cotton from India, 1859,		192,330,880
Export of cotton goods to India,	"	193,603,270
Excess of cotton sent to India,..		1,272,390

The field for the extension of the machine goods in China and India is limited only by the means of the people to buy. The more those means are increased, the greater is the demand for the raw material; and the value of cotton rises annually on that basis. The

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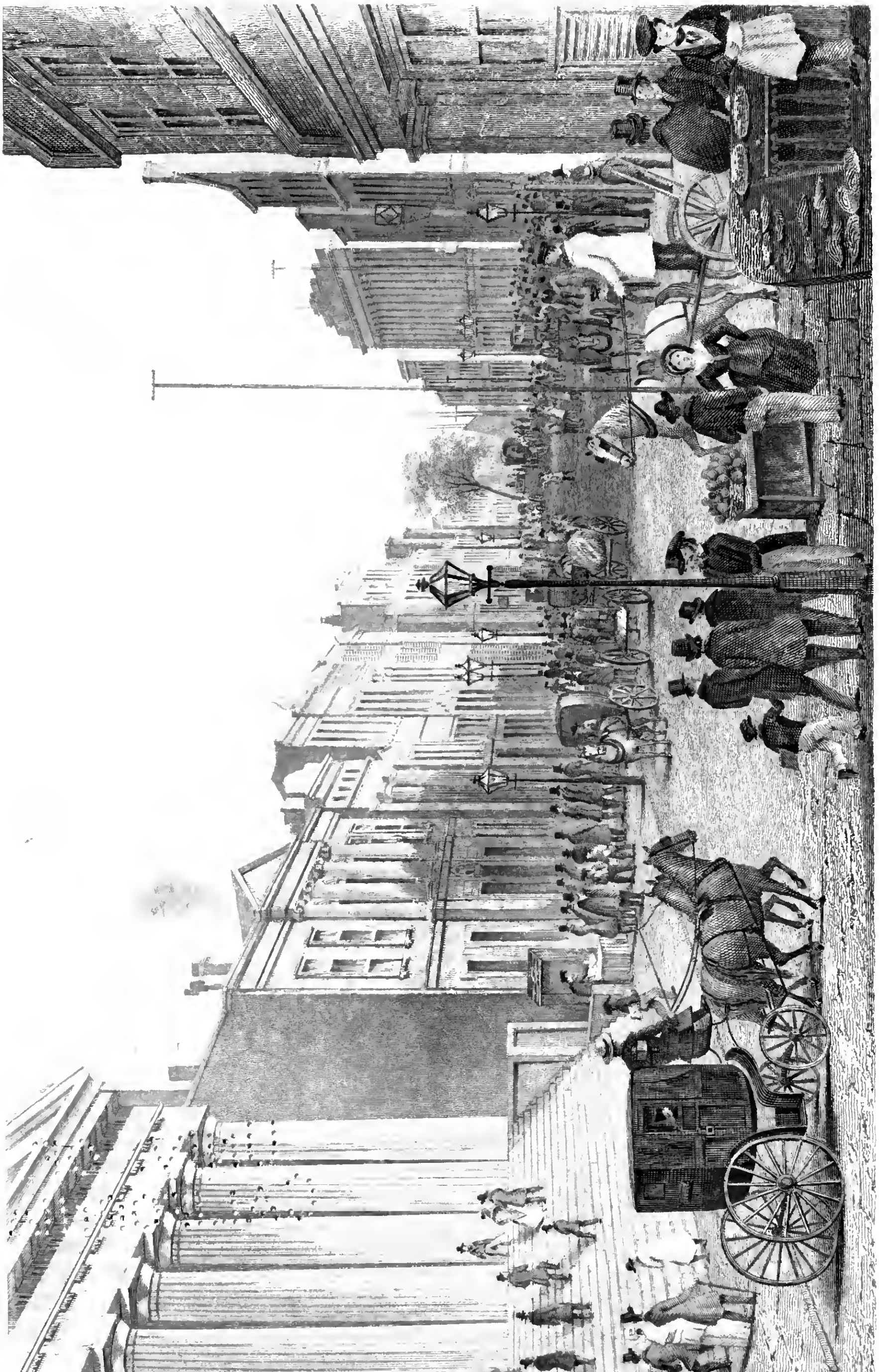


productions of the west are more exposed to rivalry than those of the south; but since the formation of the present government, England and western Europe, from being large food exporters, have come, by the growth of manufactures, to be large food importers, and their supplies are drawn more steadily from eastern Europe. Those resources are coming to be narrowed, for the same reason. The United States, on the other hand, with their immense plains and growing means of communication, are assuming a more regular position as a source of supply, which will annually swell the exports. The column of manufactures is a gratifying evidence that the colonial position is at last overcome; that the requisite skill and capital for manufacturing against all rivalry are at last acquired, and that American industry now finds sale in the markets of the world. The South American countries offer the legitimate opening for that sale. The gold of California is always a merchantable commodity, and must sell under all circumstances.

The internal production of wares has increased in a ratio more rapid than even the importation of them. The annual production rose from 62,000,000 in 1820 to 1,055,000,000 in 1850, as manifest in the column of manufactures reported in the above table. In order to manufacture to advantage, something besides a law is necessary. There must be capital and a supply of skilled labor. Those, in the long race of a thousand years, grew up in England, where the system of manufactures is mostly individual. A man learns his trade, and devotes himself to the production of an article, or a part of an article, and by the constant exercise of intelligence and economy, he comes finally to perfect it in the cheapest manner. These productions are combined by other parties into merchantable commodities. In the United States it was a consequence of the prohibition under the imperial government, that these individual industries did not grow up. There were no factories in which young artisans were learning a business, and when separation took place there was no experienced labor. When, therefore, the capital that had been earned in commerce was suddenly applied to manufactures, the only mode of proceeding was the corporate mode; the capital was subscribed by a company, and the works directed by persons often of little practical experience. Under such a system, progress was difficult. With the large immigration of skilled workmen from abroad, however, a greater breadth has been given to all branches, and progress is very rapid, the more so that the general prosperity enables consumers to extend the best possible encouragement to producers, by buying their wares. The chief consumers of these have been the agriculturists, and the interchange of manufactures for agriculture forms the chief trade of the whole country. In 1840, per census reports, the value of manufactures was $483,278,215, and of agriculture, $621,163,977; the imports were $107,000,000. The interchange of these commodities, at first hands, would involve an aggregate trade of $1,211,442,192. The same items for 1850 would give an aggregate of $2,305,343,446—nearly double the amount. But the raw material passes through many hands before it reaches the manufacturer, and his wares pass through a succession of merchants, jobbers, and retailers before they are finally consumed. Grain passes through many hands before it is finally eaten. The grinding of flour is one of the largest manufactures of the country, turning out in 1850, $136,056,736 per annum. It is probable that each of the articles which form the aggregate of the mining, manufactures, agriculture, and imports, is sold four or five times before it is finally consumed. This would give an aggregate trade of $10,000,000,000 per annum, in 1850, against $6,000,000,000 in 1840, or an average of $2,000 per annum for every effective man in the country. This seems very large. If, however, we have recourse to the circular of the leading mercantile agency in New York, whose ramifications extend over the Union, we find they report upon their books, 250,000 firms in business in 1857—the panic year; of these firms in business 4,932 failed in 1857, for an aggregate of $291,750,000 of liabilities, or an average of $58,350 each. If the average of all the persons doing business was only $50,000, or $8,350 each less than those who failed, then the aggregate amount of credits must have been $12,500,000,000 in 1857. The firms on the books do not include the retailers to any great extent. Thus the liabilities of 1857 far exceed the estimate we made on the figures of 1850. Again, the bank discounts in the past year are $637,183,899; these purport to represent bills not more than sixty days to run. The average of some of the largest city banks is fifty-four days; at sixty days the amount of discounts for a year would be, in round numbers, $4,000,000,000; and the exchanges at the New York clearing-house, as we see in another chapter, are over $8,000,000,000 per annum. These figures give some idea of the vastness of that immense traffic, which consists in the interchange of the products of industry. In 1840, the active bank loans were $278,000,000, which, at the same average time, would give $1,668,000,000 of discounts for the year, which holds about the same. In 1850, the loans were $413,756,759, which would give an aggregate discount for the year of $2,484,000,000. Comparing these aggregates for several years, we have results as follows:—

	Annual productions.	Annual transactions.	Bank discounts.
1840,	$1,211,442,192	$6,055,000,000	$1,668,000,000
1850,	2,305,343,446	11,525,000,000	2,484,000,000
1860,	4,444,500,000	22,222,500,000	3,943,003,000

We have, then, the fact that the national trade doubled in the ten years ending with 1850, as a consequence of the increased productions of industry; and the best data give the same general results for the decade now closing. These large figures, astonishing as they seem, are not out of proportion to the immense growth of the country in breadth and numbers.

The broad surface of the Union, between the Atlantic and the Mississippi river, is now covered with states. The thirteen colonies that emerged from a war, eighty years since, have grown to be thirty-three states, with a land value of, in round numbers, $9,317,000,000. All this vast territory is now productive, yielding its annual returns, and giving a productive annual capital beyond any thing the world has hitherto witnessed.

The following table gives the states in the order of their admission into the Union, the area in acres, the population of the old states in 1790, and the population and land valuation of each state in 1850, according to United States census; also the same figures from the state censuses made nearest to 1860:—

GROWTH OF THE UNITED STATES.

	Date of admission.	Area in acres.	1790. Population.	1790. Valuation.	1850. Population.	1850. Valuation.	Nearest to 1860. Population.	Nearest to 1860. Valuation.
Delaware	1787	1,356,800	59,096	4,053,238	91,532	15,896,870	112,216	30,466,924
Pennsylvania	1787	30,080,000	434,373	72,824,252	2,311,786	800,275,851	2,906,115	568,770,234
New Jersey	1787	4,384,640	184,139	27,287,981	489,555	153,251,619	672,035	179,150,000
Georgia	1783	37,120,000	82,548	10,263 506	906,185	121,619,729	1,057,286	337,969,471
Connecticut	1788	3,040,000	238,141	40,163,955	370,792	119,088,672	460,147	211,187,683
Massachusetts	1788	4,640,000	378,717	59,441,642	994,514	551,100,824	1,231,066	597,936,995
Maryland	1788	7,040,000	319,728	21,634,004	583,034	139,026,601	687,049	255,477,588
South Carolina	1788	17,920,000	249,073	12,450,720	668,507	105,737,492	703,708	214,101,201
Rhode Island	1788	763,000	69,110	8,082,355	147,545	77,758,974	174,620	111,175,174
New Hampshire	1788	5,139,200	141,899	19,028,108	317,976	92,251,596	326,073	103,804,326
Virginia	1788	39,265,280	748,308	59,976,860	1,421,661	252,105,824	1,596,318	730,817,653
New York	1788	29,440,000	340,120	74,885,075	3,097,394	715,369,038	3,880,735	1,404,907,679
North Carolina	1789	29,120,000	393,751	27,909,479	869,039	71,702,740	992,622	271,781,101
District of Columbia	1790	32,000	..	..	51,687	14,409,413	75,080	20,271,000
Vermont	1791	5,796,000	85,416	15 165,484	314,120	72,980,483	315,098	89,136,354
Kentucky	1792	24,115,200	73,077	20,208,325	982,405	177,013,407	1,155,684	334,770,701
Tennessee	1796	28,160,000	35,791	5,847,662	1,002,717	107,981,793	1,109,801	266,249,384
Total old states		267,412,120	3,833,287	479,282,646	14,620,449	$3,287,570,916	17,455,653	$5,727,973,443
Ohio	1802	25,576,960	..	..	1,980,329	433,872,632	2,339,502	840,800,031
Louisiana	1812	29,715,840	..	..	517,762	176,623,654	708,002	378,911,905
Indiana	1816	21,637,760	..	..	988,416	152,870,399	1,350,428	318,204,964
Mississippi	1817	30,174,080	..	..	606,526	85,901,204	791,305	161,747,586
Illinois	1818	35,459,200	..	..	851,470	114,782,645	1,711,951	407,477,367
Alabama	1819	32,462,080	..	..	771,623	98,870,118	964,201	201,100,100
Maine	1820	22,400,000	96,540	..	583,169	96,799,513	628,279	162,472,914
Missouri	1821	43,123,200	..	..	682,044	86,802,101	1,182,112	274,965,164
Arkansas	1836	33,406,720	..	..	209,897	20,372,101	435,450	53,255,711
Michigan	1837	35,995,520	..	..	397,654	30,877,223	749 113	120,362,474
Florida	1845	37,931,520	..	..	87,445	10,924,107	140,425	22,210,915
Texas	1815	152,043,520	..	..	212,592	30,149,671	609,215	138,722,433
Iowa	1846	35,155,200	..	..	192,214	23,714,6[illegible]8	674,948	197,223,350
Wisconsin	1848	34,511,360	..	..	305,391	26,715,525	775,881	152,537,700
California	1850	120,947,840	..	..	92,597	21,923,173	379,994	131,306,269
Minnesota	1857	90,774,960	..	..	6,077	282,088	173,855	781,101
Total new states		781,285,760			8,485,206	1,411,460,792	13,609,561	8,562,079,934
Grand total		1,048,021,890	3,929,827	$479,282,646	23,105,655	$4,699,031,708	31,065,214	$9,817,692,261

In addition to these, New Mexico had, in 1850, 61,547; Oregon, 13,294; Utah, 11,380. The official United States census for 1860 will change the figures of the states somewhat. The aggregate is 31,429,891.

CHAPTER III.

SHIPS—TONNAGE—NAVIGATION LAWS.

The appearance of the United States as a nation was fraught with the most extraordinary results in respect to the condition, policy, and governments of Europe, but in none greater than in respect of navigation. From the moment that the stars and stripes floated from the mast-head of a merchantman, a revolution was commenced which has not yet ceased its influence upon the commerce of the world. Up to that time, England had gradually attained the supremacy of the seas. The Dutch, who had fought a steady battle with the ocean, until they had driven it back and fortified their country by dykes from its invasion, had earned a right to rule; which, by their energy, they did for a time. Their country was small, however, and produced but little: hence, there was no room to support commerce in the face of the power of England. Great Britain is an island of great productive power, although but little larger than New York. Its coast is indented on all sides with good harbors; and from which side soever the wind blows, it is fair for some of her vessels to arrive, and others to depart. A sea-girt population is necessarily a nautical population. The English were peculiarly fitted for sea adventure; and with such advantages, added to their skill in building, they could not fail to acquire ascendancy upon the ocean, which their large population maintained and fed by planting colonies in all parts of the world. When the commerce of England had well grown, as a consequence of these advantages, her government, in the hands of Cromwell, sought to increase it by enacting the famous "navigation law," which was popular, because it professed to give England the supremacy of the ocean. The principle of the law was, that no goods should be imported into England from Asia, Africa, or America, except in British vessels; that goods imported from Europe in European vessels should pay more than if imported in British vessels. This was very plausible. It would, it was supposed, give England the world's commerce; but as there then existed none but British vessels in either of the three continents out of Europe, there was no more trade, in consequence of the law, than before. The law was a dead letter. The growth of English commerce was evidently great. The statesmen of Europe ascribed it rather to the law than to the circumstances of the people, and they imitated its provisions. The trade between England and her colonies was large, but the vessels were all British. The development of this industry of the North American colonies, and their trade, was probably the first real opposition on the ocean that the Dutch received. So much did it flourish in the seventeenth century, that Sir Joshua Childs, writing in 1670, states that "Our American plantations employ nearly two-thirds of our English shipping, and thereby give constant subsistence to, it may be, 200,000 persons here at home." Ship-building had been pursued with great success in the colonies; and the genius of the colonists had already given their ships a distinctive character. On the declaration of peace, in 1783, that "bit of striped bunting" was found floating at the gaff of all the best vessels. They, by the law, could now carry no goods to England. The large exports of the United States were now to go in the worst vessels, because they were English. The United States immediately passed a similar law, that forbade any goods to be imported, except in American vessels. The American vessel then went out in ballast to bring home English goods, and the English vessel came out in ballast to carry home American produce. Two ships were employed to do the work of one, and all imports and exports were charged two freights. This was too absurd, even for statesmen. A treaty was consequently made, by which the vessels of both nations were placed upon the same footing. The practical effect of this was to double the quantity of tonnage employed, since the vessels of both nations could now carry freights both ways. The position of affairs was, however, entirely new. The United States—a young country, with few ships and less capital, distributed among a sparse population—presented itself to the old, wealthy, and aristocratic governments of Europe, and demanded of them that they should admit its ships to visit their populous and wealthy cities, in return for the privilege of their visiting the comparatively poor and unattractive towns of the states. This kind of reciprocal intercourse had never existed; and the United States now came forward to propose it, and to lay down principles for its guidance. Their moral influence caused them to be adopted. These principles were, "independence," "equal favor," and "reciprocity." These principles were first laid down in the treaty made between France and the United States in 1778, and they became the basis of all subsequent negotiations. The commercial sagacity of the English prompted them to accede at once. The United States vessels were accordingly placed upon the footing of the "most favored nation." From the moment the United States entered that wedge, the whole system of exclusiveness began to fall to pieces. There are now forty-eight treaties between the United States and other countries, most of them containing the favored nation clause. The benefits of this example have been so fruitful, that all the nations of Europe have eaten through their old restrictive systems, by similar treaties with each other. Although England was forced into this concession in her direct trade, she, for a long time, refused it in respect of her colonies. It was reserved for a later period to force her into that movement. The vessels of the United States having thus gained an international footing, events supervened to give a great impulse to their employment in the carrying trade. In colonial times, Massachusetts Bay was the chief theatre for shipbuilding, but Maryland was also noted for it. The vessels built in 1771 were as follows:—

AN ACCOUNT OF THE NUMBER AND TONNAGE OF VESSELS BUILT IN THE SEVERAL PROVINCES IN THE YEAR 1771.

	Square-rigged vessels.	Sloops and schooners.	Tonnage.
New Hampshire	15	40	4,991
Massachusetts Bay	42	83	7,704
Rhode Island	15	60	2,148
Connecticut	7	39	1,483
New York	9	28	1,698
New Jersey		2	70
Pennsylvania	15	6	1,307
Maryland	10	8	1,645
Virginia	10	9	1,678
North Carolina		8	241
South Carolina	3	4	560
Georgia	2	4	543
Total	128	291	24,068

The tonnage entered and cleared for the year 1771, to all ports, was as follows:—

	Cleared from colonies.	Entered colonies.
Great Britain	98,025	82,934
Southern Europe	37,237	37,717
West Indies	108,150	106,713
South and Central America	107,552	104,578
	350,964	331,942

This was before the war. After the war, the trade received a great development from the French treaty of 1778, and from that with Great Britain. The ship-building during the colonial period had been in very different styles, so that every seaman, at a glance, could recognize the origin of the vessel. The Baltimore clipper, the Essex fishing schooner, the Chesapeake schooner, the down east lumber schooner, or brig, the Hudson river sloop, the Long Island sloop, the Newport boat, the Massachusetts Bay dory, were distinct types, and still preserve their styles to some extent, although the march of improvement has tended to assimilate all styles, by combining their good points. The changes of trade have varied the demand, and since California has brought clippers in demand, they are now by no means a Baltimore peculiarity. The fishing vessels were peculiarly adapted to their employment. The fisheries were the chief business of the northern colonists, and they had not only the benefit of the large sale to the West Indies and to the Catholic countries of Europe, but the eating of fish in England had, by the law of Elizabeth, in 1563, been ordered on Wednesdays and Saturdays, for the encouragement of seamen, thus affording a large market, from which foreign fish were excluded. The same law became a custom down to our day, it being still almost universal in New England to eat fish on Saturday. Indeed, so strictly was this custom observed, that in the old slave days of Massachusetts, it being ordered that slaves should not be in the streets on Sunday, a black was arrested on the common. He denied that it was Sunday, and proved his point by showing that "massa no eat salt fish yesterday." The fisheries were thought to be the nursery of seamen, and when the Union was formed, a law of July 4, 1789, allowed a drawback on fish exported equal to the supposed quantity of salt used. This law, in 1792, was changed to a bounty per ton on the vessels engaged in the fisheries, and has been continued down to the present time. The number of tons now in the cod fisheries is 129,637, and the bounty paid to the interest from the origin of the grant to the close of the year 1859, amounts to $12,944,998, of which Maine, New Hampshire, and Massachusetts received nearly the whole. It is to be remarked that this bounty-fed interest has prospered less than any other. The whale fishery seemed peculiarly adapted to the skill and daring of the American seamen. The whale boats were of a peculiar build, and gradually, although they received no protection from the government, they drove away other nations from the seas. The interest is, however, depressed, from the growing scarcity of whales, and the great competition that its product receives from other sources. The making of lard oil brought "prairie whales" into effectual competition with those of the ocean.

The tonnage engaged in the foreign trade increased up to 1810 very rapidly under the influence of the carrying enjoyed under the treaties with Europe, and the effect of the wars between the great powers. The coasting trade did not increase in the same ratio, for the reason that the trade enjoyed by the registered tonnage was not the carrying of American goods, but of foreign products from colonies to Europe. The comparative increase of the tonnage is seen as follows:—

	Registered tons.	Coasting.	Whalers. tons.	Cod fishery.	Mackerel fishery.	Steam. Ocean.	Steam. Coasting.	Total.
1789,	123,893	68,607	..	9,062	..	..	..	201,562
1810,	984,269	405,347	1,227	35,168	..	..	..	1,424,789
1821,	619,896	559,435	27,994	51,351	..	..	..	1,298,958
1829,	650,143	508,858	57,278	101,797	35,973	..	54,036	1,260,797
1840,	899,764	1,176,694	136,926	76,035	28,269	..	281,339	2,180,764
1850,	1,585,711	1,755,796	146,016	85,646	58,111	44,942	481,004	3,535,454
1858,	2,223,121	1,710,332	198,593	110,896	29,593	78,027	651,363	5,049,808

This table gives a sort of chart of the whole progress of the tonnage. It is observable that up to the close of the first period, viz.: to the embargo and non-intercourse of 1809, the registered tonnage, or that engaged in the foreign trade, increased most rapidly; there were then no large home productions to require much inland transportation, and the carrying trade of Europe was very active. With the growth of cotton, however, an immense freight was given as well to coasting as to registered tonnage, and that was far more valuable to the latter than the carrying trade which had been lost. When the war and non-intercourse stopped the growth of external tonnage, a great impulse was given to that of the interior. The lakes and rivers began to be covered with craft, which swelled the enrolled tonnage. In the south a good portion of this tonnage was employed in the transportation of cotton to the seaboard, where it was freighted to Europe in registered vessels. The operation of the laws in relation to the measuring of vessels had an injurious influence upon the form. The making the beam of the vessel an element in the calculation of the tonnage she would carry, led to the construction of "kettle bottoms," which swelled out in the form of a kettle, allowing her to carry much more than her register showed. These vessels carried cotton mostly to European ports, whence there was little return cargo; but when, after the war, migration set in freely from Havre, affording a return freight, the form was altered to give accommodation to the passengers, and an impulse was given to ship-building. The latter branch of industry languished up to 1829, since there was little carrying trade, and the cotton crop was only one-fourth its present quantity. The British government had refused to allow the West India colonies to be open to American vessels. The West Indies, however, were dependent upon the United States for supplies of produce, while they were required to send their own sugar, coffee, and rum to the mother country in British vessels. By refusing to let American vessels go thither, she sought to secure three freights for British ships. Thus, a vessel left England with goods for the United States, then loaded provisions for the West Indies, and took home thence sugar, etc., to England, making a round voyage. This the United States refused to permit, unless American vessels participated; and the trade was closed. The English colonists, deprived of American supplies, set up a clamor which compelled the government to open certain ports to American ships on the same terms as British ships; and Congress, in return, authorized the President, by proclamation, to open United States ports to colonial vessels, whenever he should have proof of a reciprocal movement. This took place in 1830, and the trade has rapidly increased since.

The increase of registered tonnage, as of all others, had been large up to 1840, under the general animation that trade encountered from the speculative action of those years. Two circumstances now, however, occurred to enhance the demand for shipping. These were the English-China war, and the American-Mexican war. The attempts of the English to force the opium trade upon the

Chinese, contrary to their laws, had induced the Chinese, in 1841, to destroy a large quantity of opium. This brought on the war, which resulted in the opening of five Chinese ports to the commerce of the world, and by so doing had increased the demand for American ships—always favorites with the merchants in the trade between India and China. One result of the English war with the Chinese was the negotiation of a treaty of a very favorable nature between the United States and the Chinese government. The great success of the Americans in that respect was a matter of envy upon the part of the English; but it was not a matter of surprise, that since the Chinese were compelled to open their ports to trade, they should favor those who had been friendly rather than their victors. The Americans and English had long traded together, and their nationality had long been a puzzle to John Chinaman. As far as he could see, they both spoke the same language, although they sailed under different flags; but, with his natural acuteness, he had observed that the "red-haired devils" had more capital than the Americans; he consequently classified the latter as "second-chop Englishmen." He was now, however, not sorry to give them the advantage in the treaty negotiated by Hon. Caleb Cushing, or, as they styled him, Ku-ching. The return of that minister to the United States across Mexico was attended with a new insult from that people, who robbed him of his baggage. Subsequently, the long train of insults heaped upon Americans through the recklessness and arrogance of the Mexicans, ended in a war in 1846. That event caused a large demand for shipping on the part of the government, for transports. The expedition fitted out under General Scott for Vera Cruz, was the largest naval enterprise ever undertaken by any nation up to that time—that is, a like number of troops had never before been transported so great a distance by sea to open a campaign in an enemy's country. The British and French expedition from Varna to the Crimea, ten years afterward, was no greater in magnitude, although greatly trumpeted by English writers. The American expedition was promptly successful, when even the French had failed in their previous attack upon Vera Cruz. Following these two events, that absorbed so much shipping, came the Irish famine. The same famine, which created the extended demand for American produce, also stimulated a large migration to the United States, furnishing ample freights to the homeward-bound shipping.

The increase of steam tonnage was the most remarkable. The first arrival of a steamer from England was the Sirius, April 23, 1838. That experiment was looked upon with distrust, but it has succeeded so far, that fifteen lines, running forty-five ships, have since been started between the United States and Europe. In July, 1840, the Britannia, the first Cunard boat, arrived at Boston; and that line has continued to be the most uniformly successful up to the present time. The lines since started are as follows, mostly running from New York:—

Lines.	Port.	Style.	Ownership.	Vessels.	Tons.	Average passage out. days.	hours.
Cunard line,	Liverpool,	paddle-wheel,	British,	4	10,360	11	3
" "	Havre,	screw,	"	5	11,800		
Collins "	Liverpool,	paddle-wheel,	American,	3	9,727	12	3
Scotch "	Glasgow,	screw,	British,	3	6,612	13	0
Irish "	Cork,	"	"	2	2,000		
French "	Havre,	"	French,	3	4,500	15	0
Old Havre line,	"	paddle-wheel,	American,	3	7,200	13	6
Vanderbilt "	"	"	"	3	7,600	13	0
Independent line	"	"	"	1	1,800		
Belgian "	Antwerp,	screw,	Belgian	5	12,590		
Bremen "	Bremen,	paddle-wheel,	American,	2	4,000	14	12
Hamburg "	Hamburg	screw,	German,	2	2,400	16	0
Cunard "	Bost'n to L'pool,	paddle-wheel,	British,	4	8,100	11	12
Philadelphia "	Liverpool	screw,	"	3	6,856		
Portland "	"	"	"	2	3,000		
Total				45	98,545		

Such has been the progress of steam between Europe and America. By its influence, time and distance have been reduced one-half, and, as a natural consequence, capital has been virtually increased, since, by quicker communication, it can be more frequently turned. Many disasters have attended the ocean service of steam; but it has been estimated that since the first steamer arrived, in 1838, 500,000 persons have crossed the Atlantic by steam. Of this number, 2,709 have been lost; giving a chance of loss as one out of 184. The first ocean steamer lost was the President, in 1841, with 130 lives, Since then, the losses have been as follows:—

	Ownership.	Lives lost.	Value of vessel and cargo.
President,	British,	130	$1,200,000
Arctic,	American,	300	1,800,000
Pacific,	"	240	2,000,000
San Francisco,	"	160	400,000
Central America,	"	387	2,500,000
Independence,	"	140	100,000
Yankee Blade,	"	75	280,000
City of Glasgow,	British,	420	850,000
Union,	American,	..	300,000
Humboldt,	"	..	1,600,000
Franklin,	"	..	1,900,000
City of Philadelphia,	British,	..	600,000
Tempest,	"	150	300,000
Lyonnais,	French,	160	280,000
Austria,	German,	456	850,000
Canadian,	British,	..	400,000
Argo,	"	..	100,000
Indian,	"	27	125,000
Northerner,	American,	32	75,000
Hungarian,	Brit., (about)	120	270,000
Total..................		2,797	$15,930,000

Showing that a fleet of twenty fine steamers, many of them first-class, have been totally lost within the period named. The President, Pacific, City of Glasgow, and Tempest, were never heard from; the Arctic, San Francisco, and Central America, foundered; the Independence, Yankee Blade, and Northerner, were wrecked on the Pacific, and the Canadian, Humboldt, Franklin, Argo, and Hungarian, on the Atlantic coast; the Lyonnais was sunk by collision, and the Austria was burnt. Not enumerated in this list are two-thirds as many more, generally of a class much inferior, which were lost in the California trade.

The growth of steam service in the interior of the country was more rapid than its external development. The amount of steam tonnage in ocean navigation, in 1850, was 44,942, against none in 1840. The inland tonnage engaged on lakes, rivers, and coasting, was 481,004—an increase of 283,000 in ten years, at a cost of $28,000,000.

When the western country, with its fertile fields and magnificent water-courses, attracted settlers, and these had produce for sale, there was but one way to market, and flat-bottomed boats, launched upon the descending streams, bore the freights to New Orleans. At that point they were not unfrequently broken up, the owners returning by land. In 1794, two *keel* boats sailed from Cincinnati to Pittsburg, making the trip in four weeks. Each boat was covered, so as to be rifle-proof; was loop-holed for muskets, and six guns, to carry pound balls. It was in this manner that persons and property were protected from Indian aggression. The other western rivers presented similar means of travel. Even this was progress, however; and each year saw the numbers and wealth of the dwellers increase. In 1790 the first sea-going brig was built at Marietta, Ohio. She was called the St. Clair, 120 tons, owned and commanded by Commodore Preble, who descended the Ohio and Mississippi, and arrived, *via* Havana, at Philadelphia, where she was sold. In 1802–4, four ships, three brigs, and three schooners were built at Pittsburg for the Ohio navigation. Keel boats and sea-going vessels rapidly multiplied; but the dangers of the navigation retarded commerce. The dangerous falls of the Ohio were a drawback; and the Kentucky legislature, in 1804, incorporated a company to cut a canal round them. This was, however, not done until 1830. After 1806, the march of commerce and civilization began to make itself felt, and trade was carried on in *keel boats*, which, however comfortably they might float *with the stream*, required three months for a voyage from New Orleans to Cincinnati. The first steamboat on the rivers was built by Fulton at Pittsburg, in 1811. She cost $20,000, and took her first freight and passengers at Natchez, arriving at New Orleans in December. She continued to run three or four years between those points, eight days up and three days down, clearing, the first year, $20,000. Steam tonnage then rapidly multiplied. The annexation of Louisiana, and the events of the war, had greatly stimulated western trade and river tonnage. From the period last named up to the year 1839—a period of twenty-eight years, or thereabout—how do we find the aspect of matters altered? The surface of the "beautiful river," as the French call the Ohio, constantly agitated by the revolutions of paddle-wheels, and its shores decked with cities, towns, and villages, the appearance of which sufficiently indicated the vast stores of wealth which a thrifty, industrious population was rapidly bringing to light. It is computed that the country drained by the Ohio and its tributaries embraces one-third of Pennsylvania, one-third of Virginia, two-thirds of Ohio, all of Kentucky, three-fourths of Indiana, and one-fourth of Illinois—making an aggregate of 142,000 square miles, or 91,000,000 of acres. The Ohio rises near the 42d degree of north latitude, and empties itself into the Mississippi, near the 37th degree, within which space all the tributaries, with the exception of the great bend of the Tennessee, are circumscribed. The computation of those who owned the first steamboat on this river, made after her first trip, is said to have been, that if 6 cents freight could be obtained on each pound, and *they could get enough to do*, the investment would be a profitable one. The result has shown that freight has been reduced to less than a cent, and that ample employment is afforded for hundreds of boats! The number of steamboats built previous to the year 1835 inclusive, was 588, of which 173 were built at Pittsburg, and 164 at Cincinnati. The number of boats in active business in 1838 was 357, measuring 65,000 tons, or 180 tons each; and, in 1858, the tonnage had increased to 124,941.

The opening of the Erie canal, in 1825, gave a new direction to western produce. The great lakes, from forming a separation from Canada, at once became a means of communication between the inhabitants of the vast circle of their coast and Buffalo, the gateway to the east. Those vast seas form a basin, into which pours from every quarter the produce of eight sovereign states, not including the Canada side. On these lakes a few craft had floated; and in Erie harbor, in 1812, was built, in seventy days from cutting the timber, that remarkable fleet that bore Perry's flag to victory, and made the lakes American seas. Tonnage multiplied as the produce increased, and the construction of the Ohio canals gave a northern direction to it.

Up to 1820 there was but one steamer on the lakes, and not until 1827 did a steamer reach Lake Michigan. In 1832 a steamboat landed troops at Chicago. In 1833 there were on the lakes eleven boats, which had cost $360,000. They carried 61,480 passengers in that year. In 1840 there were forty-eight boats on the lakes, and their value was $2,200,000. In 1859 the number of boats was 186, and the value $3,997,000, including propellers. The amount of tonnage upon the lakes is now as follows:—

STATEMENT SHOWING THE NUMBER, KIND, TONNAGE, AND VALUATION OF VESSELS ENGAGED IN THE COMMERCE OF THE LAKES IN 1859.

AMERICAN BOTTOMS.

Number.	Rig.	Tonnage.	Valuation.
68	Steamers	46,240	1,779,900
118	Propellers	55,657	2,217,100
72	Tugs	7,779	456,500
43	Barques	9,666	482,800
64	Brigs	30,452	456,000
833	Schooners	178,362	4,378,900
1,198	Total....	328,156	$9,771,200

CANADIAN BOTTOMS.

Number.	Rig.	Tonnage.	Valuation.
54	Steamers	21,402	989,200
16	Propellers	4,127	140,500
17	Tugs	2,921	184,800
15	Barques	5,720	134,000
14	Brigs	3,295	78,400
197	Schooners	32,198	778,300
313	Total.....	69,663	$2,305,200

The losses of screw-propellers upon the lakes by wreck and fire, rose from $39,000 in 1848 to $1,159,957 in 1855, and have since diminished to $91,830 last year. The number of vessels lost in ten years was 402, and the value $3,752,131. The number of vessels built in 1858, was 113 on the rivers, and 31 on the lakes.

Broad canals and numerous railroads are always busy delivering upon the bosom of the lakes the wealth annually created by 5,000,000 of people, and valued at hundreds of millions of dollars. The borders of those lakes are dotted with cities, whose marvellous growth has been proportioned to the rapid settlement of the surrounding country. Oswego, Buffalo, Cleveland, Sandusky, Toledo, Monroe, Detroit, St. Joseph, Chicago, Milwaukee, Racine, and many smaller ports, have, like nets, so to speak, accumulated a portion of the vast wealth that has rushed by them over the bosom of the lakes. Each of these cities has a large tonnage employed in the transportation of produce and merchandise; and that tonnage has in the last few years received a new development by the introduction of the newly constructed screws. The invention of Fulton consisted in the adaptation of paddle-wheels to propel vessels. The idea of propelling by a screw in the stern was quite as old as that of the paddle-wheels; it was not, however, successfully constructed until, in 1839, after many failures by others, Ericsson succeeded. A small iron screw-steamer was built and navigated to this country in 1839, by Capt. Crane, and she became a tug on the Raritan canal. From that time, screws vindicated their value for certain purposes, as superior to paddles. They have lately performed so well as to lead to the impression that they may yet supplant the paddles altogether. This is more particularly the case with inland navigation. The form of the screw has undergone continual changes, to obviate some of the difficulties that presented themselves. The model until recently in use upon the lakes, is the Loper propeller, invented by Capt. Loper, of Philadelphia. The screw was cast in one piece, and of a form that combines many advantages, particularly that of hoisting out of water with a fair wind. Within the last three or four years, however, a Buffalo invention has been introduced, by which the engineer may regulate the "pitch," or angle of the screw blades, according to the circumstances, without taking up the screw. These steam propellers are obviously of a nature to monopolize the trade of the lakes. They make their trips with regularity and promptness. There are now 118 on the lakes, with a tonnage of 55,657; and 68 paddle-wheels, tonnage 46,240. The great progress made in the last ten years in railroads, which have come to rival canals and rivers throughout the west and skirting the lakes, has greatly affected the trade in vessels, as well steam as sail. The introduction of steam lessened the amount of tonnage, because steam can perform more voyages. Railroads have again reduced the quantity of tonnage required, because they run all winter, and at all times with greater speed. While this has been taking place, however, greater facilities for getting to sea have made ship-building on the lakes more active. Several vessels have been built at the lake ports for Liverpool, going down the St. Lawrence, and some schooners have recently been built at Cleveland, to run between Boston and Albany and Chesapeake bay. Those of about 200 tons cost $10,000. The advantage of building on the lakes consists in the fact that ship plank is much cheaper, say $20 in Cleveland to $60 in Boston, spars $40 against $100; and the vessel makes a handsome freight in lumber on the voyage out. Nevertheless, in the last two or three years, there has been a decrease of lake tonnage, as well through the competition of the railroads, as the diminished transport of grain, arising from the cessation of the export demand for grain. The wrecks, condemnations, and departures for the ocean, at a time when building is slack, have decreased the actual tonnage. This year the vast crops moving require every available means of transportation.

These circumstances of the increase of the western and lake tonnage, indicate the means by which freights accumulated at the seaports to employ the ocean or registered tonnage, had increased in such rapid proportions in the last nine years. The increase from 1850 to 1858 was, it appears, 637,410 tons, while the sail coasting tonnage actually declined. The discovery of California gold led to the employment of clipper ships for quick passages round the cape, and these, under the pressure of high freights, rapidly multiplied. In 1855, the number of vessels built was 2,034, having a tonnage of 583,450, or a quantity equal to the whole coasting tonnage of the Union in 1830. The tonnage increased too fast, and reaction overtook it. The quantity built in 1859 was only 870 vessels, of 156,602 tons. In ordinary years, cotton is the chief freight of ships, and the ordinary proportion of shipping is as one ton to a bale of cotton produced. The progress of the registered tonnage during the eight years, from 1851 to 1858, was as follows:—

REGISTERED TONNAGE.

	Built.	Lost at sea.	Condemned.	Sold to foreigners.	Increase.
1851,	165,850	23,149	3,801	15,247	123,647
1852,	193,021	28,083	2,060	17,612	145,265
1853,	209,898	33,850	6,400	10,035	159,613
1854,	320,012	53,493	7,448	59,244	199,826
1855,	336,098	46,149	5,696	65,887	218,366
1856,	260,676	58,580	6,992	41,854	153,248
1857,	195,962	63,232	9,371	51,791	71,567
1858,	96,459	46,198	13,699	25,925	10,635

The building under the clipper fever more than doubled from 1851 to 1855. The sales to foreigners have risen to a large item. In the five years, 1854-58, it amounted to 244,700 tons, or 20 per cent. of the whole quantity built. This, at an average of $100 per ton, amounts to $24,470,000, or yearly average sales of $4,895,000, forming a considerable manufacture. The cheapened cost of building on the lakes and western rivers will transfer to that region much of that trade The enrolled tonnage has been as follows:—

	Built.	Lost at sea.	Condemned.	Sold.	Increase.
1851,	132,353	7,675	2,047	..	122,631
1853,	215,673	11,819	3,209	..	200,645
1855,	247,351	15,068	2,138	..	230,144
1857,	182,841	19,257	1,877	858	160,848
1858,	145,827	17,263	2,337	378	125,847

The amount of shipping owned in the United States, and engaged in either foreign or domestic commerce, reached its highest point in 1856, and, after some remarkable fluctuations, had attained nearly the same point in 1861; but the presence of rebel privateers in the Atlantic, Pacific, and Indian oceans, during the war, led to the sale or transfer of great numbers of vessels to a foreign flag. Since the close of the war there has been great activity in the building and purchase of ships, and three or four years will probably restore the supremacy of American shipping. The following table shows the changes which have taken place, since 1850, in the amount of shipping engaged in our commerce. It has reference to the port of New York alone, but gives the proportions of foreign and American shipping very fairly.

Date.	AMERICAN. No. Vessels.	AMERICAN. Tonnage.	FOREIGN. No. Vessels.	FOREIGN. Tonnage.
1850,	1,832	807,581	1,451	446,756
1851,	2,353	1,144,485	1,490	470,567
1855,	2,487	1,340,257	904	220,000
1856,	2,763	1,684,597	1,098	386,263
1861,	3,034	1,618,258	1,943	865,447
1862,	2,693	1,472,989	2,713	1,079,492
1864,	1,568	845,172	3,207	1,416,734
1865,	1,430	774,459	3,210	1,473,815

The commerce of the United States, both in the exportation and importation of goods and products, has advanced with far greater rapidity than that of any other nation of Christendom. The following table shows the extraordinary rapidity of its increase, as compared with that of Great Britain and France, the two greatest commercial nations of the world:—

NATIONAL EXPORTS.

Date.	United States.	Great Britain.	France.
1800,	$31,480,903	$118,413,084	$53,750,816
1819,	64,974,382	176,057,005	83,095,885
1829,	72,358,671	179,213,115	121,563,730
1839,	121,028,416	266,167,900	188,101,247
1849,	145,755,820	317,980,125	207,281,108
1859,	355,894,385	626,114,049	321,182,291
1860,	400,122,296	664,782,635	424,950,000
1862,	229,790,280	951,134,453	819,150,000
1863,	331,809,459	709,010,477	420,506,250
1864,	445,791,370	802,000,000	499,218,750
1865,	336,697,123	....	....

The exports from the United States, in 1866, will probably considerably exceed $500,000,000.

The exports of a nation, it should be remembered, are but a part of the surplus remaining after the wants of the people are supplied with the article exported. This is particularly the case with all agricultural products, and the amount of these exported bears often a very small proportion to the whole crop. Of cotton, fully one-half the yield is consumed at home; while of breadstuffs, the export in 1865 was $53,502,511, and the total yield of the year, in twenty-one states and one small territory only, was $360,000,000, or about seven times the whole export. With each year, too, the proportion of manufactured goods, the product of skill bestowed upon the raw material, is increasing; though as yet we are not so far free as we should be from the use of foreign manufactured products; and the many duties which it has been found necessary to impose upon foreign manufactures, so far from diminishing their consumption, have seemed to increase it. The importations of 1866, at a gold valuation, were $437,638,966, equal to over $650,000,000 in currency, larger than in any previous year of our history, although almost every article imported pays a duty of from thirty-three to fifty per cent. on its prime cost. It is a remarkable fact that, notwithstanding the immense waste and destruction caused by the war, the wealth of the country has increased at the average rate of about five per cent. per annum, and at the next decennial census will undoubtedly exceed twenty-five thousand millions of dollars; thus showing an actual gain of about sixteen thousand millions in the value of property in ten years. This rate of gain, continued for five decades, or fifty years, would make this the wealthiest nation on the globe; and there is no reason to doubt that it will not only be continued, but increased, since within the next five or ten years, with our Pacific railroad and its branches completed, we shall become the carriers for the whole population of the globe. Swift steamers will then bear the products of the far East to the great port of San Francisco in twenty days, or less, whence they will be brought to New York in five days, and reach Liverpool in eight days more, thus making the circuit of three-fourths of the globe in thirty-three days, while the Atlantic Cable and the Russo-American telegraph give instant communication with the antipodal markets.

CENSUS, 1860.

THE FOLLOWING TABLE GIVES THE TOTAL POPULATION OF THE UNITED STATES ACCORDING TO THE CENSUS OF 1860, DISTINGUISHING FREE FROM SLAVE, SHOWING ALSO THE NUMBER OF STATES, THE RANK OF EACH STATE ACCORDING TO ITS POPULATION AND THE NUMBER OF REPRESENTATIVES TO WHICH IT IS ENTITLED IN CONGRESS, THE TAXABLE VALUATION ACCORDING TO THE LATEST RETURNS, AND THE NUMBER OF MILITIA IN EACH STATE.

States.	Total free population.	Slaves.	Representation in Congress.	Rank as per population.	Valuation.	Militia.
Maine	619,958	..	5	22	$162,472,914	73,552
New Hampshire	826,072	..	8	27	103,804,326	83,538
Vermont	315,877	..	8	28	86,775,213	23,915
Massachusetts	1,231,494	..	10	7	597,936,995	161,192
Rhode Island	174,621	..	1	29	111,175,174	17,826
Connecticut	460,670	..	4	24	211,187,683	51,630
New York	3,851,563	..	30	1	1,404,907,679	418,846
New Jersey	676,084	..	5	20	281,333,349	81,984
Pennsylvania	2,924,501	..	23	2	568,770,234	350,000
Ohio	2,377,917	..	19	3	840,800,031	279,809
Michigan	754,291	..	6	16	120,362,474	109,570
Illinois	1,687,404	..	13	4	407,477,367	257,420
Indiana	1,370,802	..	11	6	818,204,964	58,918
Wisconsin	768,485	..	6	15	152,537,700	51,321
Iowa	682,002	..	5	19	197,223,350	110,000
Minnesota	172,793	..	1	30	781,100	24,990
Kansas	143,642	..	1	32	679,240	21,000
California	384,770	..	8	26	131,306,269	207,730
Oregon	52,566	..	1	36	1,981,101	9,000
Maryland	646,183	85,382	6	17	255,477,588	46,864
Delaware	110,548	1,805	1	33	30,466,924	9,229
Virginia	1,097,373	495,826	11	5	730,817,653	143,155
District of Columbia	72,093	3,284	..	35	20,271,000	8,201
North Carolina	679,965	328,877	7	12	271,781,101	79,448
South Carolina	308,186	407,185	4	18	214,101,201	36,072
Georgia	615,336	467,461	7.	11	337,969,471	78,699
Florida	81,885	63,809	1	31	22,216,915	12,122
Alabama	520,444	435,473	6	13	201,100,100	76,662
Louisiana	354,245	312,186	4	21	378,911,905	91,324
Mississippi	407,551	479,607	5	14	161,747,536	36,084
Missouri	1,085,590	115,619	9	8	274,965,164	118,047
Kentucky	933,707	225,902	8	9	334,770,701	88,979
Tennessee	859,528	287,112	8	10	266,249,384	71,252
Arkansas	331,710	109,065	3	25	53,255,711	47,450
Texas	415,999	184,956	4	23	188,722,683	19,766
Nebraska	28,893	..	..	38	..	..
New Mexico	82,060	..	..	34	..	..
Utah	50,000	..	..	37	..	..
Washington	11,624	..	..	39	..	..
Dakotah	4,839	..	..	40	..	..
Total	27,678,271	4,002,996	234	..	$9,312,404,850	3,303,811

It will be observed that the figures for the total population do not quite agree with those in vol. i., p. 160, for the year 1860. This arises from the fact that after that table was printed a revision took place in the official tables. The column of valuations, it will be borne in mind, is that of the several States, each for its own taxation purposes, and each on its own peculiar basis. The figures do not therefore give relative values between the States.

PRINCIPAL CITIES OF THE UNITED STATES, INCLUDING ONLY THOSE WITH A POPULATION OF OVER 50,000 IN 1860.

Name.	1790.	1800.	1810.	1820.	1830.	1840.	1850.	1860.
New York	33,131	60,489	96,373	123,706	203,007	312,710	515,547	821,113
Brooklyn	..	3,298	4,402	7,175	12,042	36,233	96,838	273,825
Williamsburg	..	..	..	..	1,620	5,680	30,780	
Boston	18,038	24,027	32,250	43,298	61,392	93,383	136,881	177,902
Baltimore	13,503	26,614	46,555	62,738	80,625	102,313	169,054	218,412
Philadelphia	42,520	70,287	96,664	108,116	167,188	258,037	408,762	568,034
Cincinnati	..	750	2,540	9,644	24,831	46,338	115,436	158,851
Chicago	..	..	..	..	..	4,479	29,963	109,420
Louisville	..	..	1,357	4,012	10,352	21,210	43,194	70,226
Newark	..	..	..	6,507	10,953	17,290	38,894	72,055
New Orleans	..	..	17,242	27,196	46,310	102,193	116,375	170,766
St. Louis	..	..	..	4,893	5,852	16,469	77,860	160,577
Buffalo	..	..	1,508	2,095	8,653	18,213	42,261	81,541
Washington	..	3,210	8,208	13,247	18,827	23,364	41,000	61,400

SLAVE POPULATION OF THE UNITED STATES,

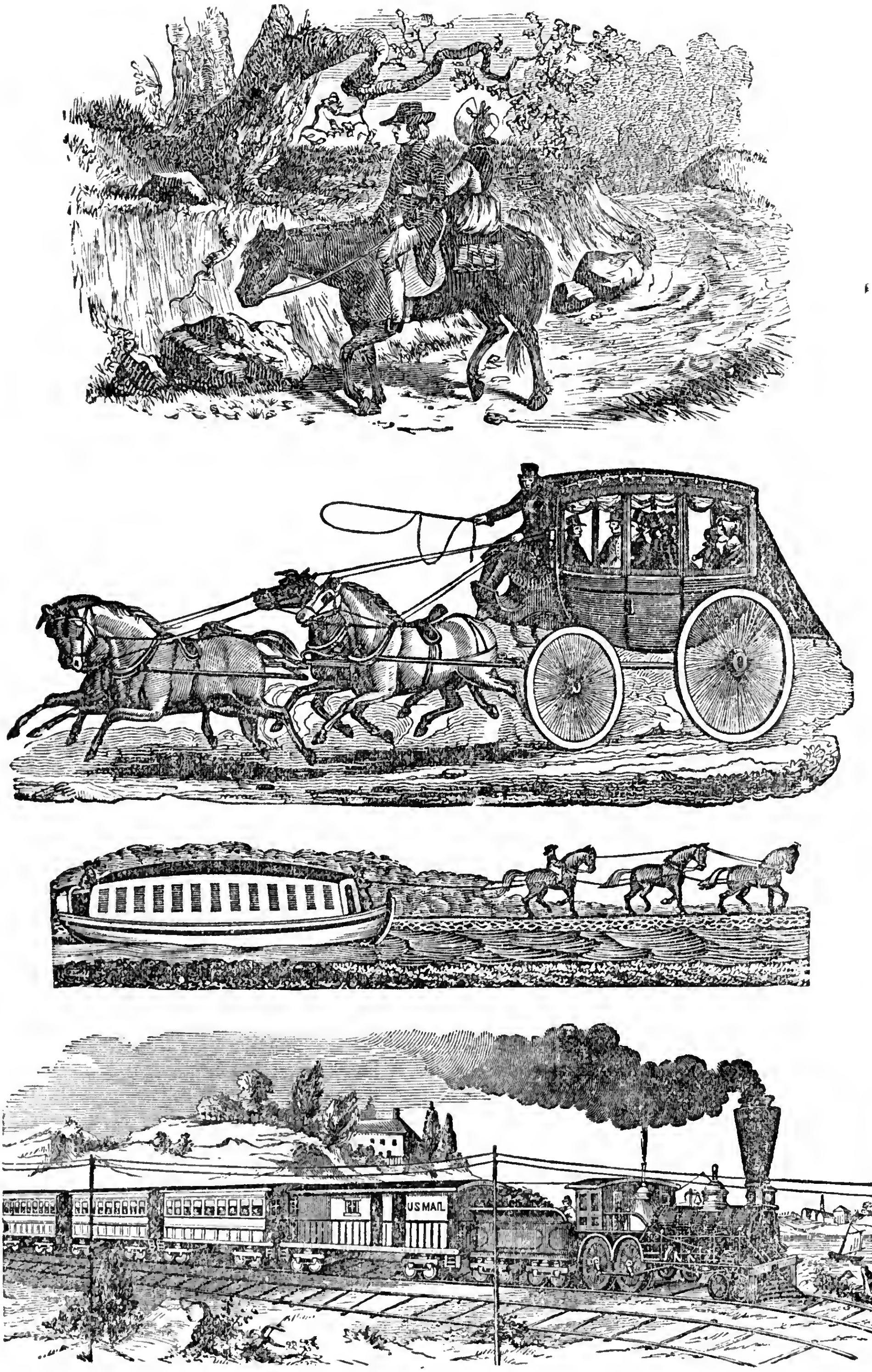
WITH THE RATIO OF SLAVES TO THE WHOLE POPULATION IN THE PRESENT SLAVE STATES, BY EACH DECENNIAL CENSUS BY THE FEDERAL GOVERNMENT SINCE ITS FORMATION.

	1790.	Ratio to pop.	1800.	Ratio to pop.	1810.	Ratio to pop.	1820.	Ratio to pop.	1830.	Ratio to pop.	1840.	Ratio to pop.	1850.	Ratio to pop.	1860.	Ratio to pop.
Maine	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..
New Hampshire	158	..	8	..	..	..	..	..	3	..	1	..	..	..	..	..
Vermont	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Massachusetts	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Rhode Island	952	..	381	..	108	..	48	..	17	..	5	..	..	..	..	.
Connecticut	2,759	..	951	..	310	..	97	..	25	..	17	..	..	..	..	..
New York	21,324	..	20,343	..	15,017	..	10,088	..	75	..	4	..	..	..	..	..
New Jersey	11,423	..	12,422	..	10,851	..	7,557	..	2,254	..	674	..	119	..	..	..
Pennsylvania	3,737	..	1,706	..	795	..	211	..	403	..	64	..	..	..	..	..
	40,370		35,811		27,081		18,001		2,779		765		119		..	
Delaware	8,887	15.0	6,153	9.5	4,177	5.7	4,509	6.2	3,292	4.2	2,605	3.3	2,289	2.5	1,805	1.6
Maryland	103,036	32.2	105,635	30.9	111,502	29.3	107,398	26.3	102,994	23.0	89,737	19.0	89,800	15.5	85,382	12.7
District of Columbia	..	..	3,244	..	5,395	..	6,377	..	6,119	..	4,694	..	3,687	..	3,234	..
Virginia	293,427	39.2	345,796	39.2	392,518	40.2	425,153	39.9	469,757	38.7	448,987	36.2	473,026	33.2	495,826	30.8
North Carolina	100,572	25.5	133,296	27.8	168,824	30.3	205,017	32.0	245,601	33.2	245,817	32.6	288,412	33.2	328,377	33.9
South Carolina	107,014	43.0	146,151	42.2	196,365	47.3	258,475	51.4	315,401	54.2	327,038	55.0	384,925	57.6	407,185	57.2
Georgia	29,264	35.4	59,504	36.6	105,218	41.6	149,656	43.8	217,531	42.0	280,944	40.6	362,996	42.1	467,461	43.7
Florida	..	..	..	..	..	..	..	..	15,011	44.6	25,717	47.2	39,341	44.9	63,809	44.0
Alabama	..	..	..	..	..	..	47,439	32.7	117,549	37.9	253,532	42.9	342,894	42.4	435,473	45.1
Mississippi	..	..	3,489	39.4	17,088	42.3	32,814	43.4	65,659	48.0	195,211	51.9	300,419	51.0	479,607	55.1
Louisiana	..	..	..	..	34,660	45.2	69,064	45.0	109,588	50.8	168,452	47.8	230,807	47.2	312,186	46.9
Texas	..	..	..	..	..	..	..	..	..	..	..	..	53,346	27.3	184,956	30.0
Arkansas	..	..	..	..	..	..	1,617	11.3	4,576	15.0	19,935	20.4	46,983	22.4	109,065	25.5
Tennessee	3,417	9.5	13,584	12.8	44,535	17.0	80,107	18.9	141,603	20.7	183,059	22.0	249,519	23.8	287,112	24.8
Kentucky	11,830	16.1	40,343	18.2	80,561	19.8	126,732	22.4	165,213	24.0	182,258	23.3	221,768	21.4	225,902	19.5
Missouri	..	..	..	..	3,011	14.4	10,222	15.3	25,091	17.8	58,240	15.1	89,289	12.8	115,619	9.8
Indiana	..	..	135	..	237	..	190	..	3	..	3	..	..	..	..	..
Ohio	..	..	..	..	..	..	..	..	6	..	3	..	..	..	..	..
Illinois	..	..	..	..	168	..	917	..	747	..	331	..	..	..	..	..
Wisconsin	..	..	..	..	..	..	..	..	..	..	11	..	..	..	..	..
Iowa	..	..	..	..	..	..	..	..	..	..	16	..	..	..	..	.
Michigan	.	..	..	..	24	..	..	..	32	..	..	..	..	..	..	..
Total	658,527		857,230		1,164,283		1,525,667		2,096,264		2,486,590		3,179,470			
General total	697,897		893,041		1,191,364		1,543,668		2,099,043		2,487,355		3,179,589		4,002,996	

TRAVEL AND TRANSPORTATION,

STEAM ENGINES,

MANUFACTURES, MACHINERY, &c.



IMPROVEMENTS IN TRAVEL AND TRANSPORTATION ILLUSTRATED.

TRAVEL AND TRANSPORTATION.

CHAPTER I.

EARLY ROADS—POST ROADS—MACADAM—NATIONAL.

Of all the marvels that have marked the present century, those which manifest themselves in the development of the means of locomotion and transportation are among the most wonderful. With the emancipation of the states from their colonial condition, and the formation of a federal government, a most extraordinary activity seems to have been imparted to the inventive faculties of the American people, and to which side soever we direct our attention, we find that all the great and useful creations of genius take date from that auspicious event. The art of transportation has, as it were, been created. Not that our fathers were not possessed of the means of transportation by land or water, but those means were so immeasurably below those now in use, that it may be fairly claimed that a new art has been created. When our fathers landed on these shores, it is easily understood that they found no roads, or carriages, or other means of moving from one place to another. Indeed, the countries they had left were at that time but poorly provided with such means, as compared with what they have at present.

The first attempts to exchange the products of labor, which mark the nascent commerce of a people emerging from barbarism, are developed through manual labor, and the application of the strength of animals in a rude and imperfect way. The peddler with his pack, and progressively his pack-horse, are the instruments of intercourse in an infant society. From village to village, pathways are formed, wheel-carriages are invented to gather the fruits of harvests, and they wear their own paths upon the surface of the soil, and finally the road is constructed, more or less perfect, as a means of transport between places more or less distant. In such a state of affairs the roads are very imperfect, and the carriages of the rudest description. It is conceivable that the first step from the pack-horse and its pathway, to the two-wheeled cart and a road was a very great advance—nearly as much as from the road to the railway. And this improvement has by no means been of so distant a date as at first we might imagine. Not only is the construction of good roads of very recent date, but up to the present moment a very large portion of the world called civilized is without them. Certain parts of Europe, the French colony of Algiers, and the United States alone possess them. In other words, but little more than one-quarter of the inhabited part of the globe is provided with roads. In China a large part of the internal land transportation is upon human backs. With the exception of one or two important communities, the extensive empire of Russia, with 60,000,000 inhabitants, is without roads; communication is kept up only in the winter, when the ground is frozen, by sledges. Spain is little better off than Russia, and Italy has few of such improvements.

The condition of affairs in this country before the construction of roads is evident to the hardy pioneers of the western frontier, and has been at times common to every part of the country. The first settlers on arriving here, it is certain, found no roads, and were not skilled in following an Indian trail. They built their houses upon the summits of hills, as well to avoid the miasmata of swamps as to get notice of the approach of hostile savages. The connection between these houses was by foot-paths that became horse tracks, and with the progress of events were enlarged into wagon roads. These, ultimately fenced in, became the highways, running irregularly over the face of the country, as they were prolonged by settlements. The science of road making never guided their direction, nor would farmers permit the squareness of their fields to give place to the straightness of roads. These highways are made in the general idea of making the passage of a vehicle between any two given points possible, and various expedients are resorted to, to overcome obstacles at the smallest expense. The plough turns up the sides, and the scraper draws the earth to the summit, which is levelled off to be hardened by travel. The reduction of hills or the filling in of swamps is not resorted to in new settlements, but the latter are mostly made passable by laying down logs across the track, and parallel with each other. This (*corduroy*) road is better than a swamp, but offers so great resistance that a far less load can be drawn over it than over a smooth, level road. The roads of the whole country, encountering these natural difficulties, took their character from their location, and transportation in each district was more or less difficult, according to circumstances. The best roads of the day were such as would now nowhere be tolerated; as a general thing, the water-courses, so abundant in the country, were the main arteries, and most roads were directed toward these, or in the neighborhood of a large city they converged upon it as a common centre.

The number of even these roads at the date of the formation of the government was not large, nor was their quality to be admired. The streams and water-courses were well supplied with small craft, that delivered goods and produce between distant points, but where the route left the water, the transportation became difficult and expensive. The war and its success had deeply stirred the public mind, and imparted full activity to the independent genius and enterprise of the people. Those 3,000,000 of souls occupied, as it were, but a foothold on this immense continent, to the ultimate possession of the whole of which they already looked forward. The means of transportation were the first object and desire that presented themselves to thinking men. Steam, as a power of locomotion, was unknown, and the science of road making little developed. Canals, therefore, presented themselves almost simultaneously to leading men in various sections. General Washington had, before he attained his twenty-first year, crossed the mountains and given his careful attention as an engineer to the subject of canals, more particularly the connection of the Chesapeake with the Ohio river. At a subsequent period he received the thanks of the Virginia House for his report on the results of his examination of the valley of the Ohio. And the war had no sooner closed than we find him, in 1784, presiding at a commission sitting at Annapolis, on behalf of Maryland and Virginia, to consider the improvement of the navigation of the Potomac, which improvement ultimately, in after years, became a canal to Pittsburg. General Washington, as an engineer, always took an active interest in works of internal improvement. When the Dismal Swamp canal, connecting the Chesapeake, at Norfolk, Va., with Edenton, Albemarle Sound, North Carolina, a distance of 28 miles, through the vast Dismal Swamp, was projected and executed at the expense of individuals with some government aid, he took some of the stock. One certificate of this stock, originally issued to him for £300, or $1,000, was sold in 1825, at auction, in Alexandria, for $12,100, to Judge Washington. Pennsylvania, nearly at the same time, appointed commissioners to explore routes for connecting the Delaware with the lakes. They reported in favor of the Juniata, partly by canal and partly by river. The result was a charter of the Schuylkill and Susquehanna Company, in 1789, and the Delaware and Schuylkill in the following year, with $400,000 capital. In New York the active mind of Gouverneur Morris had already projected the Erie canal. In Massachusetts, the Middlesex canal, 30 miles, was authorized in 1789, and navigated in 1804. In South Carolina the Santee canal was finished in 1802. These, with many other events, show the activity of the public mind at the date of the birth of the Union, in relation to means of transportation. It will be remembered, however, that the people were then few in number. They were heavily in debt. Their productions were small and trade limited. There was no surplus capital to carry out those magnificent ideas, which were in advance of the times. The natural water-courses of the country ran through the finest farms and delivered most of the produce upon noble bays, which were well provided with ships to transport it abroad for sale. This natural traffic absorbed all the commercial capital of the country, but it was so profitable that in the course of a few years it supplied accumulations for other objects, and it was left for a few years later to witness the prosecution of great enterprises. The roads of the country were in a terrible state, however, and since the new constitution had empowered Congress to establish post-offices and post-roads for the conveyance of the mails, it became its duty to look to the roads, and this was the first practical bond of union between the states. A systematic connection of every town in the whole thirteen states, by state routes under one organization, completed the means of communication and established passenger routes. The statistics of the post-office afford a very good indication of the progress of that kind of transportation :—

MAIL SERVICE.

	No. of post offices.	Miles post roads.	By stages. Miles.	Sulkies and horses. Miles.	Steam. Miles.	Rail. Miles.	Annual. Miles.
1791.....	89	1,905	89,650	756,818	..	..	846,468
1811.....	2,403	37,031	2,534,102	3,058,960	..	..	5,592,652
1833.....	8,450	115,176	17,693,839	8,531,909	628,737	..	26,854,485
1859.....	27,977	260,052	23,448,398	27,021,658	4,569,962	27,268,384	86,308,402

This table gives the transportation of the mail in the first year of its operation; in 1811, when steamboats began to run; in 1833, when railroads began to claim a share; and in the past year, when all these means have been more fully developed in all sections of the country. There are thus three distinct periods of transportation: 1790 to 1810 were 20 years of common roads and sail vessels; from 1810 to 1830 were 20 years of canals and steamboat progress; and since 1830 there have been 30 years of railroad progress, which has produced immense results, throwing an entire net-work over the surface of the country between the Atlantic and the Mississippi, and superseding other means of transportation. It is to be observed that in the first year of the operations of the post-office department, there were but 1,905 miles of post-roads, and that on these, nine-tenths of the service was on horseback; the stage service being very small; but as the roads were improved up to 1811, the stage service came nearly to equal the horse service. From that date steam began to take the mails that ran on or near water-courses, and subsequently to 1830 the railroads began to compete with the stages on land; since that time the stage service has increased but six millions, while in the previous 20 years it had increased over fifteen millions of miles. The extension of post routes has been in 70 years, it appears, over 258,000 miles in the whole country, and the federal government has taken an active part in the extension of roads. The most important work of this kind undertaken was the Cumberland or national route across Ohio, Indiana, and Illinois to St. Louis. For this purpose, large annual appropriations were made by Congress. Other roads in many directions were projected, particularly from Washington to New Orleans; and in the frontier states, numerous roads were constructed by the troops under the direction of the war department.

It was thus that the federal government imitated imperial Rome, which in the days of its power clearly understood that that power was to be maintained only by the rapid march of its legions. From the "eternal city," noble causeways ran to the remotest corners of the then world. These were military routes simply, and intelligence was conveyed upon them from station to station with great rapidity. On the fall of the empire, those noble works, instead of being preserved for the uses of commerce, were in a great measure demolished by small states, as a means of preventing invasion. Nevertheless, those Roman roads remained the best roads in England down to the present century. What is called Ermine street connected London with Carlisle, in Cumberland. Another is known as Watling street. Apart from those old works, the roads of England were no better than those of this country up to the present century. In this respect there is great difference between the works of the Romans and those of the United States. Those old Roman roads had no competitors. During 1,400 years they continued the best means of conveyance. The United States roads, on the other hand, were hardly done before the inventive spirit of the age set up a successful rival in the giant railway, which has become *the* trunk road. The French government, under the empire, saw the necessity of roads, and began a system for Europe. The noble way over the Simplon was the first of these. With the fall of the empire that system became confined to France, but has since been vigorously pushed—$20,000,000 per annum was expended for many years in their construction.

There were in 1815, 3,000 leagues of "royal" roads, and these had increased to 10,000 in 1850. 2,000 leagues of departmental, or county roads had, in the same time, increased to 12,100, and town roads were extended by 15,000 leagues. These extended means of communication have imparted to French prosperity much of its strength.

In the United States the impulse given to road building by the federal government was taken up by the several states, if not directly at the public expense, yet by laws which compel inhabitants to work on the local roads. These regulations are different in different states. The essential features of all the laws are nearly the same as in the state of New York, where the directing power is in "commissioners of highways," who are chosen in each town. Under these overseers are also chosen. The commissioners direct as to the grade of the road, general shape, drainage, etc. The overseers summon the persons who are to work, see that they do actually work, collect fines and commutation money. Every person owning land, and every male over twenty-one years, is assessed to work. The whole number of days' work shall be at least three times the number of inhabitants in each town. Under this system the roads are never very good. The commissioners work gratuitously, and skill, labor, and time are never to be had for that price. The overseers, being changed every year, are never experienced in the undertaking. The men they summon go to it as a half holiday, and the work the overseer sets them at is pretty sure to be that which most benefits his own place. The money subscribed is not expended in the best manner. These are all circumstances which do not favor the construction of such roads as will greatly reduce the cost of transportation. In the laying out of the road in this way, a passable track is the most aimed at.

To admit vehicles, the track must be cleared of wood by the ax-men, swamps must be overlaid with materials, rivers bridged, and the route laid around hills in order to avoid the difficulties of ascent. These are the main points to make a road practicable. It is very soon discovered that transportation on a bad road is much more expensive than on a good, and efforts are accordingly made by the most enterprising to improve the bad roads. The first step is to make the roads in such a manner as to accommodate the greatest nnmber of people, and at the same time allow the largest loads to be drawn by horses. The better the road the larger will be the load that a team, or two horses, can draw at a given speed, and of course, the cheaper the transportation. It is to be understood, however, that the road must be equally good for the whole distance that a load is to be drawn, since if there is a space where great difficulties are to be encountered, the load must be gauged to meet that difficulty, no matter how good may be the remainder of the road. If a highroad leading through one township is not kept up, it neutralizes the public spirit of those adjoining; hence the necessity of a general system to insure continuous cheap transportation. To effect this, science has devoted its attention, but with little effect in the manner that country roads are made and kept in repair. The requisites of a road are: 1st, straightness, because straight lines are the shortest; 2d, it should be as level as possible, because every ascent causes a loss of power. Thus, if a horse draws on an ordinary level road two tons, and comes to an ascent of one foot in every twenty, he cannot ascend, because, in addition to the draught, he must lift up 200 pounds, or one-twentieth of the whole weight through the whole height. To make the road level, and save this labor and expense, the road must wind round the hill. There is little lost by this, because generally it is no further round than over. To prove this, cut an egg in half longitudinally, and set it upon the table; the line which goes round the base is the same as that which goes over the top. The half of an apple or any similar body will give the same result. Even if it were longer, it is better to go round, since the horse can do the last and not the other. The road should never be less than a rod wide, to allow two vehicles to pass. The surface of the road must be as smooth and hard as possible, in order to overcome as much as possible the resistance offered by sinking in, which is very serious, because the depression creates little hills before the wheels. Thus, if a wheel four feet in diameter sinks in one inch, to overcome the resistance thus offered one-seventh of the load would require to be lifted up over it. The harder the road, the less the resistance from this source. The greater the number of stones, hard substances, and inequalities there are to be encountered, the greater the resistance from collision. The resistance of *friction* is proportional to the roughness of the road, and the extremes of this may be illustrated by a carriage wheel on gravel and a rail wheel. The loss of power on a road, or in other words, the cost of transportation, is increased in proportion to the increase of these resistances, and inversely as they are diminished. To overcome them many improvements have been gradually adopted, such as earth, gravel, broken stone, stone pavements, wood, and railroads.

In marshy forests charcoal roads are made. Timber from 6 to 18 inches thick is cut, 24 feet long, and piled up lengthwise in the centre of the road in such a manner that the pile will be about 12 feet high. This is covered with earth, taken from ditches on either side. When the wood is charred, the coal is raked down to the widthof 10 feet, with a depth of two feet in the centre and one at the side. Such a road becomes very compact, and free from dust. Such a one in Michigan cost $660 per mile.

In the older states mostly plank roads were at one time favorites, and many hundreds of miles were constructed at a cost of $1,250 per mile. This plan has been generally abandoned. The roads not kept up are a nuisance, and many have been complained of, and removed as such.

Gravel roads have sometimes been made with the gravel from the shores of rivers, but the resistance offered by these roads is considerable.

The modes of road making here alluded to, are those which are prevalent mostly in the country districts, and where the work is performed as a tax. These answer for cross roads; but the great thoroughfares were taken in hand either by the state or by authorized companies.

Turnpike companies were chartered by most of the states, with the intention that they should construct roads having all the requisites of the best routes, and they were authorized to make a charge to those who use them. These, like most corporations, were subject to abuse; and the people were compelled to pay tolls when they had gained nothing in the way of easier transportation. New England, New York, Pennsylvania, and other states, authorized a number of companies which answered a purpose before railroads. The New York turnpike laws enact that vehicles having tires six inches wide shall pay half tolls, those with nine inches, one quarter, and those 12 inches, none at all. These enactments were designed to encourage the use of broad tires, as being less destructive to roads, but where the road is well made, as on the Macadam plan, the breadth of the tire has no effect; on the other hand, the horses' feet do the most damage. It has been calculated that a set of tires will, in average weather, on a macadamized road, run 2,700 miles, but that a set of shoes will bear only 200 miles travel.

The Macadam road, invented by a Scotch gentleman of that name, was introduced in 1820. The principle is simply that stones broken into angular fragments not over a certain size, say that of a pigeon's egg, will, under the pressure of wheels, combine into a compact mass, excluding all water, and, therefore, not subject to the action of frost, and be as solid as the original stone. These have proved to be the best roads, answering most of the conditions, and, therefore, allowing of transportation at the smallest cost. Good, well-made pavements, as used in cities, are better, since they give little resistance, and afford a foothold to the horses. In order to understand the difference in value of these roads, it may be remarked that a machine has been invented called a dynamometer. It resembles a spring balance; one end is connected with the carriage, and the other with the horses, and the power they exert is shown by the index. By such an instrument it was determined that, on a gravel and earth road, the resistance to draught of one ton was 147 lbs.; on a Macadam road, 65 lbs.; on a good pavement, 33 lbs.; and on a rail track, 8 lbs. Whence it appears that a horse can draw three times as much on a Macadam road as on an earth road; on a pavement, four and a half times as much; on a railway, eighteen times as much.

These figures indicate the gradual advance made in the power of transportation, since the roads, under the action of the state and federal government, and of the enterprising towns and cities, gradually improved from mere wagon ways to well-constructed roads in those sections where land carriage was most used. While individuals, companies, and states thus contributed to the improvement of roads, the federal government entered the field with greater vigor.

There were two motives for the construction of roads and internal improvements by the federal government. The first was to facilitate the mails; and the second was to facilitate communication. It was obvious that the new and infant states had little means to expend in the construction of roads that were to be more or less for the general benefit. The government, therefore, in organizing new states upon the national territory, made provision for the construction of roads out of the proceeds of the public lands sold within each state. The government everywhere constructed numerous roads, and after the war of 1812, when its finances began to be easy, it employed the French General Bernard and a corps of engineers in the construction of fortifications and roads. Among these engineers was Capt. Poussin. This gentleman went back to France, carrying with him the republican ideas here collected. He there propagated them with such effect that he was, in 1848, when the Revolution chased the last Bourbon from the throne, attached to the Paris *National*, the republican newspaper, and became, in consequence, ambassador of the provisional government to the United States in 1849. Thus, after the lapse of a quarter of a century, returning to the scene of his early labors.

When the state of Ohio was admitted into the Union, there were very few roads there, and the federal government was the chief proprietor of the land. It was agreed, therefore, that two per cent. of the proceeds of the land sold should be applied to the making of a road leading to the state. The same condition was made when Indiana, Illinois, Missouri, Mississippi, and Alabama were admitted, and the road was commenced. A turnpike road from Baltimore, 170 miles to Wheeling, was laid out, and a similar road from Washington, 150 miles to Cumberland was constructed. From that point the Cumberland road runs 135 miles to the east bank of the Ohio; of this distance, 85 miles are in Pennsylvania, 35 in Maryland, and 15 in Virginia. This was extended west 80 miles to Zanesville, and so through the states of Ohio, Indiana, and Illinois, to St. Louis. The road has cost the government over $3,500,000. Its effect upon transportation was very great. Before its construction it required, to go from Baltimore to Wheeling, 8 days. This was reduced to 3 days. The figures were the same for the length of travel from Washington to Wheeling. Its influence upon the country through which it ran was great. Villages multiplied in its neighborhood, and the value of property was much enhanced. The city of Wheeling was particularly influenced by it. In the year 1828 it forwarded to Baltimore over that road 3,500,000 lbs. or 1,750 tons of produce, by over 1,000 wagons. Anticipations were then indulged that a small reduction in the cost of transport would bring 100,000 tons of Ohio produce over the road to Baltimore. They did not then foresee that the reduction in cost would be brought about only by rails to Baltimore.

The Cumberland road by no means monopolized the attention of Congress, but roads were constructed in most of the states under the war department, and in the new states the army was employed in making them. Some 800 miles were thus made in Arkansas. We may allude to a few of these roads, as that to Mars Hill, Maine; Detroit to Fort Gratiot, Michigan; do. to Saginaw bay; do. to Chicago; Laplaisance bay to the Chicago road; Fort Howard and Fort Crawford; road to Chattahoochee; canal surveys in Florida; road to Apalachicola; Pensacola bay to Pittsburg, Miss.; road from Jackson to Fulton, Mississippi; Memphis to Little Rock; Green bay to Winnebago. These few names of roads spreading from Maine to Arkansas and Florida will give an idea of the extended works of the government, which also embraced removing obstructions of rivers and improving river navigation. A grand system of internal improvements was thus developed, until its growing magnitude made it a political issue, and the whole system came to an end under the Maysville road veto of General Jackson. The principle was adopted by one party, that the federal government had no power to construct any but strictly national works, or not any that were entirely within a single state. The system thus came to a violent end, after an expenditure of some $30,000,000, but not until railroads had begun already to supersede canals and roads. The federal government had thus lent a powerful hand to the extension of highways. The great thoroughfares that it had laid open had facilitated migration and settlement, and wherever these had taken place, local roads multiplied, until we find that in the present year there are 260,052 miles of post-road in the Union.

The mails of the government were given out by contract to the highest bidder for four years' service. The whole mail service was divided into sections, north, east, west, and south, each being let for four years, but every year one of those fell due. The contractors agreed to deliver the mails on certain routes in a given time, for a certain amount of money. The mail money was generally depended upon for the expenses of running the vehicles, and such passengers as could be carried by the same conveyance afforded a profit. Thus the system for the circulation of letters and newspapers became the machinery for the circulation of the people. These accommodations were, however, far from being luxurious at a distance from the great cities. In these, indeed, the staging was conducted in a style approaching the splendid. The eastern stages running into Boston, and penetrating into every part of New England, were celebrated for their quality and style, as were those of New York, Philadelphia, and Baltimore, and most other large cities that were the centres of traffic, as well as post service. The different "lines" ran such opposition, as reduced the fare and promoted speed. The dandy "turn-out" being ready at the hour, well dressed, polite, smart drivers received the "ribbons" with gloved hands, and the "team" went through with a skill that could get the best time out of the nature of the road. As the traveller receded from the great centres, he found the "teams" worse, and the roads to match. The mails ran fewer times in the week, the vehicle dwindled from the easy coach to the covered spring wagon, to the open wagon without springs, ultimately to the horse, and finally perhaps to a man's back, and the traveller's accommodation diminished in proportion.

CHAPTER II.

COASTERS—STEAMBOATS—CANALS.

In the neighborhood of the water-courses the traveller was better accommodated by the coasting vessels. The early settlements of the country had been, as a matter of course, upon the coast and on the numerous streams with which the country is supplied. The roads had extended back, more or less, into the country from these settlements, where the freights accumulated at the landings, whence they were carried by water for interchange with other towns, or, as the country grew, to be exported abroad. The wagon charge for freight was always so high as to absorb the value of the produce at moderate distances, and travelling was mostly upon horses, unless water conveyances could be availed of. This was the common mode for long journeys on all the rivers. The following advertisement, from a New York paper early in the present century, gives an idea of the style of travelling in the youth of men now not old.

"Sloop Experiment—for passengers only.—Elias Bunker informs his friends and the public, that he has commenced running a sloop of about 110 tons burthen, between the cities of Hudson and New York, for the purpose of *carrying passengers only.* The owners of this vessel, being desirous to render the passage as short, convenient, and agreeable as possible, have not only taken care to furnish her with the best Beds, Bedding, Liquors, Provisions, &c., but they have been at very great expense and trouble in procuring materials, and building her on the best construction for sailing, and for the accommodation of *ladies and gentlemen travelling on business* or *for pleasure.*

"Merchants and others residing in the northern, eastern, or western counties, will find a *great convenience* in being able to calculate (at home) the precise time they can sail from Hudson and New York, *without being under the necessity of taking their beds and bedding*, and those in New York may so calculate their business as to be certain of comfortable accommodations up the river."

This was evidently no common luxury that Capt. Bunker proffered to an admiring public. They were no longer required to "take up their beds and walk." Ladies and gentlemen travelling for pleasure could now be supplied with bedding, as well as other luxuries, on board a hundred ton sloop, and depend upon the time of her *leaving.* The wary Elias did not commit himself to the time of her arrival, however. Long experience had made him cautious on that point. However, to be certain of leaving was something, since the taking of a passage had been only a preliminary step to a voyage. The completing of the freight, the waiting for a wind, and the notification by means of a black man to be on board at an appointed hour, were now to be dispensed with. This was a great blessing, a good way in advance of the navigation 150 years previous, when permission was granted to a sloop to go from New Amsterdam (New York) to Fort Orange (Albany), provided she did not carry more than six passengers. This was the mode of reaching most of the large cities. From any point of the eastern coast the best mode of reaching Boston was by the lumber or other coasters. In these the passengers, male and female, were stowed away in a few berths in the cabin, or *sprawled* around upon the uncarpeted floor. Sometimes these vessels, when the freight earnings were eked out by a fair number of passengers, as from Bangor, Portland, or other cities, were raised to the dignity of a "packet," when a few extra berths were decorated with a red bombazette frill of rather a scanty style. In the rainy seasons, spring and fall, these were almost the only modes of travelling. It may be suppossd that passengers were not very abundant. The vessels, however, improved in size and accommodation, and the number of passengers still, even in these railroad days, conveyed by them is, perhaps, as large as ever. The speed of these vessels was not great, and the uncertainty of arrival such as now would by no means suit ideas of business. In those seasons of the year when the roads were generally good, the stages would make four miles per hour and arrive in fair time. Such arrangements did not permit frequent visits for the purchase of goods, and most business was done fall and spring, when the goods followed the water-courses as far as possible, and then paid from 15 to 30 cents per ton per mile, according to the difficulties of the route. Even the mail charge was from 6¼ to 25 cents per single letter, or a letter on one piece of paper, being 18¾ cents for any distance between 150 and 400 miles—envelopes, of course, were not used. Those charges were continued down to 1845, when the reduction took place.

The tonnage employed in the coasting trade had increased from 68,607 in 1789, to 420,362 in 1812. Inasmuch as but little change had taken place in the speed and build of the vessels, the increase indicates the progress of business. In 1807 the enterprising sloop owners who, like Captain Bunker, had conceived the idea of furnished berths for the accommodation of the public, were struck aghast at the success of Fulton's "Clermont"—named after the country seat of Chancellor Livingston—steaming up the river at the rate of four miles an hour under all circumstances. The conservative interests were loud in demonstrating the utter ruin that was to overtake river craft, the occupation of boatmen, and, consequently, the navy, "the country's right arm of defence," by means of this great innovator. Nevertheless, the spark of genius had kindled the flame of invention, and the public were becoming absorbed in it. Each new steamer exceeded the previous ones in build and style, and the machinery underwent as rapid improvement. As usual, however, the public were slow to be convinced. It was admitted, when it could no longer be denied, that steam would answer for the river, but it was held to be idle to attempt the Sound navigation in those new-fangled concerns. This problem was decided in the Fulton by Capt. Bunker, possibly our enterprising friend of the sloop. The "Hell-gate" passage was, in those days, an object of terror. An English frigate had been lost there in the old war, and there were not a few who still held the idea that "the devil only could beat those English who had beat the Dutch." The East River rushing up the Sound at particular times of tide pours a tremendous flood between Ward's and Long Islands. The passage narrows to a few yards, and the tide rushes past the "hog's back" and the "gridiron," turns at right angles, and forms a foaming whirlpool around the "pot-rock," which, even with the surface of the water, is fatal to any vessel that touches it. Through that "gate of Hell" the steamer was to pass, and the operation was described by a passenger as follows:—

"I remember the long-agitated question, whether steamboats could be made capable of sea navigation, or so constructed as to traverse our sounds, bays, and coasts in safety. This question was put to rest by the enterprise and skill of Capt. Bunker. In the Fulton, constructed, I am told, with a view to crossing the Atlantic, he undertook the navigation of Long Island Sound, an arm of the sea in which the most severe tempests are often encountered. During a season of no extraordinary moderation, including the two equinoctial gales, Capt. B. lost but a single trip. Another doubt remained to be removed. It was supposed impossible to pass the celebrated passage of Hell-gate against the tide, at the strength of the current. This was reserved for Capt. Bunker to remove, and I happened to be on board at the time of the novel and interesting experiment, returning southward from New Hampshire. A number of respectable passengers witnessed the performance. It was in the boat Connecticut, built with all the strength to be obtained and careful workmanship. The machinist (McQueen) was accompanying his engine to prove its powers, with careful and ingenious assistants, and some of the owners were on board also. The first attempt to pass the point of greatest pressure of the contracted stream was unsuccessful, and the boat was compelled to retreat into an eddy and increase her steam. With renovated power the effort was repeated, every man fixed immovable at his post, the passengers properly stationed in different parts of the boat, the engineers employing their utmost diligence to force the passage. They were again defeated by the supposed resistless stream, and again retreated, racked, strained, and shivering, from the contest. After a short pause and fresh preparation, it was resolved by the parties concerned to make a third endeavor, and test the strength of the machinery by the greatest trial it could ever be expected to bear. After a severe struggle, in which a weaker vessel would have been disjointed and torn to pieces, the headstrong current yielded to the giant power of steam, and the triumph of art over nature was effected. A few moments of greater breathless anxiety I scarcely ever witnessed. Mechanical science achieved a victory over elementary force, and overcame an obstacle heretofore deemed in this manner altogether insurmountable. The courage and perseverance of Capt. B. were so conspicuous on this occasion, that I can never forget the impression made on all present. We have since found it as easy to traverse our sea-board, navigate the Mississippi, and cross the Atlantic, as it was to find America after Columbus had broken the egg."

To those who now so frequently make that dire passage without knowing it, this animated description must afford surprise as well as amusement. It is suggestive, not so much of the temerity of the "bold navigators" of that day, as of the feeble nature of the boats then built. The passage, to be sure, has now been deprived of some of its "horrors" by the removal of the pot-rock, which has been broken by gunpowder blasts to a depth which leaves it no longer dangerous. The noble steamers of the present day pass through at all times of tide, without apparently feeling the current, instead of butting at it three times "strained and shivering." The steamboat, after performing this feat, passed up the Connecticut river for the first time to Middletown. The North River boats continued to improve, and the time of the Clermont—36 hours to Albany—was, in 1820, reduced by the Paragon to 20 hours. In 1823, however, the time from New York to Providence, 200 miles, was 20 hours, and the stage to Boston completed the route, 40 miles, in 6 hours more, making 26 hours. At that date steamers were multiplying on all the Atlantic rivers and bays, and on the western rivers, as well as on the lakes. In 1819 the first steamer crossed the Atlantic from Savannah, Georgia, to England. In 1825 the Chief Justice Marshall had reduced the time to Albany to 14 hours 30 minutes. The progress in speed may be seen at a glance in the following figures:—

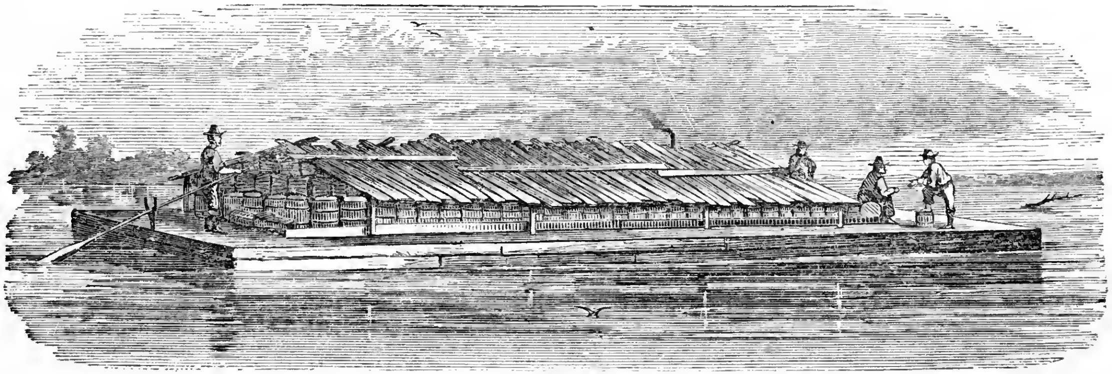
1811, Clermont's time to Albany,	4 ms. per h.,		36 hs.
1820, Paragon,	"	"	27
1825, Chief Justice Marshall,	"		14.30
1840, Knickerbocker,	"		9.33
1860, average time 18 miles per hour,			8

With the opening of the Erie canal in 1825, the quantity of goods going and coming much increased the demand for transportation, and barges in tow of steamers began a new era in that buisness. That goods could be carried west on the canal, and so by continuous water-courses on the lakes and their affluents, induced more passengers by the same route. In 1841 the improved method of propelling by screw was introduced by the patent of Capt. Ericsson. The iron screw steamer R. F. Stockton, of 72 tons, came from Liverpool under the command of Capt. Crane, and became a tug on the Raritan canal. Those steamers now gradually gained ground in public favor. The speed was long not so great as that of the paddle wheels. This has been gradually overcome by improved models and forms of screw, until in the month of October, 1860, two propellers of 100 feet length were launched for the North River trade, and made time 18 miles per hour, being the fastest boats for their length afloat. This class of vessels may ultimately be exclusively used in the European trade.

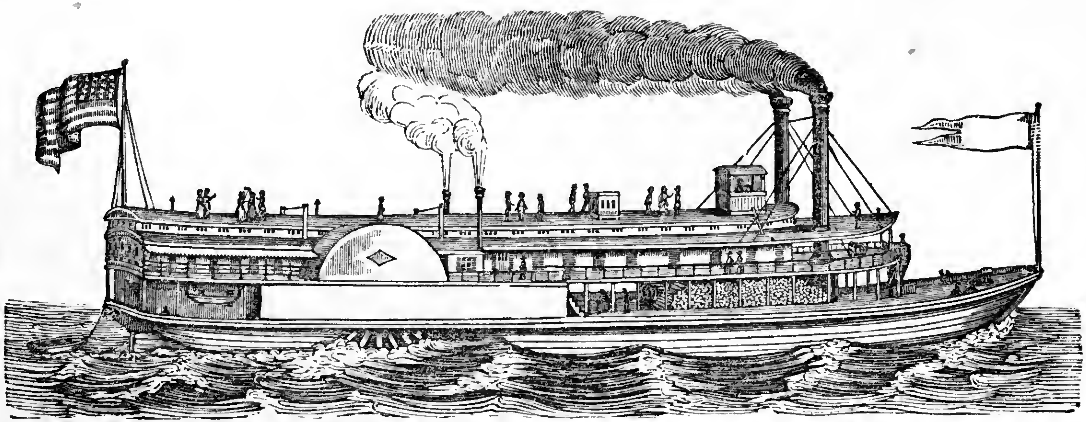
The settlers who had crossed the mountains in the early times of the government had located mostly on the great streams, within easy reach of the means of conveying the surplus to points of sale. They were not provided with vessels of a very expensive construction; and flat boats were the chief means of descending the streams. These vessels, designed only to go down stream, were composed of such material as, after

[illegible]

having served the purpose of transporting produce, could be broken up at the place of destination, and sold as lumber. These were improved into keel boats, for the purpose of ascending the streams, and in either case were propelled by long poles in the hands of the boatmen. These, standing on the gunwale at the extreme bow of the boat, thrust the pole into the mud, and setting the shoulder against the top, pushed the boat forward with the feet in walking toward the stern, which reached, they drew up the pole, walked back, and repeated the movement. In this laborious mode of travel, all the merchandise sent from the east, *via* New Orleans, reached its destination. It required four months to travel thus from New Orleans to St. Louis—a distance of 1,500 miles, and the cost of the goods, it may well be supposed, was enhanced by the process; while, on the other hand, the produce sent down realized but little. Thus, between the cheapness of the produce and the dearness of merchandise received in exchange, the settler realized but little for his labor. It is easy to conceive how great a blessing was steam on those waters, to enable the weary men to stem the ceaseless, downward flow of the mighty currents. In 1811 that blessing made its appearance at Pittsburg in the shape of a steamboat, built by Fulton, and which had a considerable success. The general progress was, however, slow, for the reason, among others, that, as in all such cases, there was a large capital invested in river craft, which would depreciate in value in face of the new power, and there was not much capital to embark all at once in steam. It was also the case that ChancellorLivingston, the partner of Fulton, claimed a monopoly of the lower Mississippi trade, and put a restraint for some years upon steam in that region. So great a power could not, however, but force its way. With the construction of the Enterprise, in 1815, St. Louis was reached in 25 days from New Orleans, and public enthusiasm was aroused. There were, however, up to 1817, still but twelve boats upon the western waters, of an aggregate tonnage of 2,335 tons. The time to Pittsburg was 54 days, of which 36 days was running time. These passages caused much excitement, and a bold merchant predicted that the rate of freight between New Orleans and St. Louis would fall to $3.50 per 100 lbs., but he was regarded as visionary, or what they would now call in Wall-street language a "bear" in freights. His sanguine nature would probably have been surprised could the veil of time have been so lifted as to permit him to see 35 years ahead—the boats of the present day making money at 40 cts. per 100 lbs., and carrying it in three days, instead of 25. The Monongahela and Ohio Steamboat Company claimed patronage because their new crack boats could go nine miles an hour! But they were in advance of the times; that speed was thought to be dangerous, even if possible. Those people are now, however, not quite satisfied unless the speed is equal to 25 miles in still water. The war had given a new impulse to settlements west; the more so that steam now so much facilitated travel, and freights multiplied in proportion. Thus reciprocally the improved means of travel induced more locomotion, and increased traffic more demand for vessels. The multiplying boats and more rapid passages still found a sufficiency of business, and even the old river craft were kept in requisition for tow boats. Cincinnati began to build barges of 100 tons to go to New Orleans in tow of steamers; and the Etna made the passage down in fifteen days, reflecting great glory on the commercial enterprise of that city, and its citizens became elated. A Cincinnati writer of 1817 estimates the territory drained commercially by that city at 10,000 square miles, and remarks: "Supposing this settled by 40,000 families, and that each farm would give two tons annual surplus for exportation, there would be 80,000 tons to send to New Orleans, or freight for 800 boats of 100 tons each." The writer apologizes for the extravagance of this estimate. Commercial enterprise began to seek new routes. In 1823 three keel boats in tow passed 450 miles up the Wabash river. It was not until 1826 that the first steamer ran up the Alleghany river. In the same year the ship Illinois reached St. Louis from New York, *via* New Orleans, 3,000 miles, in twenty-nine days and a half, and the first steamer ran up the Susquehanna to Tioga. The opening of the Erie canal, in 1825, caused a great change in travel. Thus the journey from New York to Pittsburg was accomplished by canal, with only eight days staging, and thence down the river to New Orleans. In 1824 the passage up from New Orleans to New York, *via* Pittsburg, was made in 24 days, at an expense of $90. The passage from Natchez to Philadelphia, 2,000 miles, was equal to 17 days. In



FLATBOAT FROM ST. LOUIS TO NEW ORLEANS, TIME FOUR MONTHS.



STEAMBOAT FROM NEW ORLEANS TO ST. LOUIS, TIME THREE DAYS.

the same year a remarkable voyage was projected from Charleston to Green Bay. It was a sloop of six tons, with six passengers, and it reached Rochester in 15 days from Charleston. The passage of a gentleman from Detroit to Washington and back in 16 days was regarded as a miracle.

The remarkable progress of steam upon the Mississippi may be estimated most readily by a table of the passages at different periods, as follows:—

NEW ORLEANS TO ST. LOUIS—1,300 MILES.

Prior to steam			120 days.	
1815,	Steamer	Enterprise	25 "	
1823,	"	average passages	12 "	
1826,	"	General Brown	9 "	12 hours.
1828,	"	"	9 "	4 "
1860,	"	running time	3 "	

The time between New Orleans and St. Louis was thus diminished under the various improvements suggested by experience in the form and mode of running steamers. A boat of 350 tons when fitted out will now cost some $50,000, and will carry 500 tons down stream, or 1,500 bales of cotton on deck. Twenty years ago the freight of cotton down from Memphis was $2 per bale, and below Natchez $1 per bale. The charge for freight up from New Orleans to Natchez was 75 cts. per 100 lbs. As the business increased, larger boats were built. Of these the Eclipse was the type. She carried 1,200 tons, but was too large to pay; and boats are now constructed of a less dimension. The Mississippi boats are large flat-bottomed boats, drawing from 15 to 50 inches of water. The speed depends upon the circumstances of the channel. That of the Memphis, recently built for the St. Louis and Memphis trade, is 18 miles in still water per hour. With light draught and great pressure, a speed equal to 24 miles in still water has been attained. The Altoona ran between Alton and St. Louis, 25 miles, in one hour and forty-five minutes, and in one hour down; average down and up, one hour and twenty-five minutes. Eighteen miles is said to be the time of the western boats. Those rivers flow with gentle currents in mostly shallow water; and there have been various changes in the fashion of the boats. The stern-wheel boat, we believe, is peculiar to those rivers. Instead of having two wheels paddling, one on each side, one wheel, 20 feet in diameter, is placed directly at the stern, athwart ships, and by its revolutions pushes the boat ahead. These boats are not remarkable for their speed, but answer in narrow and shallow streams. The regular steamers have their main decks within four or five feet of the water, and the guards overhanging the bow give them the appearance of a New York ferry-boat. The paddle wheels are generally much further aft than in the eastern steamers. The after part of the main deck is devoted to freight. Above the main deck from 10 to 18 feet is the saloon deck, which extends nearly over the whole of the main deck. The saloon is surrounded with state-rooms, which open into it, as well as on to a promenade which goes entirely round the outside of the boat. The saloon is from 150 to 250 feet long. Above this deck is a promenade deck, upon which is a long tier of state-rooms, and this, in its turn, is surmounted by another promenade deck, which has the pilot-house at its front, and which is usually 50 feet from the water. But formerly, when there was no restraint upon reckless steam pressure, or the explosive qualities of the boiler, its *height*, as well as that of the decks, was very uncertain. The "crack boats" are now built from 300 to 400 feet, with 36 to 40 feet beam, eight feet hold, and draught of water, light two feet, and loaded four feet. These steamers are now free from those reckless races which formerly so endangered life, when the safety-valve was fastened down, the furnace stuffed with tar and pitch, and the captain, rifle in hand, ready to shoot down the pilot of the opposing boat at the critical moment when the least deviation in steering would lose him the race. Those barbarous times have passed with the frontier manners of the passengers. Their sporting, drinking, gambling, fighting, have given place to business, temperance, prudence, and refinement, while wealth rolls up in the cities as a result of the speedy and cheapened transportation which the steamers have effected.

The increase of steam tonnage on those waters, has been as follows:—

	1842.	1851.	1860.
New Orleans	28,153	34,736	70.072
St. Louis	14,725	31,834	55,515
Cincinnati	12,025	24,709	23,136
Pittsburg	10,107	16,943	42,474
Louisville	4,618	15,181	29,037
Nashville	3,810	3,578	5,268
Wheeling	2,595	7,191	11,545
Vicksburg	..	938	..
Memphis	..	450	6,143
Galena	..	..	5,849
Total tons	76,033	135,560	249,039

It is a matter of course that when the speed of these vessels has increased in the manner indicated, their efficiency for traffic has progressed in the same ratio. In the 25 days that were formerly required to go from New Orleans to St. Louis, a steamer of the present day will make eight passages, and will carry more freight. Hence, the number of tons does not indicate the growth of the trade. If the number of tons is three times greater, the business is 30 times larger. The effect of the great reduction in the freight on goods may be illustrated by a single example. Thus, in 1815 cotton cloth was 30 cts. per yard, and 100 yards weighed 25 lbs., which would consequently be worth $30. The transportation of this at that time from New Orleans to St. Louis would cost $5, or 17 per cent. of the cost. The same quantity of cloth is now worth $9.00, and the transportation from New Orleans to St. Louis 40 cts., or 4½ per cent. of the cost. These figures speak of the greater money value realized for products, and the increased quantities of merchandise procured for that money value.

The war of 1812, by interrupting trade on the Atlantic, had induced a large migration to the west, when steam was opportunely developed to facilitate trade and traffic at the same time. The return of peace found a large population west of the mountains in the full tide of prosperity, and in the Atlantic states great excitement in regard to steam, with multiplying manufactures, which sought a market in the growing west. Under such circumstances the old canal projects for opening up the communication were revived in full force, the more so that the war had nearly destroyed the usual water communication.

Instead of transporting merchandise in sloops and schooners along the coast, now no longer safe from the enemy, recourse was had to wagons over roads not the best in the world. This was necessarily very slow and costly. The traffic between New York and Philadelphia, for instance, was carried on in a Conestoga wagon, drawn by four horses, and that which covered the distance of 90 miles in three days was known as "the flying machine," and the value of goods at either end of the round showed great fluctuations, enhanced by the expense. This extra expense for the whole coast alone, it was asserted, would have paid the whole cost of a system of internal navigation from Maine to Georgia. It was then that the enterprises to which the great minds of the Revolution had given birth at the peace of 1783 began to be realized, and two objects were sought, viz.: a safe inland water communication along the whole Atlantic border, to operate in case of war, and another was to connect the waters of the west with the east, and the public began to regard with more favor the project of uniting the lakes to the Hudson river. Mr. Morris, who had suggested it at the close of the Revolution, wrote an able report in its favor in 1812, when the war gave new interest to it. The undertaking was formidable, and New York applied to the federal government and other states for aid, but her application was met with jeers and ridicule. The result was the determination of the state to undertake it alone, when the return of peace allowed of more facility for its execution; accordingly, on the 4th of July, 1817, the Erie canal was commenced with great ceremony, Governor De Witt Clinton turning the first earth, and it was completed October, 1825. The event was celebrated with the greatest pomp along the whole line, and in the city of New York. The canal is 363 miles long, 40 feet wide at top, 4 feet deep, and the capacity of boats, 80 tons. The construction cost $7,143,789, or $19,679 per mile. This immense work gave the long-wished-for communication between the great lakes and the tide waters of the Atlantic. In the same year, viz., October, 1817, a canal connecting the waters of Lake Champlain with the Erie canal some miles from Albany was commenced. This Erie and Lake Champlain or Northern canal is 63 miles long, and was completed at the close of 1823, at a cost of $1,257,604, or $19,962 per mile. The Erie canal proved to be the most successful work of the kind in the world, and within 10 years discharged in full the debt created for its construction. The great success of the work not only gave an impulse to canal building in other states, but induced the state of New York to embark in new undertakings of the same nature, which have not proved so successful. These were what are called the lateral canals, draining the country on either side, into the grand canal. The Oswego canal runs 38 miles from Lake Ontario to the Erie canal, at Syracuse. It cost $55,437, and was finished in 1838. The Cayuga and Seneca lake runs 23 miles from those lakes to the Erie canal at Montezuma, and was finished in 1829, at a cost of $237,000. The Chemung canal, connecting the Chemung river with Seneca lake, 39 miles, was finished in 1838, at a cost of $316,000. The Crooked Lake canal, 8 miles, was finished in 1836, for $120,000. The Chenango connects the Susquehanna at Binghamton with the Erie canal at Utica, 96 miles, and was finished in 1837, at a cost of $2,417,000. These canals never paid their expenses, and became a burden upon the revenues of the Erie. There are also in New York, the Genesee Valley canal, 108 miles; Black River and feeder, 87 miles; the Delaware and Hudson, 83 miles; and the Oneida, 8 miles.

The great success of the Erie, as we have said, roused the emulation of other states, and during the five years succeeding the opening of the Erie the air was filled with canal projects, only to name which would occupy much space. We may mention some of the most extraordinary, however: a canal from Boston to Narragansett bay; Long Island to Canada, *via* the Connecticut river; Boston to the Connecticut river; a canal over Cape Cod; Providence to Worcester; a ship canal across Central America. These projects only indicate the extraordinary activity that the Erie success had imparted to the public mind. Those which were evidently the most needed for present and future commerce, were immediately undertaken. The Chesapeake and Ohio, to connect the waters that the name designates; the Ohio canal, to connect Lake Erie with the Ohio river; the Farmington canal, in Connecticut, afterward used for a railroad site; the Chesapeake and Delaware, to connect those waters, were all ready, and broke ground July 4, 1825, three months before the Erie was finally completed. These works, with many others, which we shall take up in their order, were pushed to completion, under various difficulties, inasmuch as that they required a large amount of money, but they had an immense influence upon traffic, and called into requisition an amount of engineering skill which had never before been demanded in the country, and various success has attended the construction. The object of a canal is, of course, to float boats that contain merchandise, between two points, in order to reduce the expense of the transportation. The canal is therefore constructed with some regard to the amount of business that will be required of it. The channel must be excavated on the level soil, carried over gaps and rivers by embankments that will hold the water, and it must be fed by abundant streams.

The channel is excavated with the two sides sloping at the same angle, which varies with the nature of the soil. The base of the slope is commonly to the height as 5 to 4. The bottom of the canal is generally the breadth of two boats upon the deck, in order that they may pass. The depth of water in the canal should be at least one foot more than the draught of the boats. The tow-path is about two feet above the level of the water, and about ten feet wide. When the canal runs through a sandy soil, or one that does not easily retain water, the bottom is "puddled." This process is to mix clay well with gravel and put it on in successive layers of two or three inches thick. When a new layer is put on, the old one is roughed up to make both adhere well. When repairs are needed, they are generally done at the time the water is let out for the winter. The bed of the canal is so laid as to give a gentle current to the water. The levels are the distances between the locks, and each level, proceeding downward, has a less elevation than the preceding one. In a hilly country these locks are frequent, and in some cases are continued for a distance, like steps up and down a declivity. Thus the Erie canal, on leaving Lake Erie at Lockport, descends 60 feet to the Genesee river. To perform this, ten double locks built in masonry are required, but the canal has also one level of 63 miles without a lock. The lock is a chamber built of timber or masonry, as large as possible for the size of the canal. The boats must not exceed what can be admitted to the locks. The top of the lock is above the surface of the water, and its bottom is level with that of the next lower level. Each end of the chamber is closed by heavy swinging doors, which open in the middle against the direction of the current. The doors being a little broader than the lock, they meet in the middle at an angle, and the weight of the water presses them together. When a boat going up the canal comes to a lock, it passes between the open gates, which close behind it. The water is then let in from the upper gates, until the lock being full, the boat floats to the upper level, generally about 10 feet rise, but sometimes 18 feet. It passes out, and another boat being ready to go down takes its place, when, the upper gates being closed, the water is let off below and the boat lowers with it to the lower level. A lock full of water is thus discharged. It follows that a large supply of water must be had to replace what thus passes off, in addition to leakage and evaporation. The engineer of the Erie canal calculated the loss by leakage was 100 cubic feet per minute. For supply, reservoirs are often constructed. Canal branches, called feeders, are made to bring water from distant sources. Steam power is also used to raise water to the required level. This is the case with the Illinois and Michigan canal; the waters of Lake Michigan being pumped up to the summit level. In some cases inclined planes are substituted for locks. In these cases the boats run upon trucks, which are then, by the power of steam, dragged up the plane to the higher level. In the Morris canal, of New Jersey, these have a slope of one in 21. These are the general features of all the canals, but the influence they have upon transportation depends, of course, in some degree, upon the localities and the capacities of the work. Boats are commonly towed upon a canal by horses. A single horse can draw upon a good road a ton at a speed of 2½ or 3 miles per hour, and can draw as easily 70 tons upon a canal at the same speed. The difference in cost is immense. Instead of 24 cents a ton for one mile land carriage, the Erie canal charges 6 mills per ton per mile, or one-fortieth part of the expense. The freights charged are distinct from the state tolls. It is obvious that where the boats are of greater capacity, allowing of a larger quantity to be passed down at the same passage, the cost of transportation is much diminished. Thus the Delaware and Hudson canal had a capacity for 50 ton boats, and coal was carried 108 miles for $1. The enlargement of the canal so as to admit boats of 100 tons reduced the cost 65 cents, but some of the boats carry 148 tons at proportionate rates. When the routes of the canals of other states threatened to affect the business of the New York canal, the reduction of the cost by means of enlargement was the means resorted to to retain the trade, and the enlargement has been prosecuted at great expense. The principle of the enlargement was based upon the fact that as the canal is abundantly supplied with water, the only limit to its capacity would be the time required to pass boats at the locks. It was calculated that 26,000 boats can be locked each way in a season. The old canal boats were about 70 tons, hence the utmost capacity of the canal would be 3,640,000 tons; but by the enlargement the boats were to be of 224 tons burden, hence the tonnage would be 11,648,000 tons, if the quantity moving each way was the same, but the down freight is as four to one of the up, which reduces the capacity to 7,230,000 tons. Before the canal was built, the expense of transportation from Buffalo to New York was $100 per ton! and the time 20 days. A ton of wheat in New York was then worth about $33, hence the transportation was three times the value of the wheat, six times the value of corn, and twelve times the value of oats. As a consequence, the wheat of western New York at that time went down the Susquehanna to Baltimore as the cheapest and best market, as the lumber of the head waters of that river now goes. When the canal was opened, the freight down was about $14 per ton, more or less, according to the character of the freight. This has gradually been reduced, and in 1850, when the railroads for the first time were allowed to carry freight, it was $3 to $7 from Buffalo to New York. By the enlargement it is supposed the rates will be reduced to $1.82 between Albany and Buffalo. Since the permission of railroads to carry freight, however, the business of canals is more confined to those heavy freights furnished by the raw produce of the country, lumber particularly. Those coarse and bulky articles that are of low money value as compared with their weight will continue to move upon canals, but the lighter and more costly, as well as those pressed for time, will be carried exclusively by rails. These latter have some disadvantages, however, as in the case of flour, the motion of the railroad causing it to waste, an objection not urged against canal travel.

The total length of the five great lakes is 1,555 miles, and the area 90,000 square miles, and they are estimated to drain an area of 335,515 square miles. That vast tract of waters was a waste as far as transportation went until the year 1797, when the first American schooner was launched. The craft increased to some extent for the small commerce that engaged the settlers when there was no outlet either to the Atlantic or to the south. In 1816, however, a steamer was built on Lake Ontario, and in 1819 the Walk-in-the-Water, 340 tons, was launched at Buffalo. The most of the trade, however, consisted in the operations of the Indian traders, carrying westward supplies and trinkets for the trade, and returning with furs and peltries. On the opening of the Erie canal, in 1825, a new state of things presented itself. Western New York threw off its frontier aspect, and put on an air of civilization, since it became a receiver of western produce and exporter of goods. The steam tonnage multiplied to transport the growing produce of the west. In 1822 the Superior was launched, another steamer in 1824, two in 1825, and three in 1826. One of these made the first voyage upon Lake Michigan, in 1826, on a pleasure excursion. It was not until 1832 that business called them thither, and then one reached Chicago, in the employ of the government, to carry supplies for the Black Hawk war. From that time, tonnage has increased as follows:—

	1841.	1850.	1860.
Buffalo Creek	6,773	25,990	42,640
Presque Isle	2,813	5,691	1,471
Cuyahoga	1,855	6,418	22,597
Sandusky	..	..	360
Miami	887	1,745	..
Detroit	2,053	16,469	30,381
Mackinaw	..	1,746	617
Chicago	..	652	8,151
Milwaukee	..	..	2,026
	14,381	58,711	108,243

The 11 boats running in 1833, carried to and from Buffalo 61,485 passengers, and the fares with the freight amounted to $229,-212. Those were the years of the great land speculations, and crowds of passengers went west on that errand. Three trips were made a year to the upper lakes. The trips to Chicago from Buffalo occupied 25 days to go and return. In 1841 the time required for a first-class steamer was 10 days from Buffalo to Detroit and back. This was reduced in 1851 to 3 days, and 5 for propellers. In 1834 the lake commerce was controlled by an association, owning 18 boats. This association was kept up to 1841, when the number of boats had increased to 48. The opening of the Ohio canals had poured upon the lakes a large amount of produce. The 500 miles of canal then completed, opened up the grain country to the lakes. In 1835, Ohio exported by the lakes 543,815 bushels of wheat; in 1840, 3,800,000 bushels; and in 1851, 12,193,202 bushels, which paid $500,000 freight and charges. The railroads have since interfered to some extent, but the wheat received across the lakes has this last year been as follows:—

From Ohio	2,856,216	bushels.
" Indiana	3,219,225	"
" Michigan	2,117,970	"
" Illinois	12,195,195	"
" Wisconsin	5,447,766	"
" New York	130,667	"
Total	25,967,039	"

The successive opening of the Ohio canals in 1833, the Illinois canal in 1848, and the Indiana canal in 1851, all added constantly to the amount of produce to be transported, and since the last-mentioned date the railroads have opened new regions of country, and increased the lake trade. It is to be borne in mind that the size of the vessels, their great speed when under way, and the greater dispatch in loading and unloading by steam, not only for motion, but for labor at the dock, enable the same quantity of tonnage to do ten times the business that it formerly could do. In 1859 the lake steamers averaged 437 tons. In the present year the average is 680 for steamers and 470 for propellers. A change is now going on in the power, by reason of the improvements in propellers. In 1843 the first lake propeller, the Hercules, was launched at Cleveland, 275 tons, the screw of Ericsson's patent. She was said to have made great economy in wood for fuel. In 1851 the propellers had increased to 52, with a tonnage amounting to 15,729. In 1860 there were 118, tonnage 55,657. These boats had far less speed than the paddles, but they have not ceased to gain in public opinion, not only upon the lakes, but in the Atlantic bays and rivers, until recent improvements have brought them to rival the paddle wheels in speed. These vessels will in all probability monopolize the European, as well as the internal trade.

Previous to the opening of the Erie canal, in 1825, the commerce of the lakes was necessarily local, since there were no markets east or west. The produce raised in the country bordering the lakes descended the streams that ran into them, and found interchange with other lake ports. The opening of the canal immediately gave an eastern current to produce of all descriptions, and much had accumulated in anticipation of the event, and goods returned in great quantities. In the month of May, 1825, 837 boats, carrying 4,122 tons of goods, left Albany for Buffalo, paying $22,000 tolls.

The lumber from western New York and the lake borders being now marketable where before it was valueless, a motive for clearing land was imparted, and the new canal received on its bosom from all sections of the lake shore the lumber brought by multiplying vessels. The lumber that found tide water before had been that which in southern New York and in Pennsylvania skirted the natural water-courses, and being cut and hauled, was rafted down to Philadelphia and Baltimore. The New England streams delivered the lumber in the same manner. The opening of the canal brought into competition the vast and hitherto untouched resources of the west, and the same remark applies to all farm produce. The farmers of New England were undersold at their own doors, by produce from western New York. The potatoes that had been quick of sale at 75 cents, were supplanted by the best "chenangos" at 37½ cents, and the competition was felt in corn, flour, and most articles. The effect of this was to turn the attention of that hard-working and thrifty race of men, the farmers of New England, to the western country, where the soil was so much more profitable. At that date commenced the interchange of inhabitants, which has drawn off so many New England farmers, replacing them with manufacturers from abroad. In order to show the extent of this operation, we take from the census of 1850 the figures showing the nativities of the whole people of the United States. Thus there were in the whole Union 8,370,089 persons who were born in the New England and middle states. Of these, 6,941,510 lived in the states where they were born. The remainder, 1,428,579, were living mostly west, but in their place there were living in the New England and middle states 1,292,241 persons who were born in foreign countries. These latter worked in the mills and manufactories, while 1,428,579 northern persons who had migrated west were agriculturists attracted thither by the fertile lands made available by the means of transportation. The lakes were now connected with tide water, but the whole system of western rivers with a southern course had no northern connection. The state of Ohio determined to make the connection, by means of a canal from Portsmouth, on the Ohio, to Cleveland, on Lake Erie. On the 4th July, 1825, the first spade was put into the ground, and in 1833 the first boat passed through from lake to river, 307 miles. The whole interior of Ohio was thus opened to either the northern or the southern market; and the state authorized turnpikes and other roads to feed the canal, on the borders of which trade grew rapidly. There are several branches of the Ohio canal; one, the Hocking, goes to Athens, and another to Columbus. The highest level of the Ohio canal is 305 feet above the lake, and 499 feet above the Ohio river. Another canal, the Miami, was also commenced in 1825 to connect Cincinnati with Lake Erie. In 1829 it had been opened to Dayton, 85 miles, but it was not completed until 1843, when it connected, 130 miles, with the Wabash canal, which joins Lake Erie at Toledo, making 215 miles from Cincinnati to Lake Erie. All the Ohio canals are as follows:—

	Length. Miles.	Cost.
Ohio canal	340	$4,695,202 69
Miami	85	1,020,000 00
" extension	130	3,667,440 82
Muskingum	92	1,628,028 29
Hocking	56	975,481 01
Wabash and Erie	91	3,009,923 29
Walhonding	25	607,268 99
Total	819	$15,603,345 09

Thus Ohio was crossed by canals, that gave the greatest development to her resources, and a new route was opened for all the western waters to the Atlantic; an interior transit from the Atlantic cities to all those of the east was in operation; and New Orleans might now be reached from New York and New England, by an internal route, with comparative ease and safety.

The state of Pennsylvania next undertook the great work of forming a connection between the Delaware and the Ohio. The project which had been formed at the close of the last century was now resumed; and in 1826 a law was passed to construct the work at the expense of the state, and, July 4th, 1826, the first earth was turned at Harrisburg, and in 1834 it was opened for use. The line consisted of a railroad, 82 miles, from Philadelphia to Columbia, cost $3,330,127; a canal from Columbia, 172 miles, to Hollidaysburg, cost $4,594,146;

a portage railroad across the mountain from Hollidaysburg to Johnstown, 36 miles, cost $1,634,357; and a canal from Johnstown to Pittsburg, 105 miles, cost $2,823,-192—making 395 miles, at a cost of $12,-381,822. Thus the Ohio at Pittsburg was now connected with Philadelphia, by a route much less than from Buffalo to New York. There were seven branch canals made to feed this. The aggregate length was 314 miles, and the cost $6,471,994. Every part of the state was now more or less in communication with the great outlets east and west. There were, besides, three private canals, viz.: the Schuylkill, 108 miles; the Lehigh, 85 miles; and the Union, 82 miles, which connected the great coal fields with tide water.

We have shown that Washington presided, at the close of the Revolution, at a meeting for the improvement of the Potomac. The ideas then suggested ripened into a project for a canal. The cession of a portion of Maryland and of Virginia to form the District of Columbia as a seat of government led to the national desire to connect it with the west. This was done, as we have seen, by the National or Cumberland road to Wheeling. But in 1820 the canal from Georgetown to Pittsburg was projected, Congress voting $1,000,000. Washington City issued bonds for a like sum. Georgetown and Alexandria each subscribed $250,000, Maryland $500,000, and Virginia $250,000, and 6,084 shares of $100 each were taken by individuals, making altogether $3,854,400. As the work was to run through four territories, it required a charter from Congress, Maryland, Virginia, and Pennsylvania, and July 4th (Fourth of July is a great day for canals), 1828, John Q. Adams and Charles Carroll turned the first earth. In 1834, 104 miles had been completed. The work was finally carried 191 miles to Cumberland in 1840, at an expense of some $16,000,000. It will not probably be carried further, never having answered expectations, although of late it has had business from the Cumberland coal regions.

Thus of the three great projects for connecting the eastern and western waters, only two were carried out. But, following the example of Ohio, both Indiana and Illinois determined to make a connection across their respective states, between the rivers on the south and the lakes on the north. But they were some years later than Ohio, since they were younger and weaker states. In 1836, under the spur of the speculative fever, Indiana enacted a bill authorizing a system of internal improvements. This embraced the Wabash and Erie canal, to run from Evansville on the Ohio to the Ohio state line, where it was to follow down the valley of the Maumee, taking up the Miami canal in its course, and entering the Erie Lake at Toledo. Second, the White Water canal, to connect the National or Cumberland road at Cambridge, with Lawrenceburg on the Ohio, 76 miles. Third, the White River canal, to connect Indianapolis with Evansville on the Ohio, 190 miles, and to prolong it from Indianapolis to Peru on the Wabash canal. There were also to be some Macadam roads and turnpikes. These works were to cost $10,000,000. The Wabash canal was begun in 1835, and in 1840, 90 miles were finished. The great revulsion then brought all to a stand, and some ten years elapsed before the work was completed through the aid of a loan obtained on pledge of lands granted by Congress in aid of this work.

The state of Illinois undertook a far more extensive system of public improvements. As early as 1810 a project was put forward, under the excitement of Fulton's great success, to connect New Orleans with Buffalo in 32 days by steam, by way of Chicago. The waters of the Illinois and the lakes were in high floods nearly blended. In 1823 a board of commissioners was appointed to report on the route and the cost. A grant of land was obtained from Congress in 1829 in aid. This was every alternate section of land, 10 miles on each side of the canal, in its whole length. Not until 1835 was an act passed to authorize the canal, in common with many other works, railroads or others, in a general system of internal improvements, which were to cost $12,000,000, and there had been sold of the lands granted by Congress $1,395,911.

The canal was to connect Chicago, at the foot of Lake Michigan, with the Illinois river, 102 miles. It was prosecuted with more or less vigor until the finances and credit of the state were ruined by the revulsion of 1837–9. The work then lay unfinished until in 1843, by means of a pledge of the unsold lands of the canal, a sum of $1,600,000 was borrowed, and the work completed in 1852. The sales of the land sufficed to pay off the new loan and some of the arrears.

We have thus sketched the great main canal avenues that connect important sections, and may enumerate them as follows:—

		Miles.	Expenditure.	Width. Feet.	No. of Locks.
Erie canal	Hudson river to lakes	363	$7,143,789	40	84
Pennsylvania canal	Delaware and Ohio	395	12,381,822	40	200
Ohio "	Ohio river and Lake Erie	307	4,695,824	40	152
Miami "	" " "	178	3,750,000	40	102
Indiana "	" " "	379	7,101,000	60	102
Illinois "	Lake Michigan with Illinois river	102	8,654,337	60	2
Total		1,724	$43,726,772		

The financial results of the New York canals may be thus stated in the aggregate of receipts and revenues from the commencement of the works to Sept. 30, 1859:—

Receipts.		Expenditures.	
Gross tolls	$70,565,737	Construction	$55,106,814
Loans	55,842,462	Repairs	16,932,080
Other items	20,469,924	Loans and interest	57,028,943
		Other items	17,790,286
Total	$146,858,123	Total	$146,858,123

These great state works have completed the connection between the Atlantic, the lakes, and the western rivers, and, by so doing, have promoted the circulation of the produce of all sections in active competition. The resources of every section have been drawn out in such a manner that the whole people have had the advantages of all. In the course of the development a vast capital was added to the national wealth, and a great value bestowed upon land not before very marketable. While this has been done by state means, a great number of other canals have been erected as well by public means as private enterprise. The most important of these was the Delaware and Raritan canal, connecting those two rivers. The work was completed in 1827, shortening the distance 16 miles between Philadelphia and New York, and packet propellers run regularly through it between the two cities. It is also the main source of supply of coal for New York. The state of Virginia early embarked in improvements, particularly in the James river, which is navigable to Richmond for vessels of 120 tons, the tide reaching there; above Richmond a series of short canals intended to connect the river with the Kanawha, where it is navigable 70 miles from its mouth on the Ohio. This project was undertaken by the James River and Kanawha Company, and was completed in the form of a canal, 147 miles, at a cost of $5,020,050. There are many other works of public utility in Virginia, under the control of a board of public works, chartered in 1816. There are a number of other canals in several states, as the Blackstone, of Massachusetts; the Ogeechee, of South Carolina, connecting Charleston with the Santee, cost $650,667, and many other improvements in a number of states. The Morris and Essex canal, of New Jersey, 101 miles, was completed in 1831. It had banking powers connected with it, and of all the public works in the country was the basis of the most stupendous stock speculation. Its liabilities were at one time near $10,000,000, and it was sold out in 1845 for a sum less than $3,000,000; its business is at present prosperous. It is one of the works that were erected to develop the great coal business of Pennsylvania. The discovery of that important mineral takes date about the year 1820, and the canals that were built to bring the coal down may be enumerated as follows:—

		Length. Miles.	Cost.	Width.	Locks.
Schuylkill navigation	Pennsylvania	108	$2,500,196	36	120
Lehigh canal	"	85	4,455,099	60	81
Susquehanna	"	41	897,160	40	12
North Branch	"	73	1,590,379	40	8
" " upper	"	94	4,500,000	40	..
Union	"	82	5,000,000	36	90
Delaware and Hudson	New York	108	9,100,000	75	18
Morris canal	New Jersey	102	3,612,000	32	29
				planes,	22
Total canals		693	$31,654,834		

The expenditure of large sums of money along the routes of these works for their construction promoted a local demand for produce, and aided in the settlement of the country through which they ran, and from the improvement of which their future freightings were to be derived, and there is little matter of surprise that the first years of their operation should be of large promise. The cost of transporting a ton of merchandise from Buffalo to Albany, which had been $100, and the time twenty days, was at once reduced to $20, and the time to eight days. While yet they were being constructed, however, a new agent of transportation had risen, which was to overshadow their importance, and reduce them to a second rank. The rejoicing for the completion of the Erie had hardly died away, before the locomotive began to throw its shadow on the future. The "astonishing speed" of steamboats and stages was about to dwindle into an intolerable tedium. The capacities of railroads had begun to be discussed, and the discussion rapidly elicited action, which did not cease to extend itself, until the whole country has become covered with rails. When railroads began to be constructed, however, both vehicles, sailing vessels, and steamers had made considerable progress in speed, and the connections of travel had come to be made with more regard to dispatch. It is amusing to look back at some of the accounts of the wonders of the canals after the opening. Thus, in 1823 it is stated—

"CANALS! A *sloop*, called the Gleaner, has arrived at New York from St. Albans, in the state of Vermont, with a cargo consisting of 1,200 bushels of wheat and other articles. She will carry sixty tons of merchandise, and does not appear to have had any difficulty in passing through the northern canal. It is supposed that she will safely navigate the Hudson, and she is designed as a *regular packet* between St. Albans and the city of New York. *Look at the map!* An uninterrupted *sloop navigation* from one place to the other!

"When the Green Mountain vessel arrived at New York, the veteran artillery were ordered out, and she was saluted from the battery."

In 1824. "INTERNAL IMPROVEMENT. It is stated in one of the New York papers that a barrel of flour can be transported from Albany to New York, a distance of 150 miles, for 12½ cents, and that one individual offers to do it for seven cents."

In 1825. "MARCH OF INTELLECT WITH POWER.—It is no fairy tale, that flour, *manufactured on Lake Erie*, has been profitably sold in Newbern, *North Carolina*, for $5.50 per barrel. This flour was transported from the lake to Albany, through the Grand canal; thence down the North River to New York; and thence, by sea, to Newbern. The cost of transportation from the lakes to Newbern was less than $1.50 per barrel, while that between Raleigh and Newbern (not more than 120 miles) is generally two dollars."

In 1826. "The following, from the *Pittsburg Gazette*, shows the importance of canals. Mr. Foster has published in the *Greensburgh Gazette* a statement furnished him by a merchant of Meadville, showing the amount which the merchant paid for the transportation of his goods this fall from Philadelphia, *by way of New York*, the canal, and Erie, to the town of Meadville. The whole cost per hundred pounds was $1.20½! *We are now paying three dollars per hundred for carriage in wagons from Philadelphia to this city!*"

These extracts afford—in contrasting not only the routes, but the prices, with those before their use and those which now exist—much room for reflection. It may be remarked that the Caroline, burnt in the employ of the sympathizers in 1839, at Schlosser, and sent over the falls of Niagara, was built in South Carolina, and had passed up the canals to her destination.

CHAPTER III.

RAILROADS—LAND GRANTS—EXTENT AND COST.

THE excitement in relation to canals and steamboats was yet at its zenith, when the air began to be filled with rumors of the new application of steam to land carriages and to railroads. There were many inventions and patents at home and abroad in relation to carriages propelled upon common roads by steam, but these seem never to have attained much success, although attempts to perfect them are still made with great perseverance. On the other hand, the use of railroads from small beginnings has reached a magnitude which overshadows the wildest imaginings of the most sanguine. In 1825 descriptions came across the water of the great success of the Darlington railroad, which was opened to supply London with coal, and which had passenger cars moved by steam at the rate of seven miles per hour.

The most animated controversy sprang up in relation to the possibility of such roads in England, and was shared in to some extent on this side of the Atlantic. With the national energy of character, the idea had no sooner become disseminated than it was acted upon. The construction of railroads in America is usually ascribed to the emulation excited by the success of the Liverpool and Manchester railway. This appears not to have been the case, however, since some of the most important works in this country were projected and commenced before the Liverpool and Manchester road was built. The act of Parliament for the construction of that road was passed in 1826, and the road itself was finished and opened in September, 1830, 31 miles long; but the Massachusetts Quincy road, three miles from Quincy to Neponset, was opened in 1827, and a great celebration was held in consequence. The celebrated Mauch Chunk railroad of Pennsylvania was begun in 1826, and finished in the following year. On that road the horses which draw up the empty coal wagons are sent down on the cars which descend by their own gravity. This contrivance was borrowed by the Mauch Chunk road from the Darlington road, similarly situated, in England. It is to be remarked that both the Quincy and the Mauch Chunk roads were horse roads; the locomotive was not at first introduced. In 1828, twelve miles of the Baltimore and Ohio railroad were completed, two years before the Manchester road was opened. In the same year, 1828, the South Carolina road, from Charleston to Hamburg, was surveyed, and in Massachusetts the city of Boston voted the construction of a road from that city to the Hudson at Albany. The first portion of that road, however, Boston to Worcester, 44 miles, was not opened until 1835. The second road finished in the United States was the Richmond, Va., road, thirteen miles to Chesterfield, in 1831, and in the same year that running from New Orleans, five miles to Lake Pontchartrain, was opened. Thus roads were well adopted in public opinion here before the great success of the Manchester road was known, but which gave an undoubted impulse to the fever. During the excitement in relation to "rail" roads, a writer in a Providence paper thus satirized the condition of the Connecticut roads. He claimed the invention of the cheapest "rail" roads, and proved it thus: "Only *one* English engine *alone* costs $2,000, which sum the whole of our apparatus does not much exceed, as figures will prove; for 700 good chestnut rails at $3, amounts to only $21, and it ought to be remembered that this is *all* the expense we are at, and the inference is conclusive in our favor. We place our rails fifty to the mile by the side of the road, to pry out the wheels when they get stuck, and hoist behind when wanted." The public were, however, no longer to be satisfied with this kind of "rail" road. They embarked in the new enterprise with such vigor, that in 1836 two hundred companies had been organized, and 1,003½ miles were opened in eleven states. These were highly speculative years, however, and the revulsion brought matters to a stand.

It was at once apparent to the commercial mind that if railroads would perform what was promised for them, geographical position was no longer important to a city. In other words, that railroads would bring Boston into as intimate connection with every part of the interior as New York could be. The large water communication that enabled New York by means of steamboats to concentrate trade from all quarters, could not now compete with the rails that would confer as great advantages upon Boston. Indeed, Boston had now availed herself of steam power. Up to 1828 she owned no steamers. The Benjamin Franklin, built in that year, was the first, and her steam tonnage is now but 9,998 tons. When she bought her first steamboat, however, she was laying out those railroad connections that she has since pushed so vigorously, and they have paid an enormous interest, if not directly to the builders, at least to the general interests of the city.

It is to be remarked that the national government expended, as we have seen, largely in the construction of highways, the clearing out of rivers, and the improvement of harbors. The people have by individual taxes mostly constructed the earth roads of this country. The canals have, however, with a few exceptions, been state works, built by the proceeds of state loans, with the aid of lands donated by the federal government. These lands were made marketable and valuable by the action of the canals in aid of which they were granted. The railroads of the country have been, as a whole, built on a different plan, viz., by corporations, or chartered companies of individuals. These associations have not, however, themselves subscribed the whole of the money, probably not more than half, but they have found it to their interest to borrow the money on mortgage of the works. The great object of the companies has not been so much to derive a direct profit from the investment, as to cause the construction of a highway, which should by its operation increase business, enhance the value of property, and swell the floating capital of the country by making available considerable productions of industry, which before were not marketable, since the influence of a railroad in a new district is perhaps, if not to create, at least to bring into the general stock more capital than is absorbed in its construction.

Thus in the last twenty-five years, a thousand millions of dollars have been spent in the construction of roads, and yet capital is proportionally more abundant now than before this vast expenditure, and land has, in railroad localities, increased by a money value greater than the cost of the roads! We have seen that before the operation of canals, land transportation was, and is now remote from these works, one cent per mile per hundred. If a barrel of flour is then worth in market five dollars, a transportation of 300 miles would cost more than its whole value; but by rail it may be carried from Cincinnati to New York for one dollar. Thus railroads give circulation to all the surplus capital that is created by labor within their circle. It is on this principle that may be explained the immense prosperity that has been seen to attend the enormous expenditure for railroads, particularly during the last ten years.

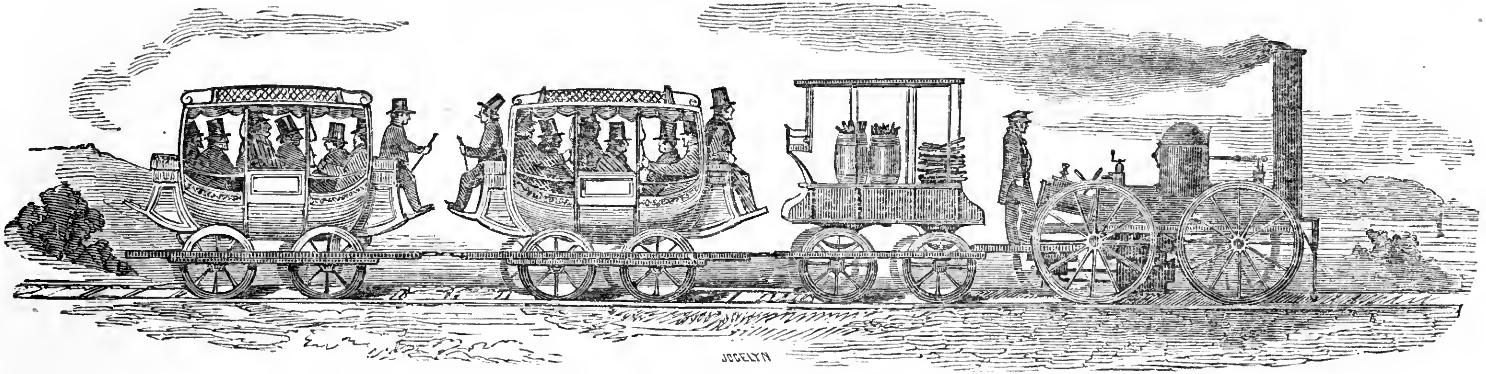
The construction of the Massachusetts Western railway, from Boston to the Hudson river, was one of the most important and financially successful of all the railroads of the country. New York had constructed her great canal, as it were making Albany basin a part of Lake Erie. Boston now grasped the idea of a railroad that should make Albany basin with its affluents a part of Boston harbor. It is to be borne in mind, however, that when that road was undertaken, railroad building was a new art; the mode of laying the track, the form, and even the model of rails were problems. The form of wheels to run on the rails, the mode of setting the car on the wheels, were all unknown compared with the knowledge on the subject which the construction of 30,000 miles of roads in this country has since accumulated. The state of knowledge at that time may be seen in the following extract from "Wood on Railroads" in 1825:—

"Nothing can do more harm to the adoption of railroads than the promulgation of such *nonsense* as that we shall see locomotive engines travelling at the rate of twelve miles per hour."

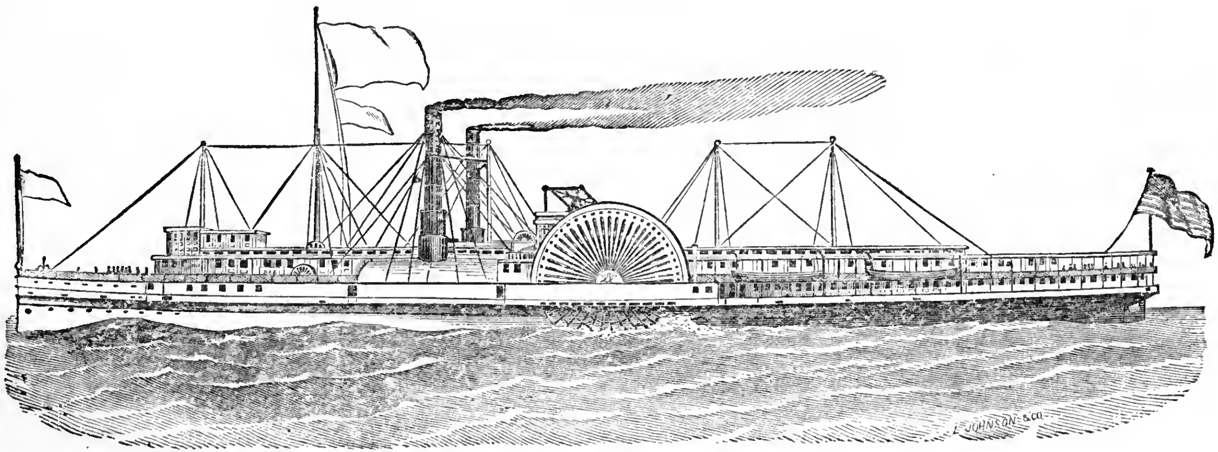
Such was engineering knowledge at the time Boston voted to build a connection 200 miles to Albany. Since that day much has been learned in relation to the characteristics of roads.

The great advantage of railroads is that they practically diminish distances between places in proportion to the speed attained. The rapidity of motion and power of traction depend upon the diminution of friction. This was sought in common roads, Macadam roads, and canals, but has approached perfection in railroads. The essential attributes are two smooth surfaces for wheels to run on. These being made of iron, are made as narrow as possible to lessen the cost; and to keep the wheels upon the rails, flanges are placed upon the inner rim of the wheel. The form of the iron rails has undergone many changes, as experience suggested improvements. The mode of laying these has also varied. The building of a railroad includes "the road bed," somewhat like a common road, and the superstructure, which embraces rails, supports, ties, etc. The main operations in the construction of the road bed consist in the "excavations, tunnels, embankments, ballasting, bridges, and viaducts."

These operations are required to give the necessary levelness and straightness to roads, both of which are requisite, not only as elements of speed, but of economy. The straightest road is the shortest; but when the road is done, the expense of keeping up the earth-work is nearly nothing, while, on the other hand, the annual expense required to keep up the perishable superstructure is very great and proportionate to the length of the road. Hence true economy requires a greater outlay to make the road straight, in order to avoid permanent cause of expense. Common roads may be lengthened to advantage, in order to avoid an ascent. In railroads this is avoided by tunnels through the obstacle when it is too high to excavate at what it would cost to tunnel. This is not, however, the only reason for straightening, since the frequency of curves greatly increases the danger of railroads.



FIRST LOCOMOTIVE EVER RUN ON THE MOHAWK VALLEY RAILROAD.



HUDSON RIVER STEAMBOAT.

When a car in motion enters upon a curve, it has a tendency to continue its straight course, and this is overcome by the resistance of the flanges of the wheel against the rail, and by the firmness of the outer rail. This resistance is always felt in the rocking motion of the cars, and is increased by the shortness of the curve. A pair of wheels is fastened to an axle and turns with it, the outer wheel moving on a curve much faster than the inner one, which would slide, under such circumstances, if both were of the same diameter, sufficiently to make up the difference. This is obviated by making the wheels conical, or of a larger diameter next to the flange than on the outside. The effect of this is that the wheels having some play between the rails, the outer wheel, forced against the rail, runs on a larger diameter than the inner one, thus compensating the speed. Further, to overcome the centrifugal force, the outer rail is made higher than the inner one, so that the weight of the car gives it a tendency to slide toward the inner one in opposition to the centrifugal force. The excavations in loose earth require to be supported at the sides by retaining walls, and to be drained by ditches and cross drains. In making a tunnel the centre of the road is set with great accuracy on the surface of the ground by an instrument, and shafts are sunk at proper levels along this line. The excavations are then made by "drifts" from shaft to shaft, and to the open ends of the tunnel. The material excavated is raised through the shafts, which serve for ventilation when the tunnel is finished. The embankments require great care to insure their solidity. When the materials for filling are at hand, they are usually made at their full height at one end, and then temporary rails permit the approach of wagons to be emptied over the head of the embankment. The progress of the work depends upon the speed with which these succeed each other. When the track passes through a country like a wooded swamp, where the materials for filling are not at hand, resort is had to trusses. Piles of a diameter of 15 inches are driven, so as to form lines of the width of the railroad; transverse ties are fastened across the tops, and, with proper supports, longitudinal timbers are laid across the piles to carry the rails. The tops of embankments and the bottoms of excavations are made about two feet below the intended or "formation level" of the road, and have there a convex surface like an ordinary road. This space of two feet is filled up with porous material, broken stones, gravel, etc. This is called "ballast," and through it the rains pass freely, and the frosts of winter do not so much affect it. On this "ballast" the sleepers are laid. Many roads are not properly ballasted, and are, therefore, unsafe. Bridges are difficult of construction, and have sometimes been made of iron. This was the case with the Erie railroad, when an accident occurred, because the iron, resting upon stone piers, contracted by the cold so as to drop off its support.

When the road bed is complete, the superstructure is put on. This is now done by cross sleepers. The best of these are second-growth chestnut, 7 feet long, and 8 by 12 inches. These are laid upon the ballast. The iron rails are laid upon these, but in some cases longitudinal timbers are first laid down, and upon these the iron rails are laid. The iron rails have undergone many improvements. At first, a simple flat iron rail was spiked down to these timbers. These rails would often get loose, and the end rising form a "snake head," and the wheel catching under, throw it up with great force and danger to passengers. These roads were ridiculed as "hoops tacked to a lath." Various forms and weights of rail were adopted as experience directed; that now the favorite is called the T rail; the shape is like that letter inverted. There must be a certain breadth of rail for the wheel to run on, and depth for strength. The smallest rails will weigh 36 lbs. to the running yard. The Massachusetts roads use 60 lbs. to the yard; the New York roads, 70 to 75 lbs. to the yard. The rail is not fastened directly to the timber, but is held in chairs, which are spiked to the cross sleepers. The chair is of cast or wrought iron, and will weigh 20 to 30 lbs. They are made in one piece, so as to receive the ends of two rails, which are fastened by wedges of iron or wood, driven between them and the chair, without interfering with the longitudinal expansion and contraction of the rails.

The proper breadth of rails apart, or the width of the track, has been matter of much discussion. There are many advocates of the "broad gauge" and of the "narrow gauge." The latter is generally 4 ft. 8 in. and the former 6 ft. The Erie railroad is of the broad gauge, and the convenience of the cars is superior to that of the narrow roads. It is a more expensive road to build, however. Both plans have their advantages. The majority of roads are, however, built on the narrow gauge. When gauges on long lines are uniform it facilitates the passage of the cars, which would otherwise be interrupted.

The power on railroads is mostly steam, but horses, stationary engines, and atmospheric pressure are sometimes used. The first really successful locomotive was built in 1814, which drew 30 tons 6 miles per hour; improvements have since been made until 70 miles per hour is attained. A Philadelphia engine drew 158 cars, 2,020 feet long, with 1,268 tons coal, 84 miles in 8 hours. The engine weighed $15\frac{3}{4}$ tons. The power of an engine depends upon the quantity of steam it can generate in a given time. Each revolution of the wheels corresponds to a double stroke of each piston, or four cylinderfuls of steam. The utmost heating surface is therefore required, and this is obtained by tubular boilers. Wheels, 7 feet in diameter, pass over 22 feet in each complete revolution. To go 25 miles per hour, therefore, they must revolve five times in a second, and each piston must make 10 strokes in the same time. This minute division of time is accurately made by this ponderous machine. This rapid exhaustion of steam causes a greater demand for fuel in proportion to the speed. The power of an engine to draw loads depends upon the pressure of steam, which is usually 50 to 60 lbs. to the square inch; but the adhesion of the engine to the rails must be great, otherwise the wheel would slip round. For this reason the wheels were first made with cogs to hold in the rail, but it was found that the weight of the engine was sufficient on level roads. The adhesion of iron upon iron is one-eighth of the weight, but in wet and freezing weather it is greatly reduced, and it lessens with the increase of the slope of the road, or ascending grade. Thus, if an engine will draw 389 tons on a level, it will draw but one-fourth of the amount up a grade 50 ft. to the mile. The average cost of locomotive power is not far from 50 cents per mile run, which includes fuel, oil, wages, repairs, wear and tear, etc. These expenses are, of course, lessened by levelness and straightness, since where these are perfect, more is carried for the same money, than on common roads. A great draw-back upon the cheapness of rail transportation is the weight of the rolling stock. The cars and engines usually are to the paying freight as 10 to 6. Various means have been proposed to lessen the burden of this expense, but hitherto without much success. It is evident from this slight sketch of the principles of railroad construction that the characteristics of a road, in relation to curves, grades, etc., have much to do with the economy with which it can be run, and its capacity to compete successfully with rival lines.

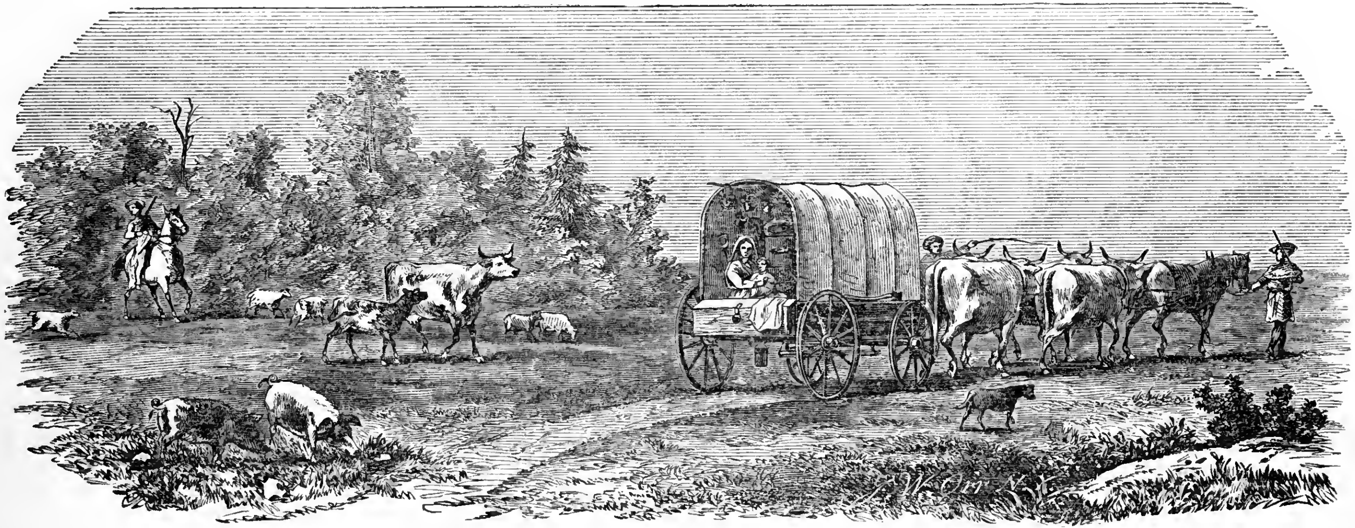
The city of Boston was, as we have said, one of the earliest to understand the advantages that were to be drawn from railroads in overcoming the disadvantages of its position in relation to the west, and the Western railroad has been the instrument by which she made the great states west of New York subservient to her interests. The charter of that road is dated March 15, 1833. The road runs from Worcester, 44 miles west of Boston, to the Massachusetts state line, and thence $38\frac{1}{4}$ miles over the Albany and West Stockbridge railroad, leased and operated by the Western road, into Albany, 200 miles from Boston. The first train of passengers that left Boston was on April 7, 1834, for Davis' Tavern, Newton, to which place the Worcester road was then opened. It was completed to Worcester July 3, 1835. The Western road, in continuation, was opened to Springfield Oct. 1, 1839, ten days before the United States Bank finally failed, and it reached Greenbush Dec. 21, 1841, thus establishing the route from Boston to the Albany basin in seven hours. It there connects with the New York Central road, which carries the line 229 miles to Rochester, whence, by the Lockport division of the Central road, 77 miles, it connects at Suspension bridge with the Great Western Canada road, and thence with the Michigan Central, the Illinois Central, and the Ohio and Mississippi roads to New Orleans. By this route Boston and St. Louis, 1,365 miles distant, are connected in 64 hours. From Buffalo the line connects south of the lakes with all the net-work of Ohio and other roads. Every portion of the country is thus brought into connection with Boston.

The Worcester railroad has a double track its entire length, laid with 60 lb. iron. Its freight-house at Boston is a single room 466 feet in length and 120 feet wide. The cost of the road was $4,843,610. The Western has a double track 68 miles; it has 20 depots, covering 118 acres of land; it has 15 stone-arched bridges, 15 to 60 feet span.

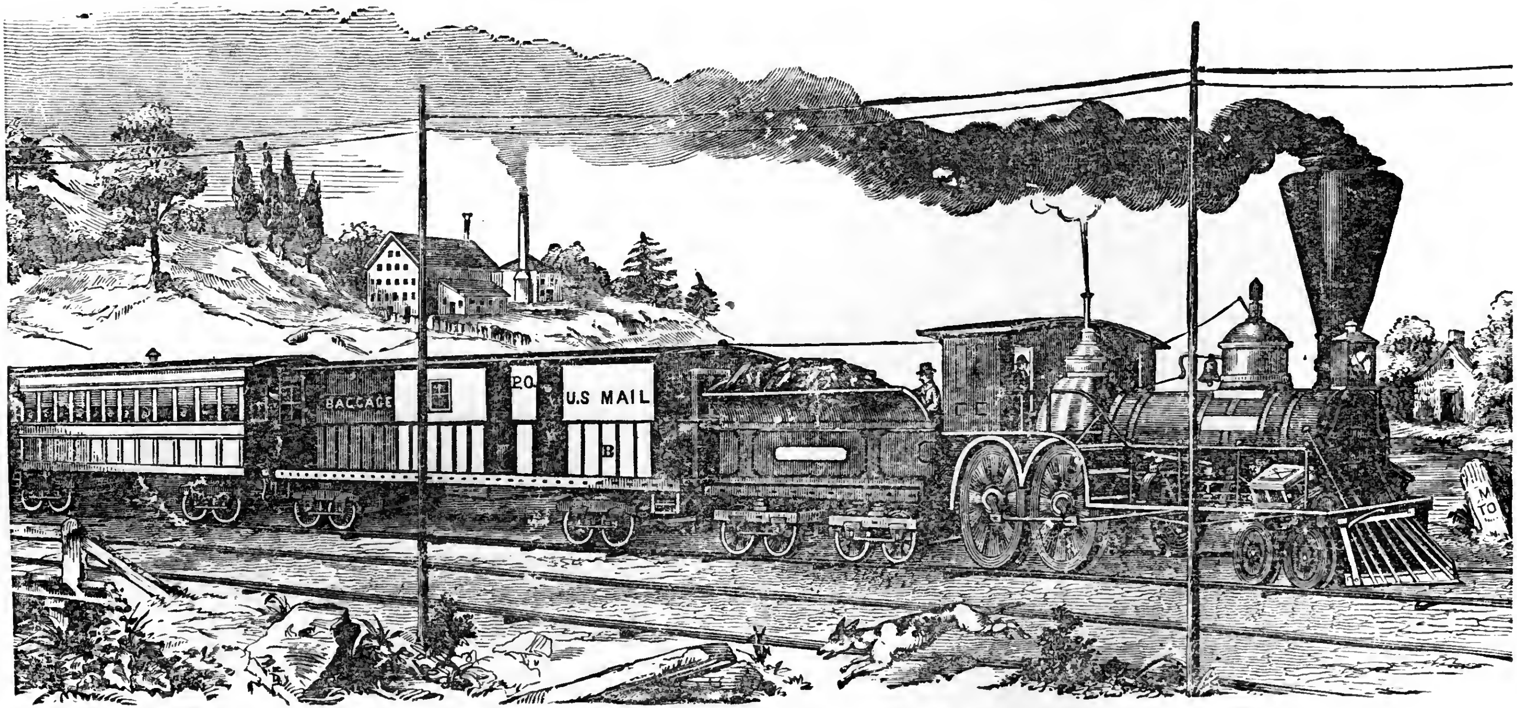
The bridge across the Connecticut is 1,264 feet long. The Western road has a grade of from 60 to 80 feet per mile for more than 18 miles; near the state line the depot is 1,456 feet above the depot in Boston! These features indicate the difficulties that were encountered in the construction, and it received much aid from the state. The original capital was $2,000,000; in 1836 this was increased, and the state subscribed $1,000,000. The state subsequently loaned its credit for $4,000,000. The present debt of the company is $5,839,080, and the capital $5,150,000, on which it uniformly pays 8 per cent. dividend. The cost of the Western road proper was $6,757,309, and of the Albany and West Stockbridge, $2,392,384. The opening of this road made a great change in flour business. Formerly the flour that came down the Erie canal, and was transhipped in sloops, made the voyage up the Sound and round Cape Cod, into Boston harbor. The Western road made the line direct, and by it about 600,000 bbls. now annually leave Albany; of this 40 per cent. is sold along the line, in what was once an agricultural region, and the balance meets in the Boston market the flour of the southern states. The Boston and Providence road was opened 41 miles in June, 1835, and at once became the connecting link between the steamboats from New York and Boston, taking the place of the stage lines. This road has now several branches, and has been very profitable. The original cost, $3,862,710, has long since been returned to its stockholders in 6 per cent. dividends. It has a debt of $195,220, which is paid at the rate of $30,000 per annum.

The Boston and Maine road, which is the second link in the great chain which reaches from Bangor to New Orleans by the Atlantic coast, 1,996 miles, was opened in 1843. It runs 74 miles to Berwick, where it connects with the Portland, Saco, and Portsmouth, extending to Portland. The cost of this has been $4,719,995, and it has no debt. It has, since Oct., 1843, paid 40 dividends, amounting to $133 per share of $100. The connections of this road are very numerous. Lateral and cross roads bring every manufacturing town in New England within easy distance of Boston. The 3,749 miles of railroad in the New England states give an active circulation to raw materials and the products of industry, making, so to speak, all the labor of those states available on equal terms.

In New York the question of railroads had been very early discussed. A publication of Colonel Stevens, of Hoboken, in 1812, advocated a railway instead of a canal to the lakes; but his proposition was opposed by Chancellor Livingston on grounds which indicate very odd ideas of the nature of the works. The first regular application to the legislature for a railroad charter seems to have been made by Stephen Van Rensselaer and others in 1826, for power to construct one between the Hudson and the Mohawk, and they received the grant for the reason that no railroads were then in the country at all, and that, as the petitioners were willing to make the experiment at their own cost, it was a good opportunity to permit it. The surveys for the road were not made until 1830, and the road was opened in September, 1831, and three cars, with twenty passengers in each, were drawn to Schenectady in 46 minutes by an American engine of 3½ tons. Meantime, the charters of the Harlem and the Saratoga and Schenectady had been granted. The opening of the Mohawk road caused much excitement. A road from the Hudson to the lakes was agitated, and applications were made to the legislature of 1832 for 49 roads, of which 27 charters were granted, and of these six have been constructed, viz.: the Brooklyn and Jamaica, Hudson and Berkshire, Erie, Rensselaer and Saratoga, Tonawanda, Watertown and Rome. In 1833, six railroads were chartered; of these the Utica and Schenectady, Whitehall and Rutland, and Buffalo and Black Rock were constructed. In 1834, ten railroads were chartered, and of these five were constructed: the Auburn and Syracuse, Buffalo and Niagara Falls, Long Island, Lockport and Niagara, and the Saratoga and Washington. In 1836, 43 railroads were chartered, seven of which were built: the Albany and West Stockbridge, Attica and Buffalo, Auburn and Rochester, Lewiston, Schenectady and Troy, Skaneateles, and Syracuse and Utica. In 1837, 14 railroads were chartered, but none of them have been constructed. In 1838, the state authorized a loan of its credit to the extent of $3,000,000 to the Erie railroad, and of $100,000 to the Catskill and Canajoharie, and of $250,000 to the Ithaca and Owego; also, $200,000 to the Auburn and Syracuse. In 1839, the Oswego and Syracuse railroad was chartered; and the city of Albany lent $400,000 to the Albany and West Stock-



EMIGRATING FROM CONNECTICUT TO EASTERN OHIO IN 1805, DISTANCE 600 MILES, TIME 90 DAYS, NUMBER OF PASSENGERS 10.



MIGRATING AT THE PRESENT TIME FROM CONNECTICUT TO IOWA, DISTANCE 1300 MILES, TIME 3 DAYS, NUMBER OF PASSENGERS 360.

bridge road. In 1840, acts were passed in the legislature to loan the credit of the state to the extent of $3,478,000 to six roads, and provision was made for a sinking fund to be paid into the treasury by the railroad companies, except the Erie. In 1841, the city of Albany was authorized to invest $350,000 in the Albany and West Stockbridge road. The Erie railroad, having defaulted on its interest, was advertised for sale by the comptroller, which did not take place, however. This was not the case with the Ithaca and Owego, which was sold for $4,500, and the Catskill and Canajoharie for $11,600. The loss to the state was $1,026,327. In 1844, the several railroads from Albany to Buffalo were, for the first time, permitted to transport freight on the closing of the canal, by paying the state the same toll as the canal would have paid. In 1846, the Hudson River and the New York and New Haven were chartered. In 1847, the seven roads making the line from Albany to the lakes were required to lay down an iron rail of 56 lbs. to the yard. They were likewise authorized to carry freight all the year by paying canal tolls; and all the railroads were made liable for damages in case of death by neglect of the companies' agents. In 1848, the general railroad law was passed. The law provides, however, that the legislature shall decide whether the "public utility" of the road justifies the taking of private property. This was removed in 1849. Thus, from 1826 to 1850, 151 charters were granted, and of these 30 have been carried into effect. We observe that the line from Albany to Buffalo was composed of seven distinct companies, finished at different times. Most of these were restricted as to fares. The Mohawk and Hudson—or Albany and Schenectady—was not restrained. The others were, as in the following table composing the line now known as the Central railroad :—

	Chartered.	Opened.	Maximum fare per mile.	Length. Miles.	Cost.
Albany and Schenectady...	1826	1831	..	17	$1,711,412
Utica and Schenectady....	1833	1836	.4	78	4,143,918
Syracuse and Utica.........	1836	1839	.4	53	2,490,083
Auburn and Syracuse......	1834	1839	.5	26	1,011,000
Auburn and Rochester.....	1336	1841	.4	78	4,210,101
Tonawanda....	1832	1842	.4	43¼	1,216,820
Attica and Buffalo.........	1836	1842	.3	31¼	906,915
Total..............................				327	$15,690,249

These companies were in 1850 allowed to carry freight without the imposition of the canal tolls, and in 1853 were all consolidated in a single company—the New York Central. When this project of consolidating was under consideration, the stocks rose rapidly to high premiums, and the principle of consolidation was to create scrip stock to the amount of the aggregate premiums, and divide this *pro rāta* among the stockholders of all the companies. That scrip, to the amount of about $8,100,000, now figures as a part of the cost of the present company. It may be remarked that the restrictions as to charge have been inoperative, since the charge has always been less. The length has been shortened in such a manner that the distance is now 298 miles from Albany to Buffalo, and the charge is $7.00, or 2½ cents per mile, the time being 14 hours. The capital of the company is $24,153,000, the liabilities $6,233,000, and the $8,100,000 debt certificates to be paid out of future income—making altogether $38,486,000, against $30,732,517, the cost of the roads. The business of the new company from its consolidation has been as follows :—

EARNINGS FROM PASSENGERS, FREIGHT, AND ALL OTHER SOURCES, FOR THE YEARS ENDING SEPT. 30, 1853–1859.

Years ending	Passengers.	Freight.	Other sources.	Total.
Sept. 30, 1853,	$2,829,668	$1,835,572	$122,279	$4,787,519
" 1854,	3,151,513	2,479,820	286,999	5,918,332
" 1855,	3,242,229	3,189,602	131,749	6,563,580
" 1856,	3,207,378	4,328,041	171,928	7,707,347
" 1857,	3,147,636	4,559,275	320,338	8,027,259
" 1858,	2,532,646	3,700,270	295,495	6,528,412
" 1859,	2,566,369	3,337,148	297,330	6,200,848
Total..				$45,733,296

Whoever glances at the map of New York will observe that the Erie canal runs mostly through the northern counties, skirting, as it were, Lake Ontario for a considerable distance; that the lateral canals extend from this toward the southern portion of the state. The Chenango canal connects the Mohawk with the Susquehanna, and the Genesee Valley canal extends from the Alleghany river to Lake Ontario. The great southern tier of counties bordering on northern Pennsylvania, after having taken great interest in the construction of the canal, were without means of communication with markets, other than by common roads. The face of the country was too rugged to permit of a canal, but in 1825 the state legislature ordered the survey of a state road from Lake Erie to the Hudson river. Several conventions were held during the four years ending with 1830 in relation to the road. The railroad fever had gained ground meantime, and finally, in 1832, a charter for a railroad was granted, with a capital of $10,000,000. The survey was made by De Witt Clinton, Jr., but the legislature required that $1,000,000 of the capital should be subscribed before the work was commenced. This was subscribed, and E. Lord chosen president in 1833. A new survey was made at the expense of the state, and the report made on it in 1835, when a reorganization of the company took place, with J. G. King president. The subscription of capital now reached $2,362,100. The work was commenced by putting 40 miles along the Delaware river under contract. The great fire of December, 1835, incapacitated many of the subscribers from paying up, and work was suspended. In January, 1836, the legislature loaned its credit for $3,000,000, but the stock could not then be negotiated. Some work was done along the line, however, by local subscription. In 1840—Mr. Lord again president—the loan act was amended so as to be available, and the company purchased its iron. The terms of the loan permitted the state officer to deliver to the company $100,000 of state stock whenever he should have evidence that the company had expended an equal amount; the state stock not to be sold under par. The company then paid its contractors with time drafts. The receipts for these drafts furnished the evidence of the company's expenditure, on which the state officer issued the stock to the company, which then borrowed on it the money to take up the drafts, and the lenders of the money sold the state stock in the state for what it would bring—some lots as low as 80. The work thus done was in detached lots, as the interest of certain parties prompted the expenditure. As soon as the last issue was made by the state the company stopped, and the state assumed the interest on the $3,000,000 issued to it. In 1842 the company assigned, and its affairs fluctuated until 1844, when Mr. Loder was elected president. In 1845 the state surrendered its lien of $3,000,000 upon the road, and authorized the individual stock to be cut down one-half by holders giving up two shares and taking one new one. A new subscription of $3,000,000 was obtained, and the work commenced anew. Much of the old work was useless; and at this day, when the passenger approaches Dunkirk, he sees, stretching out far away to the right, like an immense army of grim warriors, the piles that were driven originally for the road, at great expense, and then abandoned. From the year 1845 the road began to grow. Starting from Piermont, on the North River, 20 miles above the city, it reached Otisville, 62 miles, in October, 1846. The route was altered, and reached Binghamton, 139 miles, in December, 1848, at a cost of $9,-802,433, allowing $1,458,000 for half the old stock, after the release of the state lien. In June, 1849, 22 miles more to Owego were opened; in October 36½ miles were added to Elmira; and it finally reached the lake at Dunkirk, May, 1851. This was a single track, and it was found almost impossible to work it; consequently they put a second track under contract on portions of the road. It was now found that the location of the road at Piermont, to be reached by steamboat, would not answer. The company then made an arrangement with the Paterson and Ramapo road to allow the Erie to come into Jersey City. The Erie railroad being a wide gauge, 6 feet, and the Paterson road 4 feet 8 inches, it became necessary to lay another rail outside the track, to permit the Erie cars to come over that road, and the Erie cars reached Jersey City in November, 1853. It is remarkable in relation to this road, that it has depended upon the telegraph to such an extent that it could scarcely be operated without it. It gives constant information of the whereabouts of the trains and the condition of the track, so that the superintendent, wherever he may be, keeps up a constant communication with all the stations. The whole length of the road is 465 miles; 282 miles double track and sidings. The maximum grade of the road is 60 feet to the mile for 8 miles, and there is one of 57 feet to the mile. The cost of the road was greatly enhanced by the mode of raising money for its construction, by a constant series of loans, for which were issued first mortgage bonds, second mortgage bonds, bonds convertible in stock in 1862, bonds convertible in 1871, income bonds, unsecured bonds, and other debts, for very few of which the face was obtained, many of them being disposed of at a large discount. By these means the debts of the company ran up to $25,260,000, and the capital, $10,000,000, was in February, 1857, by a dividend of 10 per cent. in stock, money alleged to have been earned and sunk in the Long Dock, raised to the sum of $11,000,000. This load of debt exceeded the ability of the company, and it went finally into the hands of a receiver. The length of the road is 446 miles, and it has a branch of 19 miles from Chester Junction to Newburgh, making 465 miles. It leases of other companies 95 miles, consequently operates 560 miles; and it has 282 miles of second track. There are 219 locomotives, 160 passenger cars, 49 second class cars, 45 baggage cars, and 2,763 freight cars. The company connected with Jersey City over the track of the New Jersey Transportation Company, but it projected an independent connection through what is called the Long Dock. This embraced a tunnel of 2½ miles through Bergen ridge, and 2½ miles of road running out on to docks and piers built out to deep water. The Long Dock Company was chartered by the state of New Jersey with a capital of $800,000. It purchased $773,440 worth of real estate. The Erie Company leased this at 10 per cent. of the capital, and then commenced expenditures on the tunnel, which is 4,880 feet long, and up to January, 1860, it had expended $1,500,000. This, among other causes, brought the Erie railroad to default; and in August, 1859, at the suit of the fourth mortgage bondholders, a receiver was appointed. It was then proposed, as a means of arrangement, to capitalize the unsecured bonds, with the interest for two years, into a preferred 7 per cent. stock; to extend the first mortgage bonds coupon to March 1, 1860; the second mortgage to September, 1860; the third to March, 1861, and the balance to December, 1861. It is estimated that the road will clear the other claims upon it, and complete the Long Dock. The business of this road from 1842 to 1859, inclusive, was as follows:—

RECEIPTS.

Receipts from passengers	$14,428,024
" " freight	29,902,826
" " mails, &c.	1,586,935
Total	$45,917,785

EXPENDITURES.

Operating expenses	$28,993,114
Dividends	3,481,445
Total	$32,474,559

The Camden and Amboy railroad and Delaware and Raritan Canal Co., of New Jersey, is one of the oldest passenger roads, having been chartered in February, 1830, with the canal privilege. The last is 43 miles from Bordentown to New Brunswick; and the former, South Amboy to Camden, New Jersey, 63 miles. There was to be no rival route within five miles of it. In 1831 the company gave the state 1,000 shares of stock, and a new act was passed consolidating the canal and railroad companies; fares not to exceed $3 between New York and Philadelphia. In the following year 1,000 shares more were conveyed to the state. In 1837 the road was permitted to extend to New Brunswick; fares limited to 5 cents per mile. In 1842 the transit duties on the road were fixed at 10 cents per ton for freight, and one-half of all above $3 charged for passengers. The road was opened to Camden in 1834. In 1843 an arrangement was made with the New Jersey Transportation railroad for through passage from New York to Philadelphia. The Camden road cost $5,563,580, and the New Jersey railroad, Jersey City to New Brunswick, 31 miles, $4,719,176. The Camden road has paid in 25 years 281 per cent. dividends, or 11¼ per cent. average.

The New Jersey Central road extends from Elizabethport, 12 miles by water from New York, to Easton, on the Delaware; at Elizabeth it connects, also, with the New Jersey railroad; at Easton it commands the great Pennsylvania coal fields, and, prospectively, it will unite New York city with Lake Erie, over the Pennsylvania and Sunbury and Erie railroads. The cost of the road is $5,617,290; the capital is $2,000,000; and the debt $3,375,000.

The great Pennsylvania line of improvements, from Philadelphia to Pittsburg, commenced 4th July, 1826, and finished in March, 1830, comprised 82 miles of railroad from Philadelphia to Columbia, and 36 miles of portage road from Hollidaysburg to Johnstown; this consists of a series of inclined planes, which are worked by stationary engines. This 118 miles of railroad was prolonged by 278 miles of canal, and the cost of the whole to the state was over $12,000,000. This broken line was not very well calculated to compete either with the continuous water service of the Erie canal or the uninterrupted passage of freight on the New York railways. The citizens of Philadelphia felt the want of works better adapted to the growing wants of that great city; and a new railroad was proposed from Harrisburg to Pittsburg, 250 miles. The route is favorable, except for the mountain division, where the summit is crossed, 2,200 feet above tide water, requiring gradients 95 feet to the mile. These are but little in excess of those of the Massachusetts lines, which are worked to advantage. This work was opened through, November 15, 1832, at a cost of $7,978,000, It proved very successful, and up to November, 1855, its profits, over interest on capital, were, in accordance with its charter, credited to construction account, and it has since paid 6 per cent The state line of public works did not succeed financially, and the state determined to sell it. After repeated offerings it was finally purchased by and transferred to the Pennsylvania railroad in 1857 for $7,500,000, which was met by an issue of the 5 per cent. bonds of the company to the state, payable, $100,000 per annum until 1890, and the balance, $4,300,000, in four equal instalments annually thereafter. When the road took possession of the state works, the canals were found to be in a dilapidated condition, and the railroad needed repairs, which required assessments. The route then became continuous by rail from Philadelphia to Pittsburg, 353 miles. From Philadelphia 8 miles to the Susquehanna river there is a double track, and other portions of the road raise the double track to 242 miles. The cost, including the state line, is $30,168,987, composed of capital, $13,240,225, and $17,571,054 of bonds. A part of the cost is composed of $816,050 advanced to the Pittsburg, Fort Wayne, and Chicago railroad, which prolongs the Pennsylvania road to the latter city. That road was composed of three roads, viz.: the Ohio and Pennsylvania, the Ohio and Indiana, and the Fort Wayne and Chicago roads. These were consolidated into one company in 1856, and the line completed from Pittsburg to Chicago in 1859, 471 miles, at a cost of $16,079,590, of which $5,259,040 is capital, and $7,956,075 bonds. To assist the completion of this road, the Pennsylvania Railroad Company took up the rails on the 36 miles of portage road which it had bought of the state, and which was of no use, as it run parallel to its own road, and gave them to the Pittsburg road to complete its extension from Plymouth into Chicago. For this iron and the expense of taking up and moving, the Pittsburg road gave its first mortgage bonds for $650,000. The business of the Pennsylvania road, connecting, as it does, Philadelphia with Chicago and the whole net-work of railroads between and beyond these cities, is not only profitable to itself, but of immense value to Philadelphia.

We have stated that a portion of the great Baltimore and Ohio railroad was finished two years before the opening of the Manchester road in England. The company received two charters: one from the state of Maryland, February, 1827, and the other from the state of Virginia in the following March, with authority to construct a road from Baltimore to the Ohio river. The capital authorized was $5,000,000, and the company entitled to organize on the payment of $1,000,000. The company was so organized in April of the same year, and with the aid of several officers of the United States topographical corps, the road was partly located in the same summer. July 4th, ground was broken by Charles Carroll, of Carrollton, and the portion of the road to Ellicott's Mills was put under contract. The capital of the company, at the close of 1828, reached $4,000,000, of which three-fourths was taken by individuals, $500,000 by the city of Baltimore, and $500,000 by the state of Maryland. The road was gradually extended to the Point of Rocks in 1832. Here arose an obstacle of right of way. The Chesapeake canal had appropriated the narrow gorge through the mountain, and several years of negotiation elapsed before the difficulty was finally settled by the legislature. In 1833 the Washington branch was chartered, on the condition that at least 25 cents per passenger should be paid to the state. The Baltimore and Ohio Company contributed $1,016,800 toward the construction, and it was opened 30 miles to Washington, August 25, 1835. The road had then no locomotives, horse power being used. The company offered $4,000 for a locomotive of American manufacture to burn coal. One was invented by Phineas Davis and accepted. It ran 15 miles per hour on short curves and 30 miles on a straight line. The rails were flat bars laid on stone foundations, which soon gave way to longitudinal timbers with improved rails. The road reached Harper's Ferry in 1834, and the state subscribed $3,200,000 for the extension to Wheeling. In 1838 the state of Virginia extended the time for construction through its territory and subscribed $1,058,420. The road was then completed to Cumberland in 1842, but nothing further was done until 1847. Virginia again extended the time, and in 1849 state bonds granted to the company furnished means for pushing the road to completion in 1853. The city of Baltimore then furnished $5,000,000, which was expended in protecting tunnels, double track, etc. There is one tunnel of 4,137 feet, and the length of all the tunnels is 12,804 feet.

A charter for the Parkersburg branch was granted in 1851. The work began December, 1852, and was completed May 1, 1857. The road was built jointly by the city of Baltimore and the Baltimore and Ohio Company. The former gave $1,500,000 first mortgage bonds, and the latter $1,000,000 of its second mortgage bonds, and has since advanced $1,795,326. The road is operated by the Baltimore Company under a contract for five years, at a rent of 40 per cent. of the gross earnings.

The capital of the Baltimore Company is $10,011,800, and the funded debt $13,881,833. There are three sinking funds operating to redeem these debts, and all amount to about $1,200,000. The total earnings of the main road for 30 years were $9,744,351 from passengers, $29,604,970 from freight; total, $39,349,321; the amount, less expenses, was $17,421,250, and the total amount of dividends paid has been $4,589,866. These range from 1 to 7 per cent., and during the five years ending with 1852, were paid in stock.

The traffic of the road east is mostly in coal. Thus, of 566,214 tons delivered at Baltimore in 1859, 323,898 was coal. The number of passengers on the road and branches going west in 1859 was 338,037; going east, 349,501. Tons of freight going west, 303,104; going east, 770,452. This road has exercised an immense influence upon the business of Baltimore, and opened a route to the Ohio valley which rivals the Pennsylvania and the great New York routes.

The Virginia Central railroad, which now connects Richmond 195 miles with Jackson's River, was originally chartered, in 1836, as the Louisa railroad, with a capital of $300,000, and in 1837 the board of public works was authorized to subscribe on behalf of the state $120,000. In December, 1837, twenty-three miles of the road were opened. It was further extended in the following year, and in 1840 the road reached Gordonsville. Under new privileges, granted in 1848, the work was resumed, and reached Charlottesville in May, 1850, but in that year some new privileges being asked, the name of the road was formally changed to the Virginia Central railroad. There were then seventy miles in operation, and extensions at both ends were proceeded with; of these in 1851 twenty-three miles were completed, bringing the road into Richmond. It was not until 1857 that the road was opened through to Jackson's River, 195 miles, at a cost of $5,362,910; of this $3,132,445 is capital paid in, $1,878,493 by the state, and the balance by individuals. The highest grade of the road going west is eighty-three feet per mile for $1\frac{1}{2}$ miles, and going east seventy-two feet per mile for fourteen miles. There are 107 miles straight, and 77 miles curved, of which the smallest radius is 716 feet for $\frac{1}{4}$ mile. The rails are all T, from fifty to sixty pounds per yard. The cross ties 2,400 to the mile. The business of the past year was as follows:—

Going	Passengers.	Freight. Tons.
East	33,629	66,678
West	30,548	68,205
Total	64,177	134,883
Earnings	$311,980	$306,212

This road from its opening, 1837, to the close of 1859, earned as follows: average length, 90 miles; passenger earnings, $79,583; freight, $89,773; gross earnings, $180,009; expenses, $94,486; dividends paid, $22,971; per cent., 2.

In casting the eye upon a railroad map, the line from Bangor, Maine, to New Orleans, 1,996 miles, is found to be composed of nineteen grand links; one of the largest of these is that which connects Lynchburg, Va., with Bristol, Tenn., 204 miles. This was called the Virginia and Tennessee. It was opened in 1854. By this route the mails of the government are conveyed from Washington to New Orleans in seventy-five hours. This commanding position of the road is not, however, more advantageous than its local business, which is derived from one of the most fertile districts of Virginia, as well as rich in minerals. The road opened what had been one of the most secluded portions of the central states, and vast resources are there to be developed. The cost of the road is $7,050,519, of which $3,418,599 is capital and $2,833,000 bonded debt. The future of this road is one of the most promising.

The next most important link in this great line is the Orange and Alexandria road, connecting Alexandria and Lynchburg, 170 miles. This road was completed in 1859; by it the distance from New York to central Virginia is shortened sixteen miles, and the route to New Orleans, so to speak, straightened. The cost of the road was capital, $1,899,330; bonds, $2,600,000.

The South Carolina road was one of the

first projected in the country. The city of Charleston early saw the advantage and importance of the work, which was commenced in 1830, and opened in 1833. Its main trunk extends from Charleston to Hamburg, on the Savannah river, opposite Augusta, Georgia, 136 miles. The track was originally a trestle-work, on which was laid a thin flat rail. Some of the swamps and rivers were crossed at an elevation of fifty feet. On this road the first successful American locomotive was run. It was called the "Best Friend," and was built under the supervision of E. L. Miller, of South Carolina. It was introduced by Horatio Allen, and ran in 1830, when there were but eight miles of road out of Charleston. The South Carolina road cost $7,701,338, of which $4,179,475 is capital, and $2,730,463 bonded debt. The road owes most of its business to the transportation of cotton, and it pays ten per cent. regularly. Its stock is above *par*. The project of connecting Charleston with Cincinnati was early entertained, and in 1836 a grant was obtained from South Carolina, North Carolina, Tennessee, and Kentucky, for the purpose of constructing a road through Columbia, Knoxville, and Danville to Covington, opposite Cincinnati. This enterprise was swamped in 1837 by the crisis, when the road was partially constructed to Columbia. That project has now been revived by the completion of the Greenville and Columbia road, and the extension of the Blueridge road into Tennessee, thence *via* Knoxville through Danville and Lexington to Cincinnati. A more circuitous road by way of Nashville and Louisville, over the Nashville and Chattanooga, and Nashville and Louisville railroads, has been opened. Charleston thus drains the whole interior country.

The Georgia railroad system is composed of two great lines: one from Savannah to the Tennessee river, 434 miles, and the other, 255 miles, from Augusta to West Point, whence it is prolonged to Montgomery by the Montgomery and West Point road. The Georgia Central, connecting Savannah with Macon, 191 miles, was opened nearly at the same time as the Georgia road connecting Augusta with Atlanta, 171 miles, viz., in November, 1843, having been commenced in 1836. It was chartered with banking privileges, and has been eminently successful. Its capital stock is $4,010,000, and bonded debt $158,767. This road made a dividend last year of 15 per cent., and its stock is now 15 per cent. premium. The Georgia road cost $5,210,372, of which $4,156,000 is capital, and $476,895 bonded debt. The earnings of this road are 15 per cent.

From Atlanta a road stretches to West Point; it has always paid either seven or eight per cent., besides several extra dividends; and last year divided a bonus of thirty per cent. The state railroad of Georgia, built at extravagant cost, and managed by state officials, paid into the treasury last year out of its net earnings about eight per cent. on its cost.

In Alabama, Louisiana, and Arkansas, their fine rivers, navigable for steamboats, and stretching into every part of the states, have made railroads almost unnecessary. But whenever they are built, and can obtain a freight of cotton, they are sure to pay. This product is not like corn, or wheat, or even flour, worth one, two, or three cents a pound, but eight, ten, or twelve cents, and can therefore afford to pay the cost of transportation.

The most remarkable railroad in the world as to extent, location, mode of construction, and magnitude of resources, is perhaps the Illinois Central road. It may be called the corner-stone of a future empire. In 1837, when the population of the state of Illinois was less than 200,000 souls, and these agriculturists scattered over the great state, they undertook with singular boldness a system of internal improvement by canal and railroad, which would involve an expenditure of at least $15,000,000. Among these was the Central railroad, which was to extend from Cairo, at the junction of the Ohio and Mississippi rivers, longitudinally of the state, to Galena at its northern extremity on the Missisippi river, making a line of 457½ miles, which should be the base of a triangle of which the great river formed the other two sides. This road was to cross the Illinois river at the commencement of navigation, or where it meets the canal coming from Chicago. Other roads were projected to cross the state, intersecting the Central road. The Central road was undertaken, and about $3,500,000 spent upon it, when bankruptcy overtook the state, and the road rapidly deteriorated. The progress of the work on the canal, with the funds borrowed on pledge of the land granted by the federal government, had been of great benefit to the state, and had enabled the federal government to sell most of its lands on the canal and great water-courses, in fact, all within reach of market. There remained, however, some 15,000,000 acres of the richest land in the heart of the state, for which there was no sale, because it was not accessible to market. Experiencing, however, the great results from the canal grant, which not only laid open great tracts to market, but by local expenditure in construction, brought settlers and money upon the vacant lands, it decided upon a similar grant to the state in aid of the Central railroad. Accordingly, in September, 1850, Congress made a grant of lands to the state of Illinois of every alternate section, six sections in width, on each side of the road and its branches, and if any land so situated should be taken up, then any vacant land elsewhere might be selected in room of it, within fifteen miles of the line of the road. The same law conferred upon the states of Alabama and Mississippi similar grants for the extension of the road from Cairo to Mobile city. In the following February the state of Illinois incorporated the Illinois Central Railroad Company, with a capital of $1,000,000, to be extended to an amount not exceeding the cost of the road. The company on its organization was to pay over to the state treasury $200,000, and receive from the state the entire grant of lands made by the federal government, together with all that remained of the old Central road, right of way, etc. The company was to have fifty miles completed within two years, under forfeit of the $200,000 deposited, and which was to be returned to the company on the completion of the fifty miles within the time. The road was to run from Cairo to the western end of the Illinois canal, and thence branch to Galena on the river, and to Chicago on the lake. The company was to pay to the state annually five per cent. on the gross income of the road. These were the leading items of the grant, and the conditions were all carried out. The location and survey of the route showed the company entitled to 2,595,000 acres of land to be selected by the company. This vast tract of land, amounting to an area larger than the whole state of Connecticut, was all to be selected from good farming lands, not an acre of waste in the whole, but all of the richest prairie soil, of the same character as that in the neighborhood of St. Louis, which for two hundred years had given to fresh settlers annual crops, without in any degree deteriorating apparently. These lands of the company were appropriated, 2,000,000 acres, valued at $18,150,000, as a security for $17,000,000 of construction bonds; 250,000 acres were added to the interest fund to meet any deficiency of means from other sources appropriated to interest on the construction bonds; and 345,000 acres were held in reserve, but were finally the basis of $3,000,000 "free land bonds," issued and redeemed by conversion into company stock. The 2,000,000 acres were placed in the hands of trustees, who alone have power to give title to purchasers, and who are required, whenever the funds accumulate to the amount of a bond, to buy and cancel it. No land can be sold, unless bonds to the same amount are cancelled. It was estimated that the bonds thus issued would build the road, and leave the entire work free of cost to the stockholders. It was found requisite, however, to create 170,000 shares, representing $17,000,000 capital. On this instalments have from time to time been called in. The $200,000 deposited with the state was assessed $20 on 10,000 shares, and the amount has since been increased to $26,000,000, on which 80 per cent. has been called, making $20,800,000. In April, 1852, $4,000,000 of the 7 per cent. construction bonds were issued at par, and the subscribers to this loan had the privilege of subscribing ten shares of stock for each $1,000 bond. The company purchased their iron, 72,000 tons, in 1852, when it was very low, or less than half the price to which it rose soon after, when the railroad fever developed itself. In October, 1852, the whole line was put under contract, in divisions, and 10,000 men were employed at an expense of $3,700,000 per annum, at work along the line, twelve hours per day, stretching a great highway through fertile plains never before opened, conferring value on them, wealth to the farmers, and strength to the state. As the work progressed, it encountered difficulties from cholera, and the demand for labor which the growing railroad mania caused. The road was opened in 1854, and its earnings for its first year, 1855, were $1,532,118. It sold of its lands 528,863 acres for $5,598,577, and the sales have since reached 1,267,627 acres for $16,230,326, leaving on hand 1,327,372 acres. These lands are quite as valuable for farms as those sold.

The Illinois Central railroad is the longest continuous line of road under the control of a single corporation in the United States. It owns 112 locomotives (of which number twenty-five burn coal), seventy first-class passenger cars, twenty-four baggage and express cars, and 2,295 freight cars. It has extensive workshops for the manufacture and repair of machinery at Chicago, Centralia, and Amboy, with one or two smaller establishments at other places. The road is intersected by and makes connections with sixteen distinct lines of railroad. At its northern terminus—Dunleith—on the Mississippi river, the cars make connections with the boats of the Minnesota Packet Company for the upper Mississippi. The company have recently erected a grain elevator at Dunleith, by which grain will be transferred from the boats to the cars at a considerable saving in labor and expense.

At Cairo, the southern terminus of the road, the cars make direct connections (by steamer to Columbus, Ky.) with the Mobile and Ohio railroad for Memphis, Natchez, Vicksburg, New Orleans, and other southern cities. In Chicago the company's facilities for receiving and forwarding freight are unsurpassed. Sleeping cars are run on all its night passenger trains.

The land department is the most interesting branch of the company. It is divided into three bureaus—the cashier's office, the sales room, and the contract room. The whole force employed in it comprises about twenty-five clerks, one of whom is a brother of Charles Dickens, the distinguished novelist. He is on the sunny side of thirty, is a quiet, unassuming gentleman, and, it is said, writes considerable for some of the leading literary publications in this country. But to return to the lands of the Illinois Central railroad. They comprise an area covering 4,055 square miles, nearly as large as the territory of the state of Connecticut, twice as large as Delaware, more than half as large as Massachusetts, about the same size as the electorate of Hesse-Cassel, three-fourths as large as the grand duchy of Baden, and half as large as the grand duchy of Tuscany.

The most marvellous result of this great work was manifest in the report of the United States land commissioner. The lands through which the road ran had been offered on an average of 15 years at $1.25 per acre, without finding a buyer. All those lands were withdrawn while the company made its selections. When that was done, the lands were again brought into market, in June, 1852, and these in the next twelve months sold in Illinois 298,861 acres for cash, at $2.50 per acre, and 2,509,120 for land warrants. The sales were double the quantity sold in all the states in the previous year. The whole interest of the government in Illinois was speedily closed out. For lands which had been valueless to it before the completion of the road, it realized over $9,000,000. This was the effect of transportation upon those lands.

The first land grants of the government, as we have seen in a preceding chapter, were in aid of canals. The grant to the Illinois railroad was followed by others, and the aggregate grants are as follows to each state:—

	Grants for internal improvements.	Railroad grants.
Ohio	1,243,001.77	....
Indiana	1,609,861.61	....
Illinois	500,000.00	2,595,053
Missouri	500,000.00	1,815,435
Alabama	500,000.00	2,332,918
Mississippi	500,000.00	1,687,530
Louisiana	500,000.00	1,162,580
Michigan	1,250,000.00	3.096,000
Arkansas	500.000.00	1,465,297
Florida	500,000.00	1.814,400
Iowa	1,385,078.22	3,456,000
Wisconsin	1,069,371.99	1,622,800
California	500,000.00	....
Minnesota Ter.	340,000.00	4,416,000
	10,897,313.59	25,464,013

The grants for internal improvements include the canal grants to Ohio, Indiana, and Illinois, as well as for river improvements. The railroad grants, it appears, amount to nearly 25,500,000 acres. These grants have been applied to that purpose by the several states, not always, however, with the best success. The state of Wisconsin was unfortunate in the grants of the state rights, and the land has been withheld in some cases. Minnesota founded a railroad system upon her lands, but up to the present time disaster only has attended it. The system was pushed to its extent in 1857, and then suffered a severe revulsion. With the improved demand for farm produce, migration may be expected to be renewed, and the value of the land grants to be restored.

The land grant of the federal government to Alabama for the Mobile and Ohio road was to the extent of 1,120,000 acres, and it became the basis of a sinking fund for the aid granted to the states of Tennessee, Mississippi, and Alabama. The road is to extend from Mobile bay, in a line nearly due north, to the mouth of the Ohio river, opposite Cairo, a distance of 594 miles. Thence by the Illinois Central it will connect with Dunleith, on the upper Mississippi, 928 miles, and also with Chicago and the eastern lines. The road was commenced in 1851, and was pushed through Tennessee to West Point in 1857; it is by the law of that state entitled to a guaranteed state credit of $8,000 per mile, which will carry it to the Kentucky line. The work is one of the most important in the whole country.

The Memphis and Charleston railroad connects Memphis, on the Mississippi, with Charleston, by the way of the Nashville and Chattanooga road. This road connects Charleston and Savannah with the leading cities of the Mississippi river. It is 271 miles long, and forms part of the great through line from Washington to New Orleans. It is well built, and pays 12 per cent. dividends. Its cost was $6,351,752, of which $2,258,115 is capital, and $2,594,000 bonded debt.

The New Orleans, Jackson, and Great Northern road forms the southernmost link of the great chain which stretches 2,000 miles on the Atlantic coast to Bangor, thus connecting codfish with sugar, the Maine law with New Orleans rum. The road runs from New Orleans to Canton, Mississippi, 206 miles. It has, as a matter of course, an immense through business as well as a large local traffic. Its cost has been $8,949,183, of which $4,320,618 is capital, and $3,185,000 bonded debt.

There were completed in January, 1860, the last two links in the great chain of railways from Maine to Louisiana—the first, the last twenty-five miles on the Mississippi Central, and the second, of sixty-one miles between Lynchburg and Charlottesville, on the Orange and Alexandria railroad, popularly known as the Lynchburg Extension. This route, as will be seen by the following table of distances, is within a fraction of 2,000 miles in length, from Bangor to New Orleans, of a continuous rail track, with the exception of four short ferries, viz.: the Hudson river, the Susquehanna, the Potomac, and the James river at Lynchburg, the last two of which will soon be supplied with bridges.

From New Orleans to Canton, Miss., by the New Orleans, Jackson, and Great Northern railway	206
Canton to Grand Junction, Miss., by the Mississippi Central railway	165
Grand Junction to Stephenson, Ala., by the Memphis and Charleston railway	219
Stephenson to Chattanooga, Tenn., by the Nashville and Chattanooga railway	38
Chattanooga to Cleveland, Tenn., by the Cleveland and Chattanooga railway	29
Cleveland to Knoxville, Tenn., by the East Tennessee and Georgia railway	83
Knoxville to Bristol, Tenn., by the East Tennessee and Virginia railway	130
Bristol to Lynchburg, Va., by the Virginia and Tennessee railway	204
Lynchburg to Alexandria, by the Orange and Alexandria railway	169
Alexandria to Washington, D. C., by the Washington and Alexandria railway	6
Washington to Baltimore, Md., by the Baltimore and Ohio railway	39
Baltimore to Philadelphia, by the Philadelphia, Wilmington, and Baltimore railroad	98
Philadelphia to New York, by the Philadelphia and New York railroad line	87
New York to New Haven, Conn., by the New York and New Haven railway	74
New Haven to Springfield	62
Springfield to Worcester, by the Western railway	55
Worcester to Boston, by the Boston and Worcester railway	45
Boston to Portland, Me., by the Eastern and Portland, Saco, and Portsmouth railways	107
Portland to Bangor, Me., by the Penobscot and Kennebec, and Androscoggin and Kennebec railways	137
Total	1,953

This vast chain of railways is composed of nineteen independent roads, costing in the aggregate, for 2,394 miles of road, $92,784,084, or nearly one-tenth of the whole railway system of the United States, of which 1,953 miles are used in this continuous line. The roads from Washington city to New Orleans, embracing a distance of 1,249 miles, have had the contract for the great through mail to New Orleans once a day since July 1, 1858.

The state of Michigan, in 1836, contemplated the construction of three railroads to cross the state: the Southern, from Monroe to New Buffalo; the Central, from Detroit to St. Joseph; and the Northern, from Huron to Grand River. For these roads a state debt of $5,000,000 was contracted; and, in 1838, 28 miles of the Central road had been put in operation, which was extended to 146 miles, at a cost of $2,238,289, and the Southern road, 68 miles, at a cost of $1,125,590, when the state failed and repudiated its debt. As a step toward recovery, a bill was passed, at the suggestion of Mr. Charles Butler, of New York, called the "Butler act," by which the state sold the Central road to a Boston company for $2,000,000 of its own bonds, and the Southern road for $5,000,000 to another company.

Little was done, however, until 1849, when Mr. Butler and others reorganized the Southern company, and the road was pushed to completion. As it approached the Indiana line, an old Indiana state charter was purchased, enabling the company to carry their work through that state to the Illinois line, whence, under the general law of that state, it was pushed on to Chicago. The distance from Monroe, on Lake Michigan, to Chicago, is 246 miles, and the work was completed for $5,000,000, or $20,000 per mile in running order, the level nature of the country being very favorable to the construction of railroads. The work was eminently successful, but became involved through its connection with lateral jobs, which covered it with liabilities greater than its business, large as it was, could carry. It was, like the Erie canal, and indeed many other railroads, overlaid with useless and ill-judged expenditure. The company expended $1,312,534 in aid of other roads, many in nowise connected with it, and in keeping up a ruinous competition. The company thus became hopelessly involved in 1857, when its cost had risen to $19,595,407. Its struggles increased its liabilities, while its business declined. Its main line, Monroe to Chicago, is 246 miles, and six branches raise the length to 509 miles, to which 30 miles leased are to be added.

The Michigan Central reached the lake in May, 1849, and was also pushed to completion, going round the foot of Lake Michigan, where the Illinois Central put out a hand to meet it. The connection is thus 284 miles Detroit to Chicago. The cost of this road was $14,548,411. The road was laid with T rail, and was very prosperous. The capital of the company is $6,057,844, and the debt $8,284,063. The road is an important link in the line of connection between Boston and the western country.

The state of Tennessee has an important system of railroads extending to all sections of the state. The state guarantees $8,000 per mile for the purchase of iron and epuipment, upon the condition that the companies prepare the road bed and defray the charges of construction. The state retains a lien upon the whole property. The roads have been well built.

The state of Missouri had done little toward the construction of roads until the session of 1851, when it agreed to lend its aid to two great lines: the Pacific road, commencing at St. Louis and running across the state, on the south side of the Missouri river, and the Hannibal and St. Joseph road, extending 206 miles across the state from river to river, connecting the two cities named. This last has also a land grant of 600,000 acres, made the basis for $5,000,000 of the company's bonds. The state subsequently enlarged its plan, and agreed to issue some $24,000,000 of its bonds in aid of the railroads. The panic of 1857 supervened before the issue was completed, and many of the roads became embarrassed. The most important of these roads is the Pacific. It has received state aid, direct and contingent, to the extent of $7,500,000, and has also a land grant of 1,127,000 acres. The main line, St. Louis to Kansas city, is 282 miles, running nearly parallel with the Missouri river, and the south-west branch is 283 miles—together, 565. The route open is 63 miles to Syracuse. The cost is $11,701,516, of which $3,319,835 is capital, and bonded debt $8,303,000.

In the following table of the leading railroads of all the states, with the capital paid in and the funded debts outstanding, there are many roads which run through several states. These are given, the whole in those states where their greatest length is. Thus the Boston and Maine road has three miles in Maine, but the whole is put down in Massachusetts. The titles of roads in Italics show the land-grant roads. The figures are from returns a year earlier than those above.

RAILROADS OF THE UNITED STATES—PROJECTED LENGTH AND MILES COMPLETED, WITH THE CAPITAL PAID IN, AND FUNDED DEBT.

Corporate titles of companies.	Total length of Roads.	Length roads completed.	Capital.	Funded Debt.
Androscoggin	36.1	36.1	$151,833	$444,638
Androscoggin and Kennebec	55.6	55.6	457,900	1,748,451
Atlantic and St. Lawrence	149.2	149.2 }	2,494,900	3,472,000
Branch	1.5	1.5 }		
Bangor, Oldtown, and Milford	12 3	12.3 }	135,000	..
Branch	0.5	0.5 }		
Carried forward	255.2	255.2	3,239,633	5,665,095

Corporate titles of companies.	Total length of roads.	Length roads completed.	Capital.	Funded debt.
Brought forward	255.2	255.2	$3,239,633	$5,665,095
Baring and Lewy's Island	17 2	17.2	226,500	..
Calais and Baring	6.0	6.0 }	224,113	..
Branch	5.5	5.5 }		
Great Falls and South Berwick	6.0	6.0	175,000	..
Kennebec and Portland	63.0	63.0 }	1,287,779	1,280,000
Bath branch	9.5	9.5 }		
Machiasport	7.5	7.5	100,000	..
Penobscot	33.0	..	180,497	300,000
Penobscot and Kennebec	54.7	54.7	555,228	1,206,800
Portland and Oxford Central	28.5	21.5	430,000	..
Portland, Saco, and Portsmouth	51.3	51.3	1,500,000	..
Somerset and Kennebec	39.0	39.0	169,200	556,900
York and Cumberland	55.0	18.5	370,000	450,000
Total Maine	631.4	554.9	8,457,980	9,458,495
Ammonoosuc Valley	20.8	20.8	371,037	..
Ashuelot	23.1	23.1	246,018	150,000
Boston, Concord, and Montreal	93.0	93.0	1,800,000	1,050,000
Cheshire	53.8	53.8	2,085,925	738,200
Cocheco	37.0	28.5	389,047	420,853
Concord	34.5	34.5	1,500,000	..
Contoocook Valley	14.6	14.6	200,000	..
Eastern	16.8	16.8	492,500	42,795
Great Falls and Conway	46.3	20.5	166,748	209,927
Manchester and Lawrence	26.8	26.8	863,400	33,800
Merrimac and Connecticut Rivers	53.8	53.8	595,587	383,400
Northern New Hampshire	69.2	69.2 }	3,068,400	299,500
Bristol Branch	12.8	12.3 }		
Peterboro' and Shirley	10.5	10.5	245,643	..
Portsmouth and Concord	46.8	46.8	250,000	..
Sullivan	24.7	24.7	500,000	750,000
Wilton and Nashua	10.3	10.3	232,227	..
Total New Hampshire	594.8	560.5	13,206,532	4,078,475
Connecticut and Passumpsic Rivers	110.3	90.7	1,200,000	800,000
Grand Trunk of Canada	17.3	17.3	345,000	..
Rutland and Burlington	119.6	119.6	2,233,376	3,145,001
Rutland and Washington	44.8	44.8	950,000	..
Rutland and Whitehall	6.8	6.8 }	255,706	..
Branch	1.5	1.5 }		
Vermont and Canada	47.0	47.0	1,350,000	..
Vermont Central	118.0	118.0 }	5,000,000	3,853,000
Branch	4.0	4.0 }		
Vermont Valley	23.7	23.7	516,164	793,200
Western Vermont	54.0	54.0 }	332,000	700,000
Branches	10.5	10.5 }		
Total Vermont	557.5	537.9	12,182,246	9,291,201
New York and Boston air-line	23.3	..	153,312	..
New York, Providence, and Boston	50.0	50 0	1,508,000	306,500
Providence, Warren, and Bristol	13.6	13.6	287,917	109,937
Total Rhode Island	86.9	63.6	1,949,229	416,437
Danbury and Norwalk	23.9	23.9	279,100	85,000
Hartford, Providence, and Fishkill	197.5	122.4	1,936,739	1,810,500
Housatonic	74.0	74.0	2,000,000	232,000
Naugatuck	57.0	57.0	1,031,800	287,300
New Haven and Hartford	55.5	55.5 }	2,350,000	964,000
Branches	10.6	10.6 }		
New Haven, New London, and Stonington	61.5	61.5	960,748	866,000
Carried forward	480.0	404.9	8,558,387	4,244,800

Corporate titles of companies.	Total length of roads	Length roads completed.	Capital.	Funded Debt.
Brought forward	480.6	404 9	$8,558,387	$4,244.800
New Haven and Northampton	46.4	46.4	922,500	700,000
Branches	8.8	8.8		
New London, Willimantic, and Palmer	66.0	66 0	510,900	1,052,500
New York and New Haven	62.3	62.3	2,980,839	2,219,000
Norwich and Worcester	59.0	59 0	2,122,500	714,998
Allyn's Point Extension	7.0	7.0		
Total Connecticut	729.5	654.4	15,095,126	8,331,298
Belvidere Delaware	64.2	64.2	977,700	2,049,500
Burlington and Mount Holly	7.1	7.1	120,000	..
Camden and Amboy	63.0	63.0	3,798,400	6,882,000
Branch	31.0	31.0		
Camden and Atlantic	60.0	60.2	657,351	1,006,800
Central of New Jersey	63.0	63.0	2,200,000	3,186,000
Extra track	48 0	48.0		
Flemington	11.8	11.8	238,513	..
Freehold and Jamesburg	17.0	11.0	220,666	..
Millstone and New Brunswick	6.6	6.6	111,114	..
Morris and Essex	92.0	53.0	1,157,800	340,000
Newark and Bloomfield	6.0	6.0	101,387	..
New Jersey	33.8	33.8	3,749,000	188,700
Northern New Jersey	21.7	21.7	154,157	..
Paterson and Hudson	14.5	14.5	630,000	..
Paterson and Ramapo	15.0	15.0	248,225	95,000
Sussex	12.0	12.0	357,078	..
Warren	18.7	18.7	1,024,600	600,000
West Jersey	60.0	13.0	216,794	..
Total New Jersey	645.6	553.6	15,982,785	14,348,000
Agricultural branch	28.4	15.1	312,828	..
Amherst and Belchertown	43.0	19.5	295,337	..
Berkshire	21.2	21.2	600,000	..
Boston and Lowell	26.7	26.7	1,830,000	440,000
Branch	1.8	1.8		
Boston and Maine	74.3	74.3	4,076,974	..
Branches	8.8	8.8		
Boston and New York Central	74.5	74.5	3,692,144	..
Boston and Providence	43.5	43.5	3,160,000	174,200
Branches	12.1	12.1		
Boston and Worcester	44.8	44.8	4,500,000	500,000
Branches	24.3	24.3		
Cape Cod branch	46.1	46.1	681,690	190,000
Branch	1.0	1.0		
Connecticut River	50.0	50.0	1,591,100	252,500
Chicopee branch	2.4	2.4		
Danvers	9.2	9.2	203,150	..
Dorchester and Milton	3.3	3.3	136,789	..
Eastern	44.1	44.1	2,853,400	2,030,500
Branches	30 5	30.5		
Easton branch	3.8	3.8	56,353	..
Essex	19 9	19.9	299,107	280,261
Branch	1.4	1.4		
Fairhaven branch	15.1	15.1	396,085	..
Fitchburg	50.9	50.9	3,540,090	100,000
Branches	16.8	16.0		
Fitchburg and Worcester	14.0	14.0	214,296	62,900
Grand Junction	9.0	9.0	1,895,402	..
Hampshire and Hampden	24.9	24.9	298,951	303,014
Hartford and New Haven	5.9	5.9	369,218	..
Horn Pond branch	0.7	0.7	12,000	..
Lexington and West Cambridge	6.6	6.6	250,357	..
Lowell and Lawrence	12.4	12.4	200,000	100,000
Marlboro' branch	3.9	3.9	156,185	..
Carried forward	775.3	737.7	31,621,456	4,433,375

Corporate titles of companies.	Total length of roads.	Length roads completed.	Capital.	Funded debt.
Brought forward	775.3	737.7	$31,621,456	$4,433,375
Medway branch	3.6	3.6	32,554	..
Middleboro' and Taunton	8.1	8.1	149,496	..
Nashua and Lowell	14.4	14.4	600,000	..
New Bedford and Taunton	20.1	20.1	500,000	..
Branch	1.6	1.6		
Newburyport	26.9	26.9	220,240	221,600
New York and Boston air line	32.0	8.6	223,176	675,000
Old Colony and Fall River	79.5	79.5	3,015,100	134,500
Bridgewater branch	7.8	7.8		
Peterboro' and Shirley	14.1	14.1	265,327	..
Pittsfield and North Adams	18.6	18.6	450,000	..
Providence and Worcester	43.4	43.4	1,510,200	300,000
Salem and Lowell	16.9	16.9	243,305	226,900
South Reading branch	8.2	8.2	298,947	..
Branch	0.3	0.3		
South Shore	11.5	11.5	259,685	153,290
Stockbridge and Pittsfield	21.9	21.9	448,700	..
Stony Brook	13.2	13.2	267,364	..
Stoughton branch	4.1	4.7	94,944	..
Taunton branch	11.1	11.1	313,156	..
Branch	0.6	0.6		
Troy and Greenfield	36.5	36.1	385,206	219,000
Vermont and Massachusetts	69.0	69.0	2,214,225	1,003,880
Branch	8.0	8.0		
Waltham and Watertown, horse	2.2	2.2	18,978	..
Western	156.1	156.1	5,150,000	6,125,520
West Stockbridge	2.7	2.7	39,600	..
Worcester and Nashua	45.7	45.7	1,141,000	194,500
Total Massachusetts	1,474.8	1,384.2	49,462,563	13,687,565
Albany and Susquehanna	140.0	..	275,792	..
Albany and West Stockbridge	38.0	38 0	1,000,000	1,289,933
Albany, Vermont, and Canada	31.9	31.9	495,005	1,575,091
Branch	0.8	0.8		
Black River and Utica	108.5	34.9	804,648	700,000
Branch	2.6	2.6		
Blossburg and Corning	14.8	14.8	250,000	220,000
Buffalo, Corning, and New York	142.3	142.0	680,000	2,592,221
Buffalo and New York City	91.0	91.0	755,709	1,720,000
Branch	1.5	1.5		
Buffalo and Pittsburg	75.2	..	133,167	..
Buffalo and State Line	68.3	68.3	1,934,850	1,049,000
Canandaigua and Elmira	69.8	69.8	500,000	..
Canandaigua and Niagara Falls	98.6	98.6	1,300,000	2,195,832
Branch	1.6	1.6		
Cayuga and Susquehanna	34.6	34.6	687,000	411,000
Chemung	17.4	17.4	380,000	70,000
Erie and New York City	63.2	..	352,741	14,000
Genesee Valley	16.0	..	75,689	165,000
Hicksville and Cold Spring	4.1	4.1	52,000	..
Hudson and Boston	17.0	17.0	175,000	..
Hudson River	144.0	144.0	3,758,466	8,842,000
Lake Ontario, Auburn, and New York	73.8	..	71,000	..
Lake Ontario and Hudson River	182.0	..	2,715,186	870,000
Lebanon Springs	22.5	..	324,448	..
Long Island	95.0	95.0	1,852,715	636,997
Hempstead branch	2.5	2.5		
New York and Erie	446.0	446.0	11,000,000	25,326,505
Newburg branch	19.0	19.0		
New York and Harlem	130.8	130.8	5,717,100	5,151,287
Morrisania branch	2.1	2.1		
New York Central	297.7	297.7	24,153,000	14,333,771
Branches, &c	258.2	258.2		
Niagara Falls and Lake Ontario	13.2	13.2	393,721	..
Carried forward	2,724.0	2,057.4	59,837,237	67,112,637

Corporate titles of companies.	Total length of roads.	Length roads completed.	Capital.	Funded debt.
Brought forward	2,724.0	2,057.4	$59,837,237	$67,152,637
Northern, Ogdensburg	118.0	118.0	3,077,900	1,500,000
Branch	3.8	3.8		
Oswego and Syracuse	35.9	35.9	396,340	213,500
Plattsburg and Montreal	20.6	20.6	347,775	..
Potsdam and Watertown	75.4	75.4	665,419	911,000
Branch	2.3	2.3		
Rochester and Genesee Valley	49.7	18.5	557,560	150,000
Rensselaer and Saratoga	25.2	25.2	610,000	140,000
Sackett's Harbor and Ellisburg	18.0	18.0	167,485	278,400
Saratoga and Schenectady	21.0	21.0	300,000	85,000
Saratoga and Whitehall	40.9	40.9	500,000	395,000
Rutland branch	6.6	6.6		
Sodus Point and Southern	35.0	..	35,289	..
Staten Island	26.0	26.0	115,000	..
Syracuse, Binghamton, and New York	80.0	80.0	1,200,130	1,643,126
Troy and Bennington	5.4	5.4	75,370	171,200
Troy and Boston	34.7	34.7	604,911	806,500
Troy and Greenbush	6.0	6.0	275,000	..
Troy and Rutland	17.3	17.3	380,818	..
Troy, Union, and Depot	2.0	2.0	7,611	680,000
Union, Ramapo	0.2	0.2	50,000	..
Union, Syracuse	1.3	1.3	77,414	..
Watertown and Rome	96.8	96.8	1,498,500	685,000
Total New York	3,520.4	2,786.3	70,674,768	74,811,371
Delaware and Maryland	84.0	84.0	361,478	931,500
Newcastle and Frenchtown	16.0	16.0	744,520	..
Newcastle and Wilmington	5.0	5.0	93,000	..
Total Delaware	105.0	105.0	1,198,998	931,500
Annapolis and Elkridge	39.0	39.0	462,000	..
Baltimore and Ohio Branches	379.0	379.0	10,011,800	13,881,833
Washington line	30.0	..	1,650,000	..
Hoffman's Mines branch	11.0	11.0	500,000	..
Cumberland and Pennsylvania	22.0	22.0	800,000	..
George's Creek Canal and Iron	21.0	21.0	600,000	..
Northern Central Branches	138.0	138.0	2,260,000	5,578,800
Western Maryland	14.0	14.0	300,000	..
Sundry coal railroads, say	40.0	40.0	800,000	..
Total Maryland	694.0	694.0	17,383,800	19,460,633
Alexandria, Loudon, and Hampshire	122.0	41.3	1,403,018	36,188
Manassas Gap	105.0	77.8	2,969,861	775,500
Norfolk and Petersburg	79.0	79.0	1,500,124	590,610
North-western Virginia	103.0	103.0	468,605	5,719,229
Orange and Alexandria	149.0	88.0	1,981,167	2,316,879
Fredericksburg and Gordonville	45.0	45.0	231,573	..
Petersburg and Lynchburg	123.0	123.0	1,365,300	1,851,500
Petersburg and Roanoke	59.0	59.0	883,200	102,500
Richmond and Danville	140.0	140.0	1,980,997	907,491
Richmond, Frederick, and Potomac	75.0	75.0	1,041,880	643,960
Richmond and Petersburg	22.0	22.0	835,750	204,808
Richmond and York River	24.0	24.0	657,812	85,000
Seaboard and Roanoke	80.0	80.0	844,200	472,811
Virginia Central	178.0	178.0	3,132,445	1,485,346
Virginia and Tennessee	204.0	204.0	3,353,672	3,247,500
Winchester and Potomac	32.0	32.0	300,000	120,000
Total Virginia	1,540.0	1,371.1	22,949,604	18,559,316
Atlantic and North Carolina	95.0	95.0	1,545,225	400,000
North Carolina	223.0	223.0	4,000,000	..
Carried forward	318.0	318.0	5,545,225	400,000

Corporate titles of companies.	Total length of roads.	Length roads completed.	Capital.	Funded debt.
Brought forward	318.0	318.0	$5,545,225	$400,000
Raleigh and Gaston	97.0	97.0	973,300	126,200
Roanoke Valley	22.0	22.0	450,073	..
Western, coal	43.0	..	..	..
Wilmington and Manchester	161.0	161.0	1,127,511	1,060 000
Wilmington and Weldon	162.0	162.0	1,340,217	791,055
Total North Carolina	803.0	760.0	9,436,322	2,377,255
Blue Ridge	183.0	13.0	1,916,515	217,577
Charleston and Savannah	102.0	55.0	706,365	195,266
Charlotte and South Carolina	109.0	109.0	1,201,000	384,000
Cheraw and Darlington	40.0	40.0	400.000	200,000
Greenville and Columbia	143.0	143.0	1,429,008	1,145,000
Branches	21.0	21.0		
King's Mountain	23.0	23.0	200,000	..
Laurens	32.0	32.0	400,000	106.218
North-eastern	102.0	102.0	685,743	960,410
South Carolina	136.0	136.0	4,179,475	2,770,463
Branches	106.0	106.0		
Spartanburg and Union	67.0	25.0	1,000,000	..
Total South Carolina	1,064.0	805.0	12,418,106	5,978,934
Atlanta and West Point	87.0	87.0	1,250,000	250,000
Augusta and Savannah	53.0	53.0	733,700	298,500
Barnesville and Thomaston	16 0	16.0	..	..
Brunswick and Florida	67.0	24.0	151,887	..
Central of Georgia	191.0	191.0	3,750,000	106.267
Georgia and Bank	232 0	232.0	4,150,000	373,000
Macon and Western	102.0	102.0	1,438,800	23,000
Main Trunk (Atlantic and Gulf)	4 0	4.0	63,767	..
Milledgeville and Gordon	17.0	17.0	212,500	..
Milledgeville and Eatonton	22.0	22.0	275,000	..
Muscogee	50.0	50.0	669,950	249,000
Rome and Kingston				
Savannah, Albany, and Gulf	68.0	68.0	1,275,901	10,200
South-western	228.0	228.0	2,921,900	396,500
Western and Atlantic	138.0	138 0	5,901,497	..
Total Georgia	1,275.0	1,222.0	22,794,902	1,582,467
Florida	154.0	62.0	2,500,000	..
Florida and Alabama	45.0	32.0	191,485	195,000
Florida, Atlantic, and Gulf Central	60.0	32.0	205.781	204,600
Pensacola and Georgia	253.0	29.0	800,000	..
Tallahassee	22.0	22.0	425,000	..
Total Florida	534.0	177.0	4,122,266	399,600
Alabama and Florida	135.0	65.0	877,953	503,500
Alabama and Mississippi Rivers	88.0	30.0	355,010	109,500
Alabama and Tennessee Rivers	168.0	109.0	1,067.006	777,777
Marion	14.0	14.0	290,000	..
Mobile and Girard	222.0	57.0	1,500,000	..
Mobile and Ohio	518.0	362.0	3,481,791	4,717,497
Montgomery and West Point	116.0	116.0	1,419,769	922,622
North-east and South-west Alabama	209.0	..	650,000	..
Tennessee and Alabama Central	26.0	..	65,184	..
Total Alabama	1,496.0	753.0	9,646,723	7,030,896
Baton Rouge, Gros Tête, and Opelousas	17.0	17.0	225,000	..
Clinton and Port Hudson	22.0	22.0	750,666	..
Mexican Gulf	27.0	27 0	662,911	..
Milnesburg and Lake Pontchartrain	6.0	6.0	212,398	..
Carried forward	72.0	72.0	1,950,975	..

Corporate titles of companies.	Total length of roads.	Length roads completed.	Capital.	Funded Debt.
Brought forward	72.0	72.0	$1,950,975	$
New Orleans and Carrollton	13.0	13.0	497,220	..
New Orleans, Jackson, and Great Northern	258.0	80.0	1,002,959	2,121,000
New Orleans, Opelousas, and Great Western	411.0	206.0	4,437,990	2,817,000
Vicksburg, Shreveport, and Texas	189.0	21.0	882,922	58,744
Total Louisiana	943.0	392.0	8,672,066	4,996,744
Mississippi Central	236.0	236.0	2,000,961	2,554,732
Mississippi and Tennessee	99.0	71.0	798,285	456,949
Southern Mississippi	143.0	83.0	1,000,000	1,400,000
Grand Gulf and Port Gibson	8.0	8.0	200,000	..
Raymond	7.0	7.0	95,000	..
West Feliciana	26.0	26.0	620,000	..
Total Mississippi	519.0	431.0	4,714,246	4,411,681
Cairo and Fulton	78.0	12.0	50,493	327,000
Hannibal and St. Joseph	206.0	206.0	1,770,612	8,768,000
North Missouri	236.0	168.0	2,620,000	3,250,000
Pacific	311.0	182.0	3,330,657	8,203,000
South-western branch	283.0	19.0	66,974	1,400,000
St. Louis and Iron Mountain	8.6	8.6	1,999,300	3,276,000
Total Missouri	1,200.0	673.0	9,838,036	25,224,000
Breckenridge, coal	8.0	8.0	312,000	..
Covington and Lexington	80.0	80.0	1,582,169	2,930,000
Lexington and Big Sandy	133.0	20.0	694,024	sold for 26,000
Lexington and Danville	35.0	13.0	694,444	71,000
Lexington and Frankfort	29.0	29.0	514,409	130,000
Louisville and Frankfort	65.0	65.0	741,069	456,519
Louisville and Nashville Lebanon branch	269.0	185.0	2,151,430	2,300,000
Maysville and Lexington	90.0	19.0	575,000	..
Paducah and Mobile	26.0	26.0	800,000	..
Portland and Louisville	5.0	5.0	100,000	..
Total Kentucky	740.0	450.0	8,164,545	5,887,519
Central Northern	48.0	48.0	300,000	..
Cleveland and Chattanooga	30.0	30.0	867,210	..
Edgefield and Kentucky	47.0	30.0	333,204	612,000
East Tennessee and Georgia	30.0	30.0	1,289,673	2,020,000
East Tennessee and Virginia	148.0	130.0	536,654	1,902,000
Memphis and Charleston	311.0	300.0	3,809,949	2,659,000
Memphis and Ohio	306.0	300.0	570,000	1,361,000
Memphis, Clarksville, and Louisville	130.0	70.0	298,721	740,000
Mississippi Central, and Tennessee	50.0	60.8	317,447	632,500
Mississippi and Tennessee	100.0	59.0	798,285	554,949
McMinnville and Manchester	41.0	41.0	144,894	406,000
Nashville and Chattanooga	202.0	159.0	2,256,479	1,524,000
Tennessee and Alabama	62.0	46.0	595,922	860,000
Manchester and Alabama	38.0	30.0	216,962	413,000
Total Tennessee	1,543.0	1,346.0	12,335,390	13,684,449
Memphis and Little Rock (Arkansas)	146.0	38.0	351,524	446,000
Sacramento Valley (California)	22.0	22.0	785,950	729,000
Burlington and Missouri	286.0	75.0	752,733	665,000
Chicago, Iowa, and Nebraska	86.0	86.0	516,072	860,000
Dubuque and Pacific	319.0	50.0	838,086	965,000
Iowa Central air-line	438.0	..	245,000	755,000
Keokuk, Fort Desmoines, and Minnesota	140.0	38.0	921,449	570,000
Keokuk, Mount Pleasant, and Muscatine	68.0	11.0	548,216	414,000
Mississippi and Missouri	419.0	107.0	..	..
Total Iowa	1,756.0	367.0	3,821,556	4,229,000

Corporate titles of companies.	Total length of roads.	Length roads completed.	Capital.	Funded Debt.
Ashtabula and New Lisbon	84.8	..	$600,000	..
Bellefontaine and Indiana	118.2	118.2	1,859,813	$1,267,078
Carrollton Branch	11.5	11.5	225,000	..
Central Ohio	137.0	137.0	1,628,356	3,673,000
Cincinnati, Hamilton, and Dayton	60.3	60.3	2,155,800	1,411,000
Cincinnati and Indianapolis Junction	99.1	37.0	1,000,000	..
Cincinnati, Wilmington, and Zanesville	162.8	131.8	2,441,176	3,032,000
Cleveland, Columbus, and Cincinnati	135.4	135.4	4,746,100	38,000
Branches, &c.	5.8	5.8		
Cleveland and Mahoning	75.0	67.0	580,000	1,202,300
Cleveland, Painesville, and Ashtabula	95.4	95.4	3,000,000	1,667,000
Cleveland and Pittsburg	101.0	101.0		
Tuscarawas extension	32.0	32.0		
Hanover branch	1.5	1.5	3,942,368	4,918,325
Beaver extension	22.0	22.0		
Wheeling extension	47.0	47.0		
Cleveland and Toledo, N. div.	109.2	109.2	3,343,812	3,842,720
" " " S. div.	79.4	79.4		
Cleveland, Zanesville, and Cincinnati	114.0	61.4	369,673	575,250
Clinton Line	55.3	..	1,000,000	..
Clinton Line extension	94.6	..	1,983,000	..
Columbus, Piqua, and Indiana	103.0	72.0	750,000	1,600,000
Columbus and Xenia	54.6	54.6	1,490,000	290,700
Dayton and Cincinnati, tunnel	53.2	..	2,000,000	..
Dayton and Michigan	144.0	144.0	2,108,380	2,513,400
Dayton and Western	36.6	36.6	289,692	700,000
Dayton, Xenia, and Belpre	63.0	16.0	437,838	422,658
Eaton and Hamilton	45.0	45.0	469,762	728,853
Four Mile Valley	34.0	..	300,000	..
Fremont and Indiana	120.0	36.0	1,000,000	..
Greenville and Miami	32.0	32.0	300.000	473.000
Iron	47.0	13.0	118,865	50,000
Little Miami	83.4	83.4	2,981,293	1,399,000
Marietta and Cincinnati	173.8	173.8	1,399,000	7,405,917
Hillsboro' branch	21.6	21.6		
Ohio and Mississippi	192.3	192.3	6,584,681	9,880,000
Pittsburg, Columbus, and Cincinnati	117.0	117.0	1,906,736	2,400,000
Cadiz branch	8.0	8.0		
Pittsburg, Maysville, and Cincinnati	225.0	..	390,933	..
Sandusky, Dayton, and Cincinnati	153.9	153.9		
Old line	52.0	52.0	2,697,090	2,134,000
Findlay Branch	16.0	16.0		
Sandusky, Mansfield, and Newark	116.0	116.0	828,583	1,402,572
Huron branch	9.0	9.0		
Scioto and Hocking Valleys	130.0	55.5	403,975	500.000
Springfield and Columbus	43.0	19.5	193,000	150,000
Springfield, Mount Vernon, and Pittsburg	112.0	49.0	1,000,000	1,050,000
Tiffin and Fort Wayne	102.7	..	150,000	..
Toledo, Wabash, and Western	243.0	243.0	3,573,000	7,650,000
Total Ohio	4,282.0	3,060.0	62,326,631	61,376,763
Detroit and Milwaukee	188.0	188.0	2,950.009	4,250,000
Detroit, Monroe, and Toledo	51.0	51.0	1,202,821	..
Grand Rapids and Indiana	183.0	..	..	..
Iron Mountain, N. Michigan	25.0	25.0	600,000	..
Michigan Southern and Northern Indiana	246.0	246.0		
Constantine branch	4.0	4.0		
Old Goshen branch	10.0	10.0		
Michigan City branch	14.0	14 0		
St. Joseph Valley railroad	8.0	8.0	8,975,400	9,343,000
Jackson branch	42.0	42.0		
Goshen air-line	120.0	120.0		
Toledo section	3.0	3.0		
Ohio section of D. M. and T. Railroad	7.0	7.0		
Erie and Kalamazoo	30.0	30.0		
Carried forward	931.0	748.0	13,728,230	13,593,000

Corporate titles of companies.	Total length of roads.	Length roads completed.	Capital.	Funded debt.
Brought forward	931.0	748.0	$13,728,230	$13,593,000
Michigan Central	284.0	284.0	6,057,844	8,284,063
Port Huron and Milwaukee	89.8	..	500,000	..
Flint and Pere Marquette	173.0	..	..	..
Total Michigan	1,477.8	1,032.0	20,286,061	21,877,063
Chicago and Cincinnati	104.0	..	..	..
Cincinnati and Chicago	108.0	108.0	1,196,679	1,006,125
Cincinnati, Peru, and Chicago	102.0	29.0	1,000,000	..
Evansville and Crawfordsville	109.0	109.0	986,061	1,219,100
Evansville, Indianapolis, and Cleveland	155.0	..	835,000	..
Indiana Central	72 4	72.4	611,050	1,166,000
Indiana and Illinois Central	70.0	..	..	..
Indianapolis and Cincinnati	89.8	89.8	1,689,900	1,362,284
Cincinnati extension	20.2	20.2		
Indianapolis, Pittsburg, and Cleveland	84.0	84.0	835,971	1,025,700
Jeffersonville	78.0	78.0	1,014,252	681,000
Knightstown and Shelbyville	27.0	27.0	188,000	..
Lafayette and Indianapolis	64.0	64.0	1,000,000	600,000
Madison and Indianapolis	86.0	86.0		
Martinsville branch	26.0	26.0	1,647,700	1,336,816
Shelbyville branch	23.0	23.0		
New Albany and Salem	288.0	288.0	2,800,000	3,000,000
Peru and Indianapolis	74.0	74.0	1,100,000	820,000
Rushville and Shelbyville	20.0	20.0	120,000	..
Shelbyville Lateral	16.0	16.0	160,000	..
Terre Haute and Richmond	73.0	73.0	1,381,450	230,000
Union Track, Indianapolis	3.5	3.5	265,033	..
Total Indiana	1,692.9	1,290.9	16,831,096	12,447,025
Chicago, Alton, and St. Louis	220.0	220.0	3,500,000	4,500,000
Chicago, Burlington, and Quincy	138.0	138.0	4,631,540	3,158,000
Chicago and Milwaukee	45.0	45.0	988,000	762,865
Chicago and Rock Island	181.8	181.8	5,603,000	1,397,000
Chicago, St. Paul, and Fond du Lac	196.0	196.0	2,000,000	7,369,000
Fox River Valley	33.2	33.2	1,000,000	580,000
Galena and Chicago Union	121.0	121.0		
Fulton and Iowa line	105.5	105.5		
Beloit branch	21.0	21.0	6,026,400	3,783,015
Elgin branch	1.5	1.5		
St. Charles branch	10.5	10.5		
Great Western	178.0	175.6	1,600,000	3,088,426
Illinois Central	308.0	308.0		
Chicago branch	250.0	250.0	10,249,210	20,000,000
Galena branch	146.0	146.0		
Illinois Coal	4.0	4.0	100,000	..
Illinois and Indiana Central	74.5	..	..	..
Illinois River	81.5	..	..	..
Joliet and Chicago	35.0	35.0	750,000	..
Joliet and Northern Indiana	45.0	45.0	1,300,000	..
Mound City	3.0	3.0	60,000	..
Ohio and Mississippi	148.0	148.0	1,780,295	3,292,402
Peoria and Bureau Valley	46.0	46.0	..	600,000
Peoria and Hannibal	129.0	..	200,000	..
Peoria and Oquawka	94.0	94.0	1,560,889	2,200,000
Eastern extension	92.0	92.0		
Quincy and Chicago	100.0	100.0	800,000	1,200,000
Quincy and Eastern	43.0	43.0	..	..
Rock Island Bridge	1.0	1.0	200,000	..
Terre Haute, Alton, and St. Louis	168.5	168.5		
St. Louis branch	25.0	25.0	3,026,903	5,035,615
Belleville division	14.8	14.8		
Tonica and Petersburg	120.0	..	500,000	..
Total Illinois	3,177.4	2,772.4	45,885,237	56,966,324

Corporate titles of companies.	Total length of roads.	Length roads completed.	Capital.	Funded debt.
Alleghany Valley	181.0	45.0	$1,660,000	$400,000
Beaver Meadow	20.0	20.0	1,410,900	2,000
Catawissa, Williamsport, and Erie	63.0	63.0	1,700,000	2,271,536
Cumberland Valley	52.0	52.0	981,900	245,500
Delaware, Lackawanna, and Western	193.0	193.0	3,360,872	6,070,125
East Pennsylvania	36.0	36.0	386,121	365,500
Erie and North-east	22.0	22.0	600,000	400,000
Harrisburg and Lancaster	55.0	55.0	1,087,100	661,000
Hempfield	32.0	32.0	1,809,563	..
Huntingdon and Broad Top	46.0	42.0	425,015	1,000,000
Lackawanna and Bloomsburg	69.0	69.0	710,000	1,000,000
Lehigh Valley	45.0	45.0	1,966,350	1,500,000
Little Schuylkill	46.0	28.0	2,256,100	942,500
Lehigh Coal and Navigation	24.0	20.0	2,479,900	3,619,304
Mine Hill and Schuylkill Haven	145.0	72.0	2,800,000	..
North Pennsylvania	75.0	66 0	3,155,820	2,787,000
Pennsylvania	386.0	386.0	13,249,125	16,932,517
Philadelphia and Baltimore Central	79.0	12.0	..	250,000
Philadelphia, Germantown, and Norristown	24.0	24.0	1,208,500	374,800
Philadelphia and Reading	151.0	151.0	11,737,041	12,195,950
Philadelphia and Trenton	28.0	28.0	1,000,000	..
Philadelphia, Wilmington, and Baltimore	104.0	98.0	5,600,000	2,498,435
Pittsburg and Connellsville	147.0	60.0	1,753,864	1,500,000
Pittsburg, Fort Wayne, and Chicago	467.0	467.0	6,266,278	8,895,457
Pittsburg and Steubenville	31.0	31.0	1,221,277	280,000
Schuylkill and Susquehanna	54.0	54.0	1,258,700	97,000
Schuylkill Valley	39.0	24.0	568,150	..
Shamokin Valley and Pottsville	33.0	28.0	500,000	821,447
Sunbury and Erie	148.0	148.0	4,506,920	4,369,070
Tioga	29.0	29 0	97,550	396,000
Westchester and Philadelphia	26.0	26.0	682,170	944,169
Williamsport and Elmira	78.0	78.0	1,500,000	2,361,973
Total Pennsylvania	2,928.0	2,044.0	57,939,216	73,181,283
Kenosha and Rockford	176.0	55.0	800,000	700,000
Lacrosse and Milwaukee	199.0	199.0	10,872,000	10,414,066
Milwaukee and Chicago	40.0	40.0	1,000,000	600,000
Milwaukee and Horicon	42.0	42.0	1,101,200	..
Milwaukee and Mississippi	260.0	234.0	3,696,693	4,047,000
Milwaukee, Watertown, and Baraboo	130.0	130.0	345,861	132,000
Racine and Mississippi	142.0	136.0	2,705,720	1,417,000
Wisconsin Central	65.0	10.0	600,000	..
Total Wisconsin	1,054.0	846.0	21,121,474	17,310,066
Buffalo Bayou	190.0	32.0	..	..
Galveston, Houston, and Henderson	240.0	56.0	..	..
Houston and Brazoria	125.0	50.0	275,000	240,000
Houston and Texas Central	125.0	70.0	455,000	975,000
San Antonio and Mexican Gulf	135.0	25.0	..	..
Southern Pacific	784.0	28.0	..	..
Total Texas	1,824.0	251.0	730,000	1,215,000
Minnesota and Pacific	620.0	..	..	600,000
Southern Minnesota	175.0	..	..	575,000
Minneapolis and Cedar Rapids	112.0	..	..	600,000
Minnesota Transit	200.0	..	..	500,000
Root River Valley	60.0	..	..	..
Total Minnesota	1,167.0	..	..	2,750,000

There is, in addition to the roads here mentioned, a considerable length, probably 2,000 miles in all, employed in mining districts, and not used for general traffic. The grand result is over 28,000 miles of road, which have cost, in capital and funded debt, $1,066,866,284, which has been expended in the period since the first road was begun.

RECAPITULATION BY STATES.

Corporate titles of companies.	Total length of roads.	Length roads completed.	Capital.	Funded Debt.
Maine	631.4	554.9	$8,457,980	$9,458,495
New Hampshire	594.8	560.5	13,006,532	4,078,475
Vermont	557.5	537.9	12,182,246	9,291,201
Rhode Island	86.9	63.6	1,949,229	416,437
Connecticut	729.5	654.4	15,095,126	8,331,298
Massachusetts	1,474.8	1,384.2	49,462,563	13,687,565
New York	3,520.4	2,786.3	70,674,768	74,811,371
New Jersey	645.6	553.6	15,982,785	14,348,000
Pennsylvania	2,928.0	2,044.0	57,939,216	73,181,283
Delaware	105 0	105.0	1,198,998	931,500
Maryland	694.0	694.0	17,383,800	19,460,633
Virginia	1,540.0	1,371.0	22,249,604	18,559,316
North Carolina	803.0	760.0	9,436,322	2,377,255
South Carolina	1,064.0	805.0	12,418,106	5,978,934
Georgia	1,275.0	1,222.0	22,794,902	1,582,467
Florida	534.0	177.0	4,122,262	399,600
Alabama	1,496.0	753.0	9,646,723	7,030,896
Louisiana	943.0	392.0	8,672,066	4,996,744
Mississippi	519.0	431.0	4,714,246	4,411,681
Missouri	1,200.0	673.0	9,838,036	25,224,000
Kentucky	740.0	450.0	8,164,545	5,887,519
Tennessee	1,543.0	1,356.0	12,335.400	13,684,449
Arkansas	146.0	38.0	351,524	446,000
California	22.0	22.0	785,950	729,000
Iowa	1,756.0	367.0	3,821,556	4,229,000
Wisconsin	1,054.0	846.0	21,121,474	17,310,066
Minnesota	1,167.0	..	..	2,275,000
Texas	1,824.0	251.0	730,000	1,215,000
Illinois	3,177.4	2,772.4	45,885,237	56,966,324
Indiana	1,692.9	1,290.9	16,831,096	12,447,025
Michigan	1,477.8	1,032.0	20,286,061	21,877,063
Ohio	4,282.2	3,060.1	62,326,631	61,376,763
Total	40,224.1	28,007.8	$569,865,924	$497,000,360

The expenditure of such an enormous sum of money, amounting to $54 per head for the average population during the 30 years in which they have been building, is marvellous in so young a country, which, 40 years before this outlay occurred, was mostly destitute of capital. The railroads, however, exist, and capital is now, at this moment, more abundant for general purposes than it was before the construction of the railroads. It is, in fact, cheaper in the general market, and in this we recognize the vast utility of the works in developing capital. The operation has been to bring the production of millions of acres into general circulation, more than supplying the absorption that the railroad building occasioned. It is to be considered that a considerable amount, probably $300,000,000, has been borrowed in Europe. For the, in round numbers, 26,000 miles of road built since 1840, there would have been required very nearly 2,600,000 tons of railroad iron, which, at an average price, was worth $104,000,000. There was imported in the same time, 1840 to 1849 inclusive, 1,714,343 tons, at a cost of $69,799,797, mostly purchased in exchange for bonds. In the six years ending with 1857 there were opened 14,335 miles of railroad, which required 1,304,485 tons. In the same period there were imported 1,289,787 tons. Thus the quantity of domestic required was 14,698 tons in addition to the renewal of old rail. A good deal of iron was bought at very high prices proportioned to the estimated values of the bonds. That some of those bonds have not been paid is true, and also that iron was very bad. The iron has been, therefore, a positive advance to the capital of the country, to be paid out of the products of the earth newly opened to market by its means. In illustration of the value conferred by the means of transportation, we may take the Philadelphia coal fields; these were discovered as fuel in 1820. The quantity that has since been delivered is seen in the following table:—

		Tons.
1820 to 1840	21 years	6,847,179
1840 to 1850	10 "	22,034,961
1850 to 1860	9 "	55,742,000
Total tons coal		84,624,140

This, at an average value of $5, gives $423-120,760. If this coal is assumed to have been transported 100 miles average at the cost of transportation on common roads, the expense would have swallowed up the whole value, but there have been built, running into the anthracite region, the following works:—

	Miles.	Cost.
11 canals	815	$40,556,775
40 railroads	1,564	86,773,269
Total		$127,330,044

Under the supposition that the coal transported pays the interest on this cost, which would be $8,690,000 per annum, then the 7,626,000 tons brought to market last year, at a value of $38,000,000, paid $1.12 per ton, or 22 per cent., thus bestowing a clear value of $29,000,000 per annum upon those fields. The Cumberland coal fields also deliver over the Baltimore and Ohio road 617,010 tons per annum. The annual sale of coal from those regions of Pennsylvania is, including the quantities used locally, $40,000,000. This sum is added to the floating capital of the country as a consequence of the $127,330,044 absorbed in constructing the roads. In other words, the cost of construction is repaid in three years nearly, and a perpetually increasing fund flows down for the promotion of trade, since coal is as much a purchasing power for goods as is gold. What those roads have done for coal have the southern roads done for cotton. Formerly the water-courses were the only means of transportation; and when they were dry or shallow cotton accumulated at the landings until the next flood. The iron arms now stretch out in all directions, and not only is all the cotton grown added to the marketable value, but new lands are brought into action. The effect of railroads upon cotton is seen in the following table, which shows the miles of railroad open in 10 cotton states, and the quantity of cotton produced:—

	Miles of road.	Cotton crop. Bales.		Miles of road.	Cotton crop. Bales.
1841	662	1,634,945	1851	1,560	2,355,257
1842	791	1,683,574	1852	2,010	3,015,029
1843	848	2,378,875	1853	2,515	3,262,882
1844	932	2,030,401	1854	3,040	2,930,027
1845	1,109	2,394,503	1855	3,362	2,847,339
1846	1,169	2,100,537	1856	3,809	3,527,845
1847	1,303	1,778,651	1857	4,165	2,939,519
1848	1,319	2,347,634	1858	4,751	3,113,962
1849	1,415	2,728,596	1859	5,552	3,851,481
1850	1,415	2,096,706	1860	5,914	4,675,770
Total		21,174,422			32,519,111

The value of the 5,914 miles of roads built is not far from $150,000,000, but the value of the cotton produced and brought to market has been in the 20 years $2,900,-000,000. The increase in the value during the last 10 years over the former decade has been $800,000,000. That vast sum has poured out upon the markets of the world as a purchasing power, stimulating industry at home and abroad to produce the equivalents to give in exchange, and which have been consumed by the southern cotton producers.

In the western country the results are still more marked, since a country which was a wilderness has, under the influence of railroads opening the way, become the source of immense wealth. This influence upon the grain business of Chicago is seen in the following table, which shows the number of miles in operation in Illinois and Wisconsin, in each year, and the bushels of grain received in Chicago for corresponding years:—

	Miles of railroad. Illinois.	Wisconsin.	Grain receipts. Bushels.
1841	22	..	40,000
1852	148	20	5,873,141
1853	296	50	6,412,181
1854	1,200	200	12,932,320
1855	1,884	240	16,633,700
1856	2,241	285	21,583,221
1857	2,571	559	18,032,678
1858	2,678	793	20,035,166
1859	2,774	838	21,736,147
1860	2,811	951	40,000,000

The cost of the Illinois and Wisconsin railroads has been $141,283,691, most of it furnished by the eastern states and by Europe. In the same period there have been sold by the federal government, in Illinois, 15,000,000 acres of land, and the canals and railroads have sold 3,000,000 acres. This land now sends forth, it appears, over these railroads, 40,000,000 bushels of grain, at a value of $60,064,575 per annum, as estimated by Col. Graham, of the United States Engineers, and Chicago sends back, in return, a value of $60,608,779. Two years and a half of such production gives the whole cost of the railroads, and a permanently increasing affluence of wealth from that region. The railroads of the other sections bordering the Lakes have not been less efficient.

As an illustration take Chicago as a great railroad centre:—

	Passengers.	Freight.	Mail and Mis.	Total.
Chicago and Milwaukee.....	$145,580 84	$46,363 40	$12,235 91	$204,186 15
Racine and Mississippi......	41,151 80	114,077 85	..	155,229 65
Lacrosse and Milwaukee....	205,745 19	269,941 10	16,767 45	492,453 74
Chicago and St. Paul.......	102,876 26	194,608 50	12,824 92	310,319 68
Milwaukee and Mississippi..	305,305 93	557,900 20	17,479 89	383,176 01
Galena and Chicago........	1,022,141 65	472,269 13	53,150 45	1,547,561 33
Mineral Point..............	14,015 77	37,487 05	1,552 52	53,055 35
Chicago and Iowa..........	15,379 29	32,817 86	2,555 08	50,853 24
Chicago and Burlington.....	533,034 75	103,421 97	34,252 92	1,600,709 63
Dubuque.................	30,900 17	29,468 83	1,200 00	61,578 00
Burlington and Missouri.....	46,377 58	42,869 46	1,975 06	91,222 10
Chicago and Rock Island....	449,526 02	439,152 32	43,101 66	981,789 00
Mississippi and Missouri....	90,280 02	124,162 51	3,400 00	717,842 53
Chicago, Alton and St. Louis	417,800 26	424,734 84	24,753 32	967,288 52
Illinois Central....	819,829 87	975,904 87	180,804 28	1,976,578 52
Pitts., Ft. Wayne, and Chicago	742,372 04	699,053 79	126,354 35	1,567,780 18
Michigan Southern...... ...	920,366 53	849,528 36	269,452 08	2,039,346 97
Michigan Central...........	1,013,062 24	931,753 98	71,370 63	2,016,186 85
Total..........				$15,297,156 85

This gives a value of $15,297,155 earned by roads running into Chicago from almost every point of the compass. A large portion of the earnings were derived from passengers who had been connected with railroad building and land speculation.

While all these rivers, canals, and roads have been busy bringing down produce from swelling numbers of settlers, the traffic of the great outlets has been equally as active. We are to bear in mind that in 1825, when the Erie canal opened, there was no transportation of produce from west to east of the mountains. Bearing that in mind, we shall inspect the following table with interest. It shows the tonnage and revenues of the five great outlets, for the year 1859, as follows:—

THROUGH TONNAGE.

Going	East.	West.	Total tonnage.
New York canals.............	2,121,672	817.459	8,781,684
New York Central............	234,241	113,833	834,379
New York and Erie...........	200,000	60.000	869,072
Pennsylvania railroad	129,767	103,839	1,170,240
Baltimore and Ohio railroad ..	135,127	66,470	897,496
Total..................	3,820,807	667,601	7,552,871

RECEIPTS.

	Freight.	Passengers.	Total receipts.
New York canals(tolls)..	$1,723,945	..	..
New York Central.......	8,357,148	$2,566,369	$6,200,848
New York and Erie......	8,108.248	1,154,083	4,394,527
Pennsylvania railroad....	8,419,491	1,412,603	5,362,355
Baltimore and Ohio......	2,928,411	690,207	3,618,618
Total............	$14,517,246	$5,823,262	$19,571,848

Thus these five routes collected in 1859 $14,517,246 in tolls and freights, and $5,823,262 from passenger traffic. This has been the sum of the progress in transportation across the mountains east and west. The vast lines of railroads now in operation are probably more than the present wants of all parts of the country may require, but the glance we have made at the past shows that the country will very soon outgrow this supply of rails, and call for a completion of those projected.

This immense length of continued rail now enables an individual to travel from one extremity of the Union to the other without fatigue; not only are the distances shortened, but every appliance for comfort makes the journey, even to invalids, commodious. For this purpose there have been recently introduced on the long lines, sleeping-cars, wherein the passenger takes his natural rest while the iron horse is whirling him toward his destination at the rate of 30 miles an hour. This is an improvement upon the invention introduced by Captain Bunker, as we have seen on the Hudson river sloops in the early part of the century, whereby gentlemen and ladies could be accommodated with beds. They were probably more necessary in that day, however, when it might have been necessary to while away the time in their berths. The rail cars do not go the less rapidly that the passengers are well accommodated. There have been many instances not only of berths provided but of births taking place in the cars. Such an event happened on the Long Island cars, which were going at the speed of 40 miles per hour, and a grave difficulty sprang up as to where the young gentleman was born, a problem not easily solved, when towns passed at the rate of a mile in 90 seconds.

We have seen that the passenger of the present day does not occupy much time in performing long distances, and that these passages are by no means costly as compared with the inconvenient mode of locomotion in the olden time. Twenty years since it was recorded as a marvel that a gentleman made the distance from Chicago to Albany in 154 hours, or 6 days and 10 hours, and 24 days from New Orleans to Baltimore was recorded as matter of wonder. Now, 89 hours from New York to New Orleans is an easy passage, and Cincinnati is reached in 36 hours. A passenger is booked through from Bangor to New Orleans in less time than was employed to go from Boston to New York. From New York, as the great centre, lines radiate in all directions, bringing the most distant cities within a more convenient distance than was Philadelphia in the past century.

It is instructive to look back at the changes the means of locomotion have wrought in the views of passengers. At the close of the last century enterprising contractors advertised as follows:—

"PHILADELPHIA STAGE-WAGGON and NEW YORK STAGE-BOAT, *performs* their *Stages* twice a *Week*. John Butler, with his waggon, sets out on Mondays from his House, at the Sign of the Death of the Fox, in Strawberry-ally, and drives the same day to Trenton Ferry, when Francis Holman meets him, and proceeds on Tuesday to Brunswick, and the passengers and goods being shifted into the waggon of Isaac Fitzrandolph's the same day, where Ruben Fitzrandolph, with a boat well suited, will receive them, and take them to New York that night. John Butler returning to Philadelphia on Tuesday with the passengers and goods delivered to him by Francis Holman, will again set out for Trenton Ferry on Thursday, and Francis Holman, &c., will carry his passengers and goods, with the same expedition as above to New York."

By this remarkably ingenious plan and diction of John Butler, everybody got to his journey's end in the course of time; "with the same expedition as above," that is, it appears, from Monday morning to Tuesday night, if Ruben Fitzrandolph's boat did not get aground or becalmed, or weather-bound, or driven off, in either of which cases the time of arrival was dubious. But honest John "with his waggon," was soon "cut out." Those "Yankees," immortalized by Knickerbocker, came down from the north and innovated even upon so admirable an arrangement as was here devised in the tap-room of the "Death of the Fox," Strawberry-ally, under the administration of Jefferson. Ruben's boat with its vicissitudes was abandoned, notwithstanding the attractions of the "Kill van Kull" passage, and a land route through adopted. The attractions of this route were set forth as follows:—

"FOR PHILADELPHIA AND BALTIMORE—SWIFTSURE MAIL STAGE.—A new line has removed from No 2 Courtlandt street to No. 116 Broadway, and is now running between New York and Philadelphia, through a beautiful country, and on the short and pleasant road through Newark, Springfield, Scotch Plains, Bound Brook, Somerset, Arnwell, Coryell's Ferry, Cross Road, Crooket Billet, and Jenkintown to Philadelphia.

"To start from New York every day at 10 o'clock, A. M. (Sundays excepted,) lodge at Somerset, and arrive at Philadelphia next day afternoon. The Swiftsure is the only opposition stage from this city to Philadelphia and Baltimore."

There does not appear to have been much time saved by this new plan, any further than that the vicissitudes of the boats were exchanged for those of muddy roads. Spring coaches had, however, supplanted honest John Butler's wagon, since travellers had become more dainty. A few years more brought steam into competition for the use of travellers, and the number multiplied to such an extent, that, on the occasion of the great semi-centennial jubilee anniversary of the National Independence, held July 4, 1825, it was recorded in *The Philadelphia Gazette*, that 300 New Yorkers were said to have been in Philadelphia. There were passengers enough to fill 35 *coaches!* Great doings, that, in the travelling way! What would Francis Holman have done with the crowd between Brunswick and Trenton? Travelling had clearly outgrown his arrangements. Well, 35 years more passed on, and railroad connections being constructed, the papers of the day contained a new advertisement of a trip to Philadelphia. It was no longer "John Butler with his waggon," but that "John Brougham with his company" would perform as usual in the evening at the New York theatre, then proceed by the cars to Philadelphia and perform at the theatre there in the same evening, and return to New York to sleep. Thus two performances were had in two cities 90 miles distant, and the passage made both ways in the same evening by rail! The ordinary passage is some 4 hours, and the expense $3.00. The fare is reduced to $2.25, if the passenger does not care about an hour or so of time.

The influence of these great improvements in travel has been in an eminent degree to consolidate population in cities, and these grow the more readily that the distance within which perishable food can be brought to market is so much increased by rapidity of travel. The elements of growth of a city are supplies of food, fuel, and water. Unless these are abundant and cheap, the disadvantages thence arising will counterbalance the geographical and commercial advantages of a city. To supply food the circle of country about the city which supplies market-gardens, dairies, etc., must be fertile and accessible. The width of this ring, or, in other words, the area thus devoted, is determined by the speed with which the produce can be transported. The distance of its extreme limits must not be greater than will permit the products to reach the centre in time for use; any improvement that enables a larger space to be gone over in the same time increases the area of dwellings and market-lands. The area thus commanded increases as the square of the distances. Thus, if the speed is doubled, the area is four times as large, if it is tripled, the area adapted to city supplies is *nine* times as great, consequently there will be nine times as much milk, butter, vegetables, food, and produce as before. Steamboats opened a market in New York for large quantities of early southern fruits and vegetables that compete with those coming by rail from a country before secluded. If the city is thus benefited, so are the distant farms, the value of which, as compared with those near, becomes equalized. If wheat is worth $1.00 in the city, and it cost 25 cents to get it there from a certain farming district, the producer will get 75 cents only. If the cost of transportation be reduced to 10 cents, then there is 15 cents to be divided between the city consumer and the producer. The comparative influence of a railroad in effecting this result over a common road is great.

Another very important development of railroads has been for city service. It is now nearly 30 years since, the city of New York having spread over a greater surface of ground than it was convenient to walk over, lines of omnibuses were started to run on the great thoroughfares, to carry passengers. The price was, at first, 12½ cents for a ride any distance on the line. This was gradually reduced to 6 cents. About the year 1852, however, the plan of horse railroads was proposed, and one was laid down the Sixth Avenue, to the lower part of the city. This was at once eminently successful. The advantages accruing to the general benefit from the development of this system may be briefly enumerated as follows:—The quickest, cheapest, and most agreeable facilities of travel to all parts of the city; the surprising increase of the value of property upon the outskirts, now easy of access at all hours of the day and evening; the spreading of the laboring population to the suburbs, and the consequent rapid extension of the city; the opening of new branches of occupation by the necessity created for conductors and drivers, and the building of cars; and, lastly, the creation of an extensive and profitable investment for capital, the stock of some of these lines of railway being eagerly sought as safe and lucrative. It resulted, that others were put into operation. The plan was soon adopted in Boston, and in Philadelphia, which is, from its broad and rectangular streets, well adapted to railroad travel. From there the system has spread to Baltimore, Pittsburg, Cincinnati, St. Louis, New Orleans, and other cities. The extent of the roads is as follows:—

	No.	Miles.	Cost.
Boston	5	30.4	$968,943
New York and Brooklyn.	7	56.8	5,212,586
Philadelphia	18	154 8	8,550,000
Total	30	242.0	14,731,529

The amount of traffic on these roads is immense. In New York, the number of passengers carried in a year more than equals the whole population of the United States. Thus while the railroads favor the settlement of cities, by concentrating in them a large manufacturing and commercial population, which can draw cheap food from every section of the Union, they at the same time circulate that city population cheaply and speedily, enabling them to occupy a larger space of ground, and at the same time concentrate the manufacturing operations in a manner to facilitate the greatest production of commodities that are reciprocally required by the producers of food. In no country have railroads been availed of to the extent which the United States exhibit. Under the free action of the national energy, the roads have multiplied in a marvellous manner, but it is to be remembered that this has had an immense tract of rare and fertile soil to respond to the operations of the roads, and the country has been taken up, step by step, by an immense immigration. Such a state of affairs cannot exist in Europe. There are no new lands and crowds of immigrants, the resources of which need only the railroad to be developed. There the money put into railroads is a positive investment, here it calls into activity a sum larger than its own amount. The gross income of 257 roads in the United States, for 1859, was $111,203,245 freights and passengers, or $4 per head for each soul in the Union. This was for goods transported and for travelling. The roads of the United States, as compared with Europe and Great Britain, will be seen in the following tables of the number of miles in operation throughout the globe at the commencement of the year 1857:—

United States	28,500	miles.
Canada and British Provinces	1,465	"
Cuba	391	"
Jamaica	10	"
New Granada	49	"
Brazil	53	"
Peru	22	"
Chili	80	"
England and Wales	6,426	"
Scotland	1,138	"
Ireland	1,012	"
Spain	263	"
France	3,712	"
Belgium	1,119	"
Holland	422	"
Denmark	188	"
Norway and Sweden	67	"
Russia and Poland	637	"
Prussia	2,309	"
Smaller German States	4,235	"
Austria and Hungary	1,697	"
Switzerland	167	"
Italy	812	"
Egypt	132	"
British India	311	"
Australia	39	"
Total of railways in the world in 1857	55,256	"

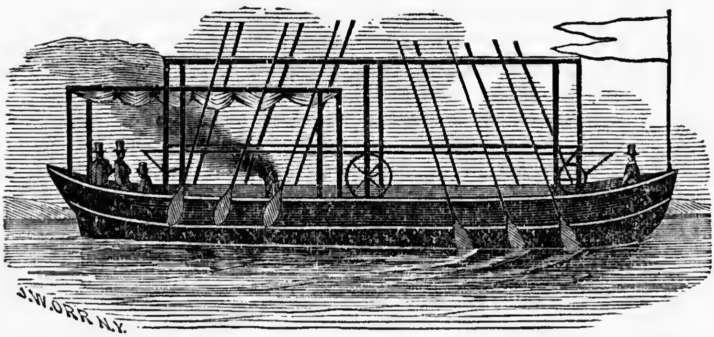
The comparative cost of the roads by another authority is as follows:—

	Miles.	Cost.	Cost per mile.
United States	28,037	$1,086,865,399	$38,800
Great Britain	8,297	1,487,916,420	179,000
France	4,038	616,118,995	152,000
Germany	3,213	228,000,000	71,000
Prussia	1,290	145,000,000	63,000
Belgium	1,095	98,500,000	90,000
British Provinces	826	41,600,000	50,000
Cuba	359	16,100,000	41,000
Panama	47	7,000,000	150,000
South America	60	4,500,000	75,000
Russia	422	42,000,000	100,000
Sweden	75	7.500,000	100,000
Italy	170	17,000,000	100,000
Spain	60	6,000,000	100,000
Africa	25	3,100,000	125,000
India	100	15,000,000	150,000
Total	48,114	$3,823,200,814	$79,000

Although the territories of the United States abutting on the Pacific coast and the north-west were the scene of Mr. Astor's enterprise early in the century, California, up to the Mexican war in 1846, was an unknown region. That war resulted in an acquisition of territory, that was no sooner annexed, than the inquisitive settlers discovered those gold treasures that set the world in a blaze, and made that region the centre of migration for many years. The route thither was by Cape Horn, on a voyage of many months, or across Central America, by a perilous journey. That was not to be suffered long by a people who had learned the art of railroad building, and the Panama railroad, 48 miles, was constructed at a cost of $8,000,000; $4,973,000 capital, and $2,427,000 debt. This road, connecting on the Atlantic side with New York by a steam-line, and on the Pacific side with San Francisco, by another, became at once the great route, and its revenue last year was $1,925,444. The facilities of trade thus afforded, caused a rapid multiplication of people on the north-west coast, the more so that new discoveries of gold were being made. Meantime the public mind was awakened to the necessity of an inland route by rail, not only to shorten the transport trade from India, but as a means of support, in case of war, and also as a bond of union. The undertaking was regarded with hesitation, even by those who had seen the active progress of great works among us. It was supposed impossible to build a road 2,000 miles to connect St. Louis with San Francisco, across the mountains, although the map shows a line between St. Louis and New York, and between New Orleans and Brazos. What is there more difficult in one than in the other? It is said the country is unsettled! What was the country between Detroit and New Orleans, through which there are now 1500 miles of road, 25 years since? The settlement of the country goes on at a railroad pace. The frontier line of the country is 1,600 miles. Along this the population advance west, at the rate of 1,000,000 souls per annum. The demand for a railroad in 1850 came from 20,000,000 people, without any answering reply from beyond the Rocky Mountains. The demand is now prolonged by 30,000,000, to whom 500,000 voices from the Pacific coast respond. Before the roads can be constructed, if now undertaken, 40,000,000 on the east of the mountains will be eager to communicate with 1,000,000 on the western slopes. These vast numbers will be pressing toward each other, so as to shorten the purely through route, increase the local traffic at both termini, and a terminus which shall be 500 miles south of one centre and 500 miles north of another, will not suffice. The mind at once becomes impressed with the necessity of having *three*. Let us revert thirty years, to the connection of the Atlantic with the Mississippi river. Suppose the necessity of a railroad connection had then been agitated to run 12 or 15 hundred miles to St. Louis; that one connection would have ill supplied the numerous routes that now cross the country between Canada and Charleston. A parallel case will soon present itself with the western slopes, and three routes will be found by no means too many, either to answer the purposes of communication or to accommodate the travel. The requisites of a road are *shortness* and *cheapness*. These are relative. The road which is shortest and cheapest to connect the Columbia river with the great northern interests, including those of Canada, which concentrate round Lake Superior, is not the shortest and cheapest mode of reaching New Orleans from San Diego; nor would a route between the two latter at all accommodate those northern interests. The Pacific railroad extended from St. Louis to San Francisco would be the shortest and cheapest for those central interests, but it could not advantageously do the business of the other sections.

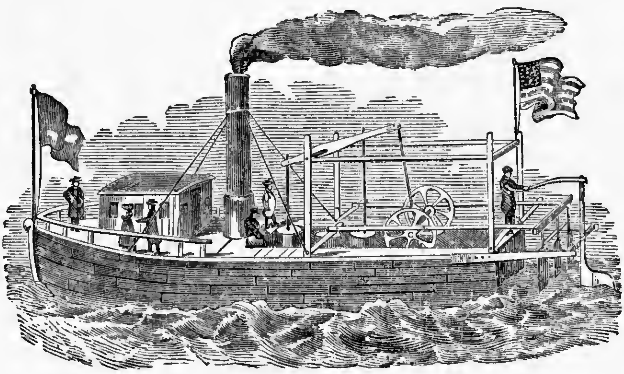
Each of these sections has large means that can be applied to the construction of a road that would serve their necessities, but which could not be enlisted in favor of one that would be of no direct benefit. If, therefore, the government should give authority for the construction of three roads, with a grant of six-mile sections along the route of each, and in addition aid each by a grant of $50,000,000 of 5 per cent. bonds, taking a first lien upon the road, the local interests of each section would complete the balance. Migration will follow these lines of communication settling the best lands, until those coming east will meet those proceeding west, and a continuous line of settlement will follow the rising sun from New York to San Francisco, and the entire Union be united with the waters of the Pacific, that bring the commerce of Asia on the east, and with those of the Atlantic, that float its commerce with Europe on the west.

The Pacific railroad, though long discussed, was not definitely located, nor the company incorporated, till July 1st, 1862, and acts amendatory of it were passed July 2d, 1864, March 3d, 1865, and July 3d, 1866. By this act, the right of way, to the extent of 200 feet in width on each side of the railroad, was granted to the company; and also every alternate section of public land, to the amount of five alternate sections per mile, except mineral lands; and also provided for issuing thirty-year government bonds, to the amount of $16,000 per mile, for every section of forty miles completed, to the company, such bonds constituting a first mortgage on the road. Under this act and its amendments, the road was commenced from both termini, and has been vigorously prosecuted. On the 1st of January, 1867, there were completed about 305 miles of the eastern division, extending to within 200 miles of Denver, Colorado; and it was progressing at the rate of from one to two miles per day. Of the western division, 156 miles east from Sacramento, to the state line, was to be finished by July 1st, 1867, and to Salt Lake, 675 miles from Sacramento, by 1869. It is expected to be completed in its whole extent by 1870. The completion of this road will bring the carrying trade between Europe and Eastern Asia through the United States, and will greatly facilitate the development of the vast mining interests of the Rocky Mountain and Pacific regions.



THE SECOND EXPERIMENTAL BOAT OF JOHN FITCH.

Finished in May, 1787, and run at the rate of four miles per hour on the Delaware. Cylinder twelve inches in diameter, stroke three feet.



THE FIRST STEAMBOAT EVER BUILT TO CARRY PASSENGERS.

Constructed by John Fitch, and finished April 16th, 1798. Cylinder eighteen inches in diameter, speed eight miles per hour in smooth water. The following year this boat was run to Burlington regularly as a passenger boat.

STEAM.

BY JOHN C. MERRIAM.

CHAPTER I.

INTRODUCTORY.

HISTORY OF STEAM ENGINE.

One hundred years ago, a harmless vapor arose with the morning sun, and floated o'er our heads, remarked by the artist, poet, or philosopher, but almost unheeded by the mechanic, and only regarded by the mariner as a prognosticator of the wind.

How is it to-day? From myriad towering columns, o'er which the fierce fire-king his sombre mantle flings, gushes, in mimic clouds, the quick breath of our new-born Titan. The ancient rocks echo to his shrill voice, and tremble as he rushes by. He troubles the waters, and rides on their crest defiant. O'er hill and dale, and lake and river, is his white flag unfurled, proclaiming peace to all nations. From the pine of the frozen north, to the palmetto of the sunny south, his twin track tunnels the mountain, belts the prairie, and spans the flood. Mightiest of kings is this son of fire! proudest of monarchs is this genius of the lamp and the fountain!

In an article like this, it is not necessary that we should dwell upon the genius of James Watt — abler pens have awarded him the fame he so richly deserves, and a proud monument in Westminster Abbey tells the passing stranger that it was

NOT TO PERPETUATE A NAME,
WHICH MUST ENDURE WHILE THE PEACEFUL ARTS FLOURISH;
BUT TO SHOW
THAT MANKIND HAVE LEARNED TO HONOR THOSE
WHO BEST DESERVE THEIR GRATITUDE,
THAT THE KING,
HIS MINISTERS, AND MANY OF THE NOBLES
AND COMMONERS OF THE REALM
RAISED THIS MONUMENT TO
JAMES WATT,
WHO, DIRECTING THE FORCE OF AN ORIGINAL GENIUS,
EARLY EXERCISED IN PHILOSOPHIC RESEARCH,
TO THE IMPROVEMENT OF
THE STEAM-ENGINE,
ENLARGED THE RESOURCES OF HIS COUNTRY,
INCREASED THE POWER OF MAN,
AND ROSE TO AN EMINENT PLACE
AMONG THE MOST ILLUSTRIOUS FOLLOWERS OF SCIENCE,
AND THE REAL BENEFACTORS OF THE WORLD.

What greater praise could be awarded to him than this? How could his unrivalled genius be more concisely expressed, or clearly acknowledged? and yet, at that time, they had but begun to see the stupendous results of his inventions. To realize the inventive mind of James Watt, it requires careful study, and thorough mechanical knowledge, even at this late day; and when we consider that with him all was comparatively novel, we pause in astonishment at a mind so fertile in mechanical devices.

England, ever true and grateful to her *own* genius, has fitly honored her greatest inventor, while America has suffered genius as great to die, unrewarded in life, and forgotten in the grave; but she has not neglected to profit by their inventions; and it is our purpose to show, in this article, how great have been the results.

The first steam engine of which we have any knowledge in America was at the Schuyler copper mine, Passaic, N. J. It was, more properly speaking, an atmospheric engine, and was imported from England in 1736, and put up by a Mr. Hornblower. The first engine that was constructed in America was built by Christopher Colles for a distillery in Philadelphia; the machine was, however, very defective. It was built in October, 1772, and was, like the other, an engine upon Newcomen's plan.

Thus it will be seen that it is less than a hundred years since America took her first lessons in a science that was destined to work such a revolution in the whole world; and her birth, as a nation, may be considered as cotemporary with that of the steam engine. In 1787, John Fitch, of Connecticut, built, in Philadelphia, the first condensing engine, and this without the aid of Watt's experiments—for it was only in the year 1786 that the latter patented, and made public, his most important improvements; and we have every reason to believe that Fitch was at first ignorant of them. With the assistance of common blacksmiths, he constructed a low-pressure engine, and, more than this, applied the motor to a steamboat. Then came the experiments and success of Robert Fulton, a man whom we have not forgotten to honor; the improvements of Stevens, to whom we owe our great success in river navigation, and the energy and perseverance of Oliver Evans, the first to apply the principles of the high-pressure, or non-condensing engine, to common use, and to demonstrate its advantages not only for the stationary engine, but also its adaptability to carriages on common roads; from which we may date the invention of the locomotive engine, for it was only the experience of Stephenson in tram-roads that led him, at a much later day, to the invention of the latter, and Watt's engines would never have become applicable thereto, on account of their great size.

In spite of the difficulties under which a young nation labored, from the want of an accumulated capital, we took a start from the first introduction of the locomotive engine, that has astonished the world; and have grown a race of civil engineers that, with a limited amount of money, have produced effects wonderful even to themselves. Well may Americans be proud of the results of their inventive genius. To the general reader these events have come to be a matter of course, and steam, with its thousands of detailed improvements, is looked upon as something wonderful, but inexplicable; the mass of people understanding little or nothing of its nature. We propose, then, to explain, as simply as possible, the cause of this great effect, and, dropping technicalities, to give the great public a concise idea of steam, and the steam engine, before proceeding to the results of its use.

When Watt constructed his first engines, he used them to replace horses in the mines, and, in order to give some idea of their value, he reckoned his engines as at so many horses' power; and the power of a horse was computed from the effect produced by a horse raising a weight to a certain height in a given time: this he computed as 33,000 lbs., raised, in one minute, to the height of one foot. The following description, from S. Holland, chief engineer of the English navy, concisely shows the manner of obtaining the horse-power of a steam engine:—

"Work is a term in mechanics of recent origin, but of great utility; it means a compound of force (or pressure) and motion. Work is said to be performed when a pressure is exerted upon a body, and the body is thereby moved through space. The unit of a pressure is one pound, the unit of space one foot, and work is measured by a 'foot-pound' as a unit. Thus, if a pressure of so many pounds be exerted through a space of so many feet, the number of pounds is multiplied into the number of feet, and the product is the number of foot-pounds of work; hence, if the stroke of a steam engine be seven feet, and the pressure on each square inch of the piston be 22 pounds, the work done at each single stroke, for each square inch of the piston, will be 7 multiplied by 22, equal to 154 foot-pounds. Power contains another element in addition to those contained in work. It implies the ability to do so much work *in a certain period of time;* and, in order to have a proper idea of it, a unit of measure is also employed. This unit is called a 'horse-power,' and is equal to 33,000 pounds raised through a space of one foot in one minute; it is the execution of 33,000 foot-pounds of work in one minute. To find the horse-power of a steam engine is to find the number of pounds pressure on the piston in square inches, and to multiply this by the number of feet travelled by the piston per minute, which gives the work; then this is divided by 33,000 pounds, and the quotient is the horse-power, which is usually abbreviated H. P. As the pressure is always indicated by the square inch, the number of square inches in the area of the piston has to be found. This is done by squaring the diameter of the piston, and multiplying this by the decimal, ·7854."

The horse-power of an engine is always calculated with the steam in the boiler at a moderate pressure, and, consequently, if the steam is kept at a higher pressure, it will be capable of more work, and the engine will be of a greater effectual horse-power than the one given. Hence the terms *real* and *nominal* horse-power. The term horse-power is, in reality, of itself nominal, as Watt, in order to have his engines give satisfaction, added some twenty-five per cent. to the real work of the best horses in Cornwall. Having thus given an explanation of this term concisely, that it may be remembered, we will endeavor to instruct the general reader as to some other terms not always understood, although constantly made use of in conversation.

Engines are divided into two kinds: low and high-pressure, or condensing and non-condensing. The low-pressure engine was, in the main, invented by James Watt; and its peculiarity consists in the fact that, while the steam is entering upon one side of the piston, the steam upon the other side is condensed, and forms a vacuum that adds to the power of the engine from twelve to fourteen pounds to the square inch. Thus, with steam at the pressure of twenty-five pounds only, we have an effective force of nearly forty. The low-pressure engine has the advantage of not carrying so much steam, and, consequently, is less dangerous. From the fact, however, that it is much more complicated and expensive, it is not often used on land, unless for large engines, and its size prevents its adaptation to locomotion.

The high-pressure engine was invented by Leopold and Trevithick, subsequent to the other. Oliver Evans, of Philadelphia, was the first to advocate its use, and, in fact, to practically apply it. Engines of this description discharge the steam, after using it, into the air, and have, consequently, the resistance of the atmosphere to contend with; they are, however, much cheaper, and with properly built boilers are not necessarily more dangerous. All our locomotives are upon this principle, and the draft of the furnaces is accelerated by the rush of the waste or exhaust steam, as it passes into the chimney. The pressure of steam used in our high-pressure engines, averages more than in any other country; from eighty to one hundred pounds per square inch being the common average. In order to prevent an amount of steam from accumulating to a higher pressure than this, the safety valve is placed upon the boiler, so constructed that, when the pressure rises above the point desired, it will open the valve, and allow the surplus to escape. Over-weighting this valve, or not taking proper care of it, and allowing it to rust into its seat, are fruitful sources of boiler explosions. No engineer should run an engine without trying his valve at least once a day.

It is important that the water in the boiler should always be at about the same height; not full, as in that case water is apt to pass over into the cylinders, and the engine is said to be flooded; nor too low, for the heat of the furnace would melt the flues, if they were not covered with water. Various automatic contrivances have been invented to keep the water at the true level; but their liability to get out of order has prevented their use, and engineers unite in the opinion that man's judgment alone is comparative security. To assist the competent engineer, there are several devices. The most common are the three gauge-cocks, placed, the one above the other, at some three inches apart—the centre one being the desired level; by trying these cocks, the exact height can be readily seen. Other water gauges have been in use, some of them since the earliest engines were constructed, upon the principle that a float upon the water will indicate, by means of a rod, its exact height. A glass tube, connected above and below the water line, is much used in our steamers.

In order to determine the steam pressure at any point below that at which it raises the safety valve, various steam gauges have been in use from time to time; the most common in steamboats is called the syphon gauge, and works upon the principle of balancing a column of mercury in a syphon tube. Within the last ten years the spring gauge has come into general use in locomotive and other engines; they occupy but little room, and, if occasionally tested, answer every purpose of the more cumbersome syphon. With the exception of the Bourdon (French) and Schaeffer (Prussian), all the spring gauges in use in the United States, some thirty in number, are American inventions, and both of the foreign gauges have been improved upon, and are made in a superior manner here.

The passage between the boiler and the cylinder was at first opened and closed by means of a cock; the slide valve, modifications of which are now universally used, was the invention of Murray, of Leeds, England, in 1810. The piston was at first packed with hemp, saturated with grease; the brass rings, now used, were invented by Murdock & Aiken, of Glasgow, in the year 1813. The paddle-wheel between two boats was first used by William Symington, in Scotland; but the side wheel, as now used, together with the screw propeller, were both made use of in the models by John Fitch. His first steamboat, however, was worked by oars, or paddles, after the same manner as an Indian uses them. The first boat that carried passengers, built by John Fitch in 1789, was propelled by a set of paddles at the stern. The North River, of Clermont—Fulton's first passenger boat—was driven by the present form of side wheel; she made a successful trip in the year 1807.

One of the greatest improvements of steamboats with regard to speed was made by Robert L. Stevens, who added the false bow to a boat constructed by him in 1815. She attained the speed of 15 miles per hour, a great improvement over the North River (which only made four miles per hour), but seeming very slow at the present date, as contrasted with the time made at a trial trip of the Daniel Drew, in 1860, which was 22 miles per hour against the tide.

It is quite curious to follow the various improvements that have been made upon the steam engine, and to see how the present simple apparatus was settled upon. It required years of experiment before the crank was adopted, notwithstanding that the same device had been in use in the common foot-lathe for several centuries. It was finally adopted by Picard; but, after his invention, Watt patented a much more complicated method of transmitting the reciprocating into the rotary motion. This was called the sun and planet motion, and went out of use only after repeated trials with the crank. It is true that the latter was patented; and the fact that Mr. Watt wished to avoid another patent, had much to do with this persistent trial of an inferior device. In the use of the locomotive engine, also, it was only after years of experiment that it was realized that the traction of the wheel upon the rail was sufficient to propel the carriage not only upon a level, but also up a very steep grade.

On the line of the Pennsylvania railroad, beyond the town of Altoona, the track has an ascending grade over the mountains of over 100 feet to the mile, yet a passenger train of six or seven cars, with the assistance of two locomotives, surmounts the grade at a speed of nearly thirty miles per hour, and this, too, upon a road that lies coiled upon the side of the mountain like a huge serpent. So short are its curves, that the locomotive is quite visible from the fourth car during many parts of the ascent. No other nation in the world can show so great a triumph of civil engineering as this. The first road that was constructed at this place was worked by stationary engines, and the cars were drawn up by ropes and chains. This was a copy of European engineering; but American genius is destined always to rise superior to imitation, and it is, in fact, only when it so rises, and trusts to its own gigantic plans, that the true power of American character shows itself. The stolid English engineer imitates the Egyptians and the Romans, and piles stone upon stone, and iron upon iron. The American imitates nature, with whose great works he is in constant communion, and, like the spider, constructs a bridge light in appearance, but sufficiently strong to withstand the tempest and the storm, and bear with an easy vibration, double, nay, triple, the load put upon it. Only an appreciation of the grandeur of such a fall as that of Niagara, could fit a man to construct the bridge that spans its river.

But to return to the improvements in the steam engine itself. When we look at the combination of them, as at present in use, we cannot but feel the wonderful genius therein displayed. It is but a few years since the steam engine, although vastly superior to horse power, was a cumbersome and expensive machine both to construct and repair; and although it is at present far from being perfect, yet the difference in its first cost, and the amount of fuel it uses for the same effect, is astonishing. Stand and look at some of our immense stationary engines, and see how noiselessly and steadily they turn the ponderous wheel! One would think a child's power could stop it. Then pass on, and on, through the groaning mill, and see the labor of thousands of men performed by this untiring giant. It is only after seeing the work he accomplishes, you can realize his strength. Stand upon the western prairie at night. The moon silvers a twin track that glistens far into the darkness; soon you hear a distant hum that grows upon the ear, and detect a faint spark that brightens as you gaze; anon the sound increases, and the eye of the iron horse overpowers the moon's pale gleam; he sees you, and screams his shrill warning. Who can help starting as he rushes by, or not feel as though steam itself were personified. Mark the groaning train, with its living freight, tearing madly through the darkness, bearing absent friends to the loved at home, or perhaps good news from the beloved afar.

Again, stand upon the Battery, at New York, and watch the almost countless fleet of steamships, steamboats, propellers, and tugs; some moving steadily toward the Narrows, as though conscious and proud of a power that can span the ocean in so short a time; others plashing and dashing madly about, or clinging to some gigantic ship, and tugging manfully at its side, when old Boreas has left it helpless; others, again, in holiday attire, bearing a happy throng over the glad waters, and tuning the voice of this giant slave into fitting melody for the joyous hour. Here comes the Sound steamer, a floating palace fitted up in almost regal elegance, drawing but little water, and yet a staunch sea-boat, large, and, to the foreign ship-builder, apparently top-heavy, yet fast as the racehorse, and frequently tried by the stoutest gales. Up and down both rivers ply the ever busy ferry-boats — movable bridges, ever crowded with passengers. Did Fulton's wildest dreams ever picture a scene like this? Did John Fitch ever imagine a triumph so wonderful? Yet it is all the work of steam; and to them we owe, in part, the bands by which we hold this half-tamed Titan. Not only are these steamers propelled by steam, but his aid is called in both to load and unload them, and, in the hour of danger, steam works at the pumps with untiring hands. Not alone in the large manufactory, the gallant steamer, and the rushing car, does the vapor of water show its strength and usefulness, but thickly strewn about our cities and villages, delving in the mines, driving the rattling press, it helps all trades, and multiplies the power of man a thousand fold. Cities have sprung up under its magic touch, and everywhere we see traces of the king of motors—steam.

And to whom are we indebted for all this improvement, this immense power? Mainly to the American inventor, and our patent laws. It is not too much to say that one-half of the patents issued at the United States Patent Office for the last twenty years related either directly to the steam engine, or to machines intended to be driven by it; nearly all of them patented by citizens of the United States. The use of steam expansively was an English invention, but it is doubtful whether it was profitably used until improved upon in America. American locomotives have borne off the palm wherever they have been brought into contact with those of other nations. In ocean steamers we may be second, but the reason is plain: foreign builders have the assistance of rich and powerful governments, while our own success is entirely due to private enterprise, with a limited amount of capital.

As for steamboats for rivers and lakes, to which our immense inland navigation has turned the attention of our mechanics, we are far ahead of our rivals. The Yangtsze and Peiho, built for the Chinese coast, have never been equalled by England, as is sufficiently plain from the following China overland trade report, written by one of their own countrymen:—

"Steamboat builders in England, and Scotland, too, are certainly the most adroit 'shavers' living. They turn out so many miserable botches, that really we think a very great majority of the community would, were they 'going into steam,' resort to the United States. As far as river navigation is concerned, our attempts to compete with Jonathan are simply absurd, as those who own English river steamers here at present, must, ere this, have discovered to their cost. But, even in sea-going steamers, 'if the proof of the pudding be in the eating,' we should wish to know where the British steamers are, which are as swift, as safe, as commodious, as serviceable, or as economical in expenditure of fuel, as the Yangtsze or the Peiho? We maintain that every boat sent out here from England or Scotland, on China account, whether for coast or the river, has either been a miserable failure, or a glutton for fuel. We do not make one exception. We do not like to mention names, as we are averse to depreciate people's property, but we confidently leave it to every unfortunate sufferer to say whether or not we are correct in our statement.

"We, of course, except the P. & O. Company, as they seem to have a secret plan of constructing boilers, which makes them last as long as the boat; that is, for an indefinite period. We declare one never hears of any thing occurring to one of the company's boilers, nor any of their boats being laid up to have a new one, or the old one mended.

"We will take, for instance, the Chevy Chase, which vessel, we believe, cost on the Clyde about three times the sum that the Yangtsze cost at New York. Now the Yangtsze has been running nearly three years hard upon the coast, making unprecedentedly swift passages, and never was docked until the other day. The Chevy Chase will not carry so much as the Yangtsze, nor has she as good accommodation; but she burns twice as much coal, and, in a race between this and Shanghai, would be sparingly backed. She is about as strong again and as heavy again as there is the slightest occasion for; and has clearly twice as much power as she can bear, for the weight of it sinks her. She is a very shallow craft, and her deck is so near the bottom, which contains an enormous mass of iron, that compasses will not act, and it becomes dangerous to run her in thick weather. She will bring grief to the hearth, but never grist to the mill; and the sooner she is altered the better. She should be made into a screw propeller, and a suitable vessel built for the valuable and powerful machinery now fitted in her. With a screw, and a spar deck fore and aft, she might be rendered serviceable yet. If the beams, etc., of the spar deck were constructed of wood, and the compasses put on an elevation, they would act well enough; they are at present neutralized by their proximity to a prodigious mass of iron.

"The American boilers, though not so durable as ours, are much better adapted to economy of fuel. Coal, in the United States, costs as many dollars as it does shillings in England. Economy of fuel is, therefore, more studied than with us, space being sacrificed. Our short tubular boilers send half the heat into the chimney, while the long flue boilers of the Americans absorb the heat pretty much in making steam. The difference is very great, and well worth the subject of an inquiry.

"Our engineers are such a pig-headed, self-satisfied, conceited set of people, that, until they see their trade gone, and their crotchets explode, they will not believe their own eyes. We are not venturing on opinions, so much as stating results; and too many here can corroborate the sad experience we unfold."

Having spoken thus, in general terms, of the steam engine, it may not be amiss to give a description of the simplest form thereof, by describing its component parts in terms easy to be understood and remembered. A steam engine consists, then, of a *cylinder*, closed at both ends, having fitted to it a piston, whose rod passes out at one end through a steam-tight hole called a *stuffing-box*. The piston consists of a skeleton, technically called a *spider*, having three brass rings made thin enough to yield to the inequalities of the cylinder as it wears, and forced against it by springs resting upon the spider, and held in place by a plate commonly called a *follower*. The steam is admitted to the cylinder on the side, at each end, through what are called the *ports;* the two ends of the ports are brought near each other at the point where they enter the *steam-chest*—a small box near the centre of the cylinder. These ports are alternately opened to the boiler and the atmosphere, by a sliding valve, that obtains its motion from what is called the eccentric, which is placed upon the main shaft. The piston-rod is fastened, at the external end, to a *cross-head*, which communicates its motion to the *crank-rod*, and through it to the main shaft. In stationary engines, working by a single cylinder, it is evident there will be two points at which the rod has no power over the crank; these points are called *dead centres*, and to overcome them the momentum of the balance-wheel is used. In the locomotive, two cylinders being used, they are set *quartering* (at right angles with each other), and the one overcomes the dead centre of the other. In the marine engine the motion of the wheel is continued by the action of the water, as the boat advances, and, consequently, no balance is required.

If, after a part of the steam has entered the cylinder, the induction valve be closed, the expansion of the steam would continue the stroke of the piston until the pressure became the same as that of the external air, or until the piston had reached the end of its stroke. Thus, if the pressure of the steam was eighty pounds per square inch in the boiler, and the valve was closed after the piston had made one quarter of its stroke, it is evident that the pressure would constantly decrease up to the end of that stroke, and that the average pressure would be less than the pressure in the boiler, but at the end of the stroke there would be but very little waste steam; in other words, the pressure remaining in the cylinder would not be in so great an excess over the atmospheric pressure as if the steam had followed the piston throughout its entire stroke. To show this more plainly, it must not be forgotten that steam at eighty pounds pressure is, in reality, steam at ninety-five pounds to the square inch, working against fifteen pounds (the atmospheric pressure), or a *difference of pressure* of eighty pounds; therefore, at the end of the stroke, the ninety-five pounds would have become twenty-three and three-quarters of pressure working against fifteen pounds atmospheric, or a difference of eight and three-quarters of pressure; so that, when the cylinder was opened by its exhaust to the air, there would be only eight and three-quarters of a pound to the square inch thrown out into the air, and thus wasted, while you have had an average of sixty-seven pounds to the square inch throughout the stroke of the piston, working against fifteen pounds of atmospheric, or an actual *difference of pressure* of fifty-two pounds. Had you used fifty-two pounds of indicated pressure, following the full stroke of the piston, it is evident you would have thrown into the air the contents of the cylinder at that pressure, instead of at eight and three-quarters, as by the *cut-off.* This is, in brief, the theory of the cut-off; but, like many other improvements, it has been carried to an extreme, and has thus become a positive evil. In order to realize this, notice carefully the following: If steam, at thirty pounds per inch, as indicated, be used in a cylinder, cutting off at one-quarter stroke, what will be the pressure at the end of the stroke? Thirty is, as before shown, forty-five against fifteen: at the end of the stroke it will then be eleven and one-quarter against fifteen, or a back pressure of three and three-quarter pounds. Many people, who have found fault with cut-offs, have overlooked this important point, and have judged all cut-offs by an engine that was thus working at a disadvantage.

In explaining the cut-off, we have not taken into consideration the condensation of the steam from its expansion; and this is, of itself, a very important item of loss, as is also its increased friction; so that the actual gain from the use of a cut-off is not as great as it would theoretically appear.

Having thus stated some of the most important parts of a steam engine, we will now speak of some of its accessories. In order to give a uniformity of speed to the machinery driven by a steam engine, no matter how much the work it has to do may vary, the governor was invented: it consists, in its simplest form, of two balls revolving around an upright shaft, and suspended from its top by rods; if revolved with great rapidity, these balls are carried by their centrifugal motion to the greatest circumference that their rods will allow them; if moved slowly, they will assume their smallest circumference, and, by these motions, close or open the throttle, or, in the improved engines, vary the cut-off: thus controlling the speed of the engine, and keeping it always at nearly the same velocity.

In order to keep the boiler filled with water to the requisite level, one or more pumps are placed in connection with it, of a capacity to supply it, if only working part of the time. These pumps should always be provided with a *pet-cock,* which, when opened, will show whether the pump is doing its duty, as the valves of any pump are liable to become clogged and useless. On the locomotive engine the casual observer will notice that the engineer frequently tries these cocks, which are placed upon the side of the engine, and, in fact, that he sometimes tries them to the detriment of dandified-looking individuals, who approach too close to the iron steed. The pet-cocks are not, however, as much used as they should be, and, in fact, are very frequently left out altogether in the construction of the stationary engine. The safety valve, as at present in use, has a great many faults: it was originally the invention of Denis Papin, of France, and was constructed by him in his experiments with what was called Papin's steam digester—a machine for dissolving bones, etc. It consisted, as at first constructed, of a small round plate covering a hole, and held in its place by a weight suspended from a lever, whose fulcrum rested upon the plate. But little improvement has been made upon this simple device; it is now tapered, to fit a counter-sunk hole, and possesses the advantage of being more difficult to calculate. But one of its chief faults is in the fact that the point of contact between the lever and valve is so large, that its wear creates a constantly varying leverage. This could be obviated by making the point of contact a knife-edge instead of a half-inch pin. Another disadvantage in the common safety valve is the fact that the engineer has the power of weighting it to an unlimited extent. We have seen this difficulty obviated by an American invention. The weight is suspended in the boiler directly from the valve, and consists of the greatest weight the boiler should ever be allowed to carry. The lever is now so applied, that its tendency is to always lighten the valve, so that the more it is weighted the less steam can be carried.

CHAPTER II.

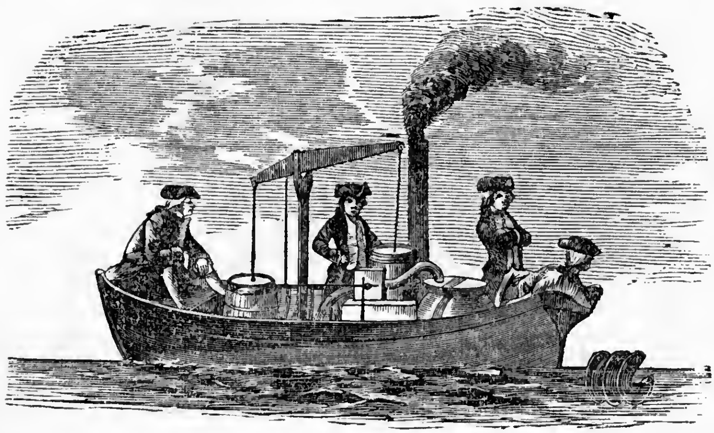
STEAMBOATS.

In looking over English works upon steam, we cannot help noticing the truth of Dr. Lardner's remarks: "England has been so dazzled by the splendor of her own achievements in the creation of a new art of transport by land and water within the last thirty years, as to become in a measure insensible to all that has been accomplished in the same interval and in the same department of the arts elsewhere." Not content with the praise other nations have ever been willing to give her for the invention of the steam engine, she also wishes to rob John Fitch of the only reward we can now give him for a life devoted to the steamboat. It is true that her arguments are aided to this end by the writings of some Americans who have endeavored to prove Fulton as the first practical steam navigator, thereby putting the date of this invention some twenty years later. But the time is fast approaching when the true inventor will be acknowledged by his countrymen, and the man who prophesied so truly that "this will be the mode of crossing the Atlantic in time, whether I shall bring it to perfection or not; steamboats will be preferred to all other conveyances, and they will be particularly useful in the navigation of the Ohio and the Mississippi. *The day will come when some more potent man will get fame and riches for my invention*" —when this man, we say, will be honored as he should be by the millions who enjoy the fruits of his genius; when our school-books will place his name in connection with that of Fulton, and his biography will be found in every library; when his grave and the tomb of Washington will not bring a blush to the American cheek.

And are you not to blame, reader? Have you ever read the life of John Fitch, the American Watt—a life that remained sealed for thirty years by his own request, and now teaches a lesson of perseverance, under trials that few ever have to encounter? If not, it is a duty you owe your country and yourself to read it at once, and thus add another name to the tablets of your memory, already inscribed with those of Franklin, Fulton, and Morse.

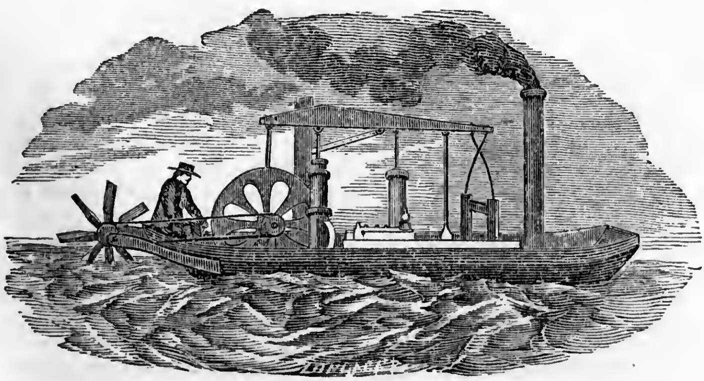
The extent to which steam navigation has improved our country, is scarcely realized even by those who have travelled over it the most. The Hudson river, from the first voyage of the North River, Fulton's steamboat, up to the present time, has remained at the head of all competitors in river navigation. We had then two trips per week, each consuming from thirty to thirty-six hours; we have now four passenger boats per day over the entire route, and many making short trips, besides those used for towing barges and canal boats; the passenger boats making the entire trip of one hundred and fifty miles in from ten to twelve hours. The increased prosperity of New York, growing out of this immense traffic by steamboats alone, is very great, but even this is small when compared with the navigation of the Mississippi and the other western rivers. In 1856 there were over one thousand steamboats and propellers on the western waters, costing not less than nineteen millions of dollars, and of a carrying capacity of four hundred and forty-three thousand tons. Of these boats, the smallest was the Major Darien, of ten tons, built at Freedom in 1852; and the largest was the Eclipse, of one thousand one hundred and seventeen tons, built at New Albany the same year. Thus, on the western waters, in the short space of forty-five years, steam created a business that absorbed nineteen millions of dollars in steamboats alone.

Up to the year 1811, the only regular method of transportation had been by means of flat boats, which consumed three or four months in the passage from New Orleans to Pittsburg. The price of passage was then one hundred and sixty dollars; freight, six dollars and seventy-five cents per hundred pounds. The introduction of steam has reduced the price of passage between these two cities to thirty dollars, and merchandise is carried the whole distance for a price which may be regarded as merely nominal. Besides this great saving of time and money effected by steam navigation on these waters, the comparative safety of steam conveyance is an item which especially deserves our notice. Before the steam dispensation began, travellers and merchants were obliged to trust their lives and property to the bargemen, many of whom were suspected, with very good reason, to be in confederacy with the land robbers who infested the shores of the Ohio, and the pirates who resorted to the islands of the Mississippi. These particulars being understood, we are prepared to estimate the value and importance of the



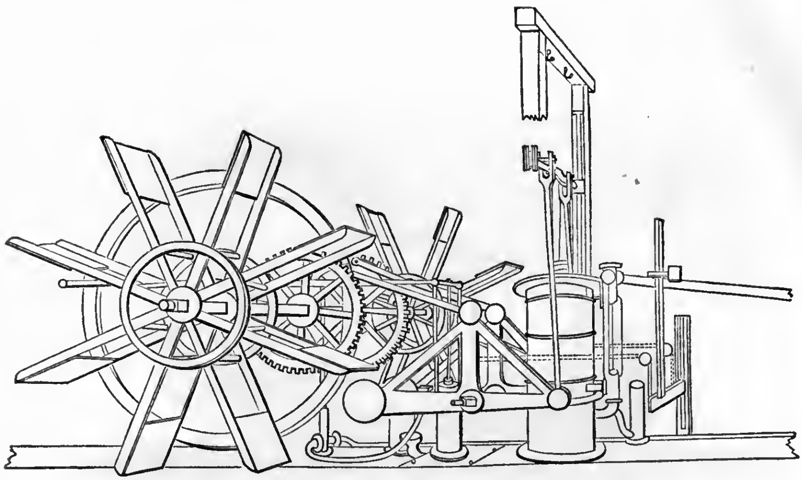
THE FIRST PROPELLER EVER BUILT.

Constructed by John Fitch, and experimented with by him on the Collect pond, New York city. The boiler was a twelve gallon pot, with a bit of truck-plank fastened by an iron bar placed transversely. This was in the year 1796.



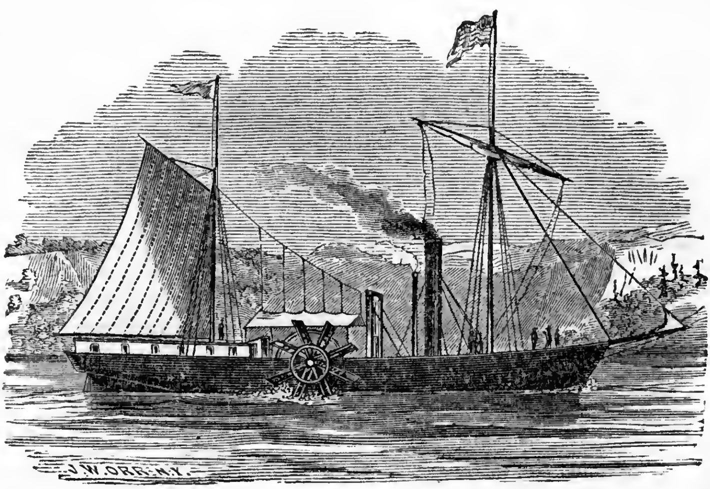
OLIVER EVANS' ORUKTER AMPHIBOLOS.

Thirty feet long and twelve broad. Cylinder five inches in diameter with a nineteen inch stroke. Constructed by Oliver Evans about the year 1804.



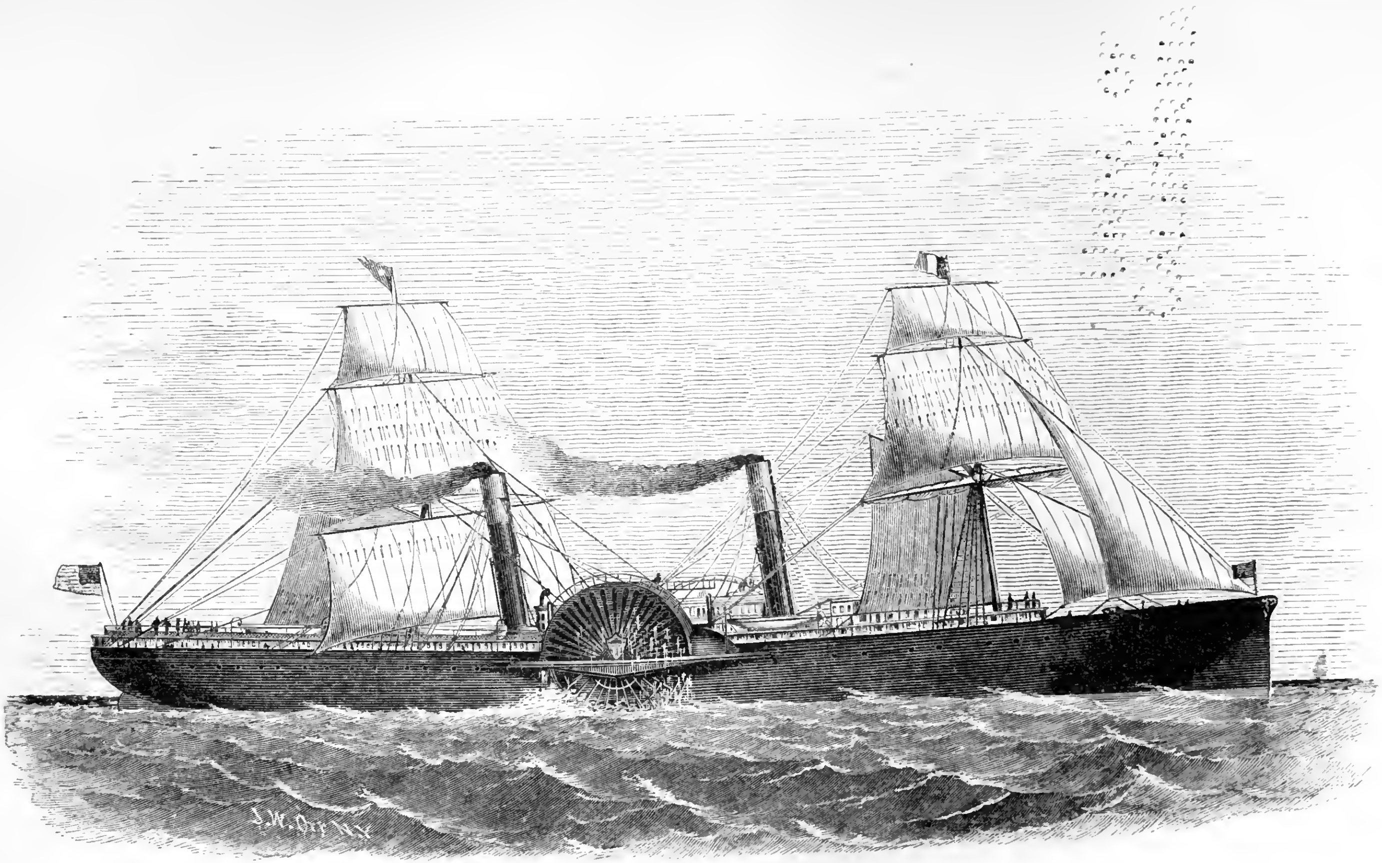
THE MACHINERY OF FULTON'S FIRST STEAMBOAT.

Imported from England where it was constructed in 1805. Wheels fifteen feet in diameter, cylinder twenty-four inches in diameter, four feet stroke.



THE NORTH RIVER, OF CLERMONT.

Robert Fulton's first steamboat as she appeared after being lengthened in 1808. She was launched in 1807, and was run as a regular packet between New York and Albany. Speed four miles per hour, length 133 feet, beam 18 feet, depth 8 feet, tonnage 160.



THE ADRIATIC.

services which the steam engine has rendered to the commerce and prosperity of the western states.

In 1811, Messrs. Fulton and Livingston, having established a ship-yard at Pittsburg for the purpose of introducing steam navigation on the western waters, built an experimental boat for this service—and this was the first steamboat that ever floated on the western rivers. It was furnished with a stern wheel and two masts—for Mr. Fulton believed, at that time, that the occasional use of sails would be indispensable. This first western steamboat was called the Orleans; her capacity was one hundred tons. In the winter of 1812, she made her first trip from Pittsburg to New Orleans in fourteen days.

The first appearance of this vessel on the Ohio river produced, as the reader may suppose, not a little excitement and admiration. A steamboat at that day was, to common observers, as great a wonder as a navigable balloon would be at the present. The banks of the river, in some places, were thronged with spectators, gazing in speechless astonishment at the puffing and smoking phenomenon. The average speed of this boat was only about three miles per hour. Before her ability to move through the water without the assistance of sails or oars had been fully exemplified, comparatively few persons believed that she could possibly be made to answer any purpose of real utility. In fact, she had made several voyages before the general prejudice began to subside, and for some months, many of the river merchants preferred the old mode of transportation, with all its risks, delays, and extra expense, rather than make use of such a contrivance as a steamboat, which, to their apprehensions, appeared too marvellous and miraculous for the business of every-day life. How slow are the masses of mankind to adopt improvements, even when they appear to be most obvious and unquestionable!

The second steamboat of the west, was a diminutive vessel called the Comet. She was rated at twenty-five tons. Daniel D. Smith was the owner, and D. French the builder of this boat. Her machinery was on a plan for which French had obtained a patent in 1809. She went to Louisville in the summer of 1813, and descended to New Orleans in the spring of 1814. She afterward made two voyages to Natchez, and was then sold, taken to pieces, and the engine was put up in a cotton factory. The Vesuvius was the next; she was built by Mr. Fulton, at Pittsburg, for a company, the several members of which resided at New York, Philadelphia, and New Orleans. She sailed under the command of Captain Frank Ogden, for New Orleans, in the spring of 1814. From New Orleans, she started for Louisville, in July of the same year, but was grounded on a sand-bar, seven hundred miles up the Mississippi, where she remained until the 3d of December following, when, being floated off by the tide, she returned to New Orleans. In 1815-16, she made regular trips for several months, from New Orleans to Natchez, under the command of Captain Clement. This gentleman was soon after succeeded by Captain John D. Hart, and while approaching New Orleans, with a valuable cargo on board, she took fire and burned to the water's edge. After being submerged for several months, her hulk was raised and re-fitted. She was afterward in the Louisville trade, and was condemned in 1819.

In 1818, the first steamboat was built for Lake Erie and the upper lakes, at Black Rock, on the Niagara river, for the late Dr. I. B. Stuart, of Albany, N. Y., by Noah Brown, of New York city. She was a very handsome vessel, 360 tons burden, brig rigged, and her engine, on the plan of a Boulton and Watt square engine, was made by Robert McQueen, at the corner of Centre and Duane streets, New York city; her cylinder was 40 inches diameter, 4 feet stroke. The materials for making the boiler were sent from New York, and the boiler was made at Black Rock—9 feet diameter, 24 feet long—a circular boiler, with one return flue, called a kidney flue, seldom, if ever, carrying more than nine inches of steam. This steamer was called the Walk-in-the-Water, after a celebrated Indian chief in Michigan. Her engines were transported from New York to Albany by sloops, and from Albany to Buffalo by large six and eight horse Pennsylvania teams. Some of the engine was delivered in fifteen days time, and some was on the road about twenty-five days.

The trip from Black Rock, or Buffalo, to Detroit, consumed about forty hours in good weather, using thirty-six to forty cords of wood the trip. The price of passage in the main cabin was eighteen dollars; from Buffalo to Erie (Penn.), six dollars; to Cleveland, twelve dollars; to Sandusky (Ohio), fifteen dollars; to Detroit, eighteen dollars. The strength of the rapids at the head of the Niagara river, between Buffalo and Black Rock, was so great, that besides the power of the engine, the steamer had to have the aid of eight yoke of oxen to get her up on to the lake, a distance of about two and one-half miles. In those days, the passenger and freighting business was so small, that one dividend only was made to the owners for the first three years from the earnings of the steamer. In 1821, in the fall, the steamer was totally lost in a terrible gale. On the coming winter, a new steamer was built at Buffalo, by Mr. Noah Brown of New York—a very strong, brig-rigged vessel. She was called the Superior, flush decks fore and aft; the first steamer, the Walk-in-the-Water, having had a high quarter or poop deck.

Compare the *time* and *expense* of travelling in those days with the present time! Mr. Calhoun (now living), the engineer of the Walk-in-the-Water, says, "Every two years I used to return to New York from Buffalo in the fall, and in the spring from New York to Buffalo. I have been *three* and *four* days, by stage, to Albany; never less than three days, and sometimes near five days; the stage fare was ten dollars to Albany. From Albany to Buffalo, I have been ten days in getting through; the shortest time was eight days; the stage fare through, was *twenty-one* dollars. *How is it now?* My usual expense in going to Buffalo from Albany was thirty dollars, including meals and sleeping." Such facts show the advantages we have obtained from the use of steam in our river navigation.

The boats that then plied upon the Hudson river, would not be sufficient to carry the passengers' baggage of the present day. The first boat was only 160 tons, while the New World, built in 1847, was of 1400. The latter has made the trip from New York to Albany in seven hours and fifteen minutes, including nine landings of say five minutes each; the actual running time being six hours and twenty minutes; distance, one hundred and fifty miles—performed by the North River in thirty-six hours.

The application of the steam engine to navigation, has been successful by three methods only: the side wheel, the stern wheel, and the propeller. The side wheel was known to the ancients, and was used in connection with a windlass, turned by men, as a means of propulsion, by the Romans, in their war galleys. It was first partially applied to steam navigation by Robert Fulton, but since his day it has undergone vast improvement. As at first constructed, it consisted of a double-spoked water-wheel, suspended by a shaft with no outside bearing, which shaft, being of cast iron, was very liable to break. The outside bearing and guard were subsequently invented by Fulton, as appears from his specification of patent. The wheels being totally uncovered, were found to throw water upon deck, and a dash-board was put up to prevent it, which was in time replaced by the present wheel-house. The paddle was next surrounded with a circular brace, or rim, as at present in use. In Fulton's first boat, the wheels could, at will, be disconnected from the engine, but this plan went out of use in order to simplify the machinery, after the crank shaft was adopted, connected directly with the engine. Various side wheels have been patented, that are so constructed as to prevent the lift of water as the bucket rises therefrom. One on the Richard Stockton appears to work well, but their complication, cost, and liability to get out of repair, have prevented their general introduction.

The stern wheel was first thought of by Jonathan Hull, of England, in 1736, as sufficiently appears from drawings thereof published by him; but it certainly was first practically applied by Robert Fulton, in the steamboat Orleans, of which we have already spoken. This wheel is now in almost universal use on our western rivers, as it is peculiarly adapted to boats drawing but little water. The wheel is suspended at the stern, and is sometimes covered with a wheel-house, but more frequently entirely exposed.

The propeller was first applied to a small steamboat built by John Fitch, and experimented with by him under the patronage of Chancellor Livingston, on the Collect Pond in New York. The propeller was a screw or worm. Great improvements have, however, been made in the screw, and to the English we are indebted for some of the most important. Captain Ericsson deserves great credit for his improvements in this respect. Among the finest of our propellers may be named the R. R. Cuyler and the Matanzas; the former is of wood, her total length is 240 feet; she is 33 feet wide, and has 24 feet depth of hold. She is furnished with one direct-acting inverted condensing engine, the largest single engine as yet built for a propeller. Her cylinder has a diameter of 70 inches and 48 inches stroke. She is furnished with two return tubular boilers 13½ feet wide, 17 feet long, and 14 feet 4 inches high, with separate chimneys and separate connections to each boiler.

The Matanzas is the first steamer, whose hull is entirely of iron, that has ever been constructed in the United States. Her frame is of angle iron, with reverse bars also of iron; her keel is of solid iron, 3 by 9 inches, as are her beams and deck knees. She is clipper built, 900 tons burden; her dimensions are—length 210 feet, keel 200 feet, 30 feet beam, depth 20½ feet. This beautiful propeller, as all her visitors have unanimously called her, was built at the Delamater Iron Works, under the direction of Mr. J. W. Caper, and is the first iron ship constructed at that shop. Her engine is an inverted cylinder, 56 by 44 inches, of the same pattern, although smaller, as that of the R. R. Cuyler, and was designed by the same engineer, Mr. John Baird, chief engineer of Cromwell's line.

The chief advantage claimed for the propeller over the side wheel, is the fact that in sea-going vessels the latter rarely possess an equal immersion, and consequently are constantly varying their purchase upon the water, whereas the propeller is always acting, or nearly so. The disadvantage of the propeller is the increased speed of the engine; this was at first overcome by gearing, but the plan is objectionable on account of breakage and friction. The true form of a propeller is not yet decided, and probably we shall soon see many vast improvements both in its construction and the application of the engine that drives it. In war vessels, the propeller is less liable to be damaged by shot than the side wheel, and as an auxiliary for the sailing vessel, it is far preferable to the latter. Various devices have been adopted to disconnect and take in the propeller when using sails, but the use of two arms instead of four has in a great measure obviated the necessity so to do. Propellers have been tried with success on the Raritan canal, and are now extensively used there; their cheapness, as compared with the side wheel, will always recommend them for small vessels. Whether the propeller will ever entirely supersede the side wheel is still a question; that they are cheaper in connection with sails as freighters no one questions, and it is possible that they may eventually be so improved as to eclipse the side wheel in speed; but this we very much doubt. They are, however, as yet comparatively in their infancy, and time alone will prove them.

Among sea-going side wheel steamers, the Americans may point with pride to the Adriatic, the largest steamer afloat except the Great Eastern; she measures 350 feet in length, 50 feet beam, and is about 5,000 tons burden. She was modelled and built by the late George Steers, and is a perfect vessel in appearance, appointments, speed, and every other respect. Her engines were built at the Novelty Works; her total cost was over a million of dollars. She has two oscillating engines, 101 inches in diameter by 12 feet stroke, and carries 25 lbs. of steam; her paddles are 40 feet diameter, floats, 3 by 12 feet; she has eight vertical tubular boilers, with 30,758 square feet of heating surface. She is truly a magnificent ship, and will compare favorably with any steamer in the world, not excepting the Great Eastern, that mammoth—we had almost said blunder.

Of our steam navy, the first commencement of which was the steam battery Fulton the first, built under the personal supervision of Robert Fulton, we can only say that it is small but efficient; steam in the navy is now a positive need, and we hope to see our force largely increased. The steam engineers in the United States navy are second to none in the world.

The use of the donkey engine or auxiliary pump, has been adopted in nearly all of our steam vessels, and is a decided improvement over the old method of filling the boilers by the main engine, as it obviates the difficulty of working the wheels while lying at the wharf, or stopping from any cause. The *sages* who managed the Great Eastern have thrown out the "donkeys," probably because they think there are sufficient for all purposes among the directors.

The use of coal in our steamers is now universal upon the Atlantic coast and rivers. John E. Mowatt, the first to establish the tow-boat business, was also among the first to burn coal. His boat, the Henry Eckford, was fitted up for that purpose, but the want of a sufficient draft was the cause of its abandonment after several trials; this was in 1825. A few years after, Robert L. Stevens tried a blower on his crank boat, the North America. His first blower was of rude construction, being made of planks, and placed directly in front of the furnace, under the doors. After his success, the blower came into general use both for coal and wood; but improvements in furnaces have now, in a measure, superseded its use. Mr. Stevens tried several expensive experiments, and many of them proved of value only as lessons to the engineer. While experimenting upon the blower, he caused to be constructed a spiral fan in the chimney, but abandoned it after one or two trials. Placing the boilers on deck was his invention, as also the false bow that made so great an improvement in speed. The present open work walking-beam is also ascribed to him; in fact we may safely say that Robert L. Stevens did more than any other man toward the improvement of the steam engine.

When steam was first used, great fears were entertained of explosions, and dangers by fire; this was increased by the explosion of the steamboat Washington. This happened June 9th, 1816. She was the largest and finest boat that floated on the western waters. Her commander, Capt. Shreve, was skilled and experienced in all the duties of his calling; her machinery was all presumed to be in the best possible order, and no human foresight could have anticipated the fatal event. The boat left Marietta, Ohio, on Monday, June 7th, and on the afternoon of the following day came safely to anchor off Point Harmar, where she remained until Wednesday morning. The fires were now kindled, and other preparations made for continuing the voyage down the Ohio; but a difficulty occurred in getting the boat into a proper position to start the machinery. While laboring to effect this object (the boat having, in the meantime, been carried by the force of the current near the Virginia shore), it became necessary to throw out a kedge anchor at the stern. Shortly after, all hands were called to haul in the kedge, and while there collected together, the end of the boiler nearest the stern was suddenly blown off, and a column of mingled water and steam was thrown among the crowd, killing a number upon the spot, and inflicting the most frightful injuries on the remainder. The captain, mate, and several others, were blown overboard, and, with the exception of one man, were afterward rescued from the water, and found to be more or less injured by the scalding water and the scattered fragments of the boiler.

At Harmar, a neighboring town, the inhabitants were alarmed by the sound of the explosion, appearing, as it did, to shake the earth. A number of citizens—among whom were several physicians—rushed to the boat to ascertain the extent of the calamity. Language is but feeble to explain the misery and torture which presented itself to their view. Strewn about the deck were the mangled and writhing forms of human beings, filling the air with screams and groans, while others, more fortunate, had ended their sufferings in death. Those who experienced the greatest pain, apparently, were injured by inhaling the scalding steam, which is agonizing, beyond all the powers of imagination to conceive. The cause of this explosion is not exactly known, but it is supposed to have been from over-pressure, owing to the displacement of the valve weight, which had accidentally slipped to the end of the lever.

This accident, as we said before, added to the general prejudice against steamboating, and caused a great excitement among the inhabitants of that region; people being oblivious of the fact that in proportion to the passengers carried by steamboats up to that date, there had been much less accident and danger than by the original conveyance of barges and flat boats. Still, there was a great deal of mismanagement, resulting from ignorance, in our first steam vessels, and the general introduction of high-pressure engines, without the proper increase of strength in the boilers, caused many serious accidents, that in time drew the attention of Congress to the subject. Several laws were passed; but it was not until quite a late period that the present comparatively perfect system of inspection was matured by our government.

In the year 1852, an act was passed by Congress, containing provisions against fire, regarding pumps, boats, life preservers, the transportation of dangerous articles, etc. This act also provided for an inspector of boilers in each district, whose duty it is to test all the boilers in his district, used on board of vessels carrying passengers, once when first constructed, and at least once a year thereafter. The Board of Inspectors were also empowered with the examination of engineers, which duty is set forth in the following section: "Whenever any person claiming to be qualified to perform the duty of engineer upon steamers carrying passengers, shall apply for a certificate, the

Board of Inspectors shall examine the applicant, and the proofs which he produces in support of his claim; and if, upon full consideration, they are satisfied that his character, habits of life, knowledge, and experience in the duties of an engineer are all such as to authorize the belief that the applicant is a suitable and safe person to be entrusted with the powers and duties of such a station, they shall give him a certificate to such effect, for one year, signed by them, in which certificate they shall state the time of the examination, and shall assign the appointee to the appropriate class of engineers."

It was also provided that nine supervising inspectors should be appointed by the executive, to carry out the provisions of the act. Since the passage of this law, steamboat explosions on the Atlantic coast have become almost unknown, and have greatly decreased in the west. With competent inspectors this law is invaluable, and we hope to hail the day when a similar act is passed in every legislature, touching locomotive and stationary boilers.

No one who looks at the immense amount of business done by steam vessels, will question the advantages obtained by the application of steam to navigation, still this branch of commerce is as yet in its infancy, and it is our belief that not only will steam supersede sails entirely, but also that the laborious occupation of rowing will eventually be mainly done by steam. It is unquestionable that boats requiring four men to pull them can, even now, be much more economically worked by machinery, and certainly run much faster. Their cost need not exceed five hundred dollars. For such small craft the propeller is better fitted than the side wheel. There is a boat of this description now running in the harbor of Norfolk, Virginia, and capable of carrying twelve passengers at eight miles per hour, at the expense of seventy-five cents per day for fuel, and the wages of one man, who can easily do the work and steer the boat. This boat carried passengers to the Great Eastern, when she lay off Old Point Comfort, and appeared like the minnow beside the whale.

We have already stated that John E. Mowatt was the first to introduce the tug business on the North River. This was Jonathan Hull's idea; he never dreaming that large vessels could be provided with propelling power, both on account of its weight, the weight of fuel for a voyage, and the danger from fire. This branch of steam navigation has proved very lucrative. Within the past few years the propeller has here also been substituted. Philadelphia, we believe, was the pioneer in this enterprise, and most of the propeller-tugs were built in that place. We will conclude this chapter with the following statement of the tonnage of steam vessels belonging to the several ports of the United States in 1859, as published in the "Report on Commerce and Navigation":—

New York	120,598.09
New Orleans	75,789.91
St. Louis	54,515.64
Pittsburg	40,550.08
Buffalo	42,464.04
Detroit	33,005.12
Louisville	29,626.72
Cincinnati	25,668.31
Mobile	28,898.52
Philadelphia	22,238.50
Cleveland	21,720.73
Baltimore	19,260.83
San Francisco	10,214.94
Boston	9,998.52
Chicago	7,651.45

The total steam tonnage of the United States, for the year ending 30th of June, 1859, was 676,004 83-95 tons.

CHAPTER III.

LOCOMOTIVES.

Our second chapter referred more particularly to the application of steam to navigation. In this, we shall endeavor to set forth its advantages in land transportation. Among the earliest experiments upon this subject in America, were those by Oliver Evans, of Philadelphia. The following is his account, published in 1804:—

"I constructed for the Board of Health of Philadelphia a machine for cleaning docks, called the Orukter Amphibolos or Amphibious Digger. It consisted of a heavy flat-bottomed boat, thirty feet long, and twelve feet broad, with a chain of buckets to bring up the mud, and hooks to clear away sticks, stones, and other obstacles. These buckets are wrought by a small steam engine set in the boat, the cylinder of which is five inches diameter, and the length of stroke nineteen inches. This machine was constructed at my shop, one mile and a half from the river Schuylkill, where she was launched.

She sunk nineteen inches, displacing five hundred and fifty-one cubic feet of water, which, at 62.5 pounds, the weight of a cubic foot, gives the weight of the boat thirty-four thousand four hundred and thirty-seven pounds, which, divided by two hundred and thirteen, the weight of a barrel of flour, gives the weight of one hundred and sixty-one barrels of flour that the boat and engine is equal to. Add to this the heavy pieces of timber and wheels used in transporting her, and the number of persons generally in her, will make the whole burden equal to at least two hundred barrels of flour. Yet this small engine moved so great a burden, with a gentle motion, up Market street and around the Centre Square, and we concluded from the experiment that the engine was able to rise any ascent allowed by law on turnpike roads, which is not more than four degrees."

After giving a comparison of the merits of steam and horse power, for moving carriages on common roads, Evans says: "Add to all this that the steam wagon consumes nothing while standing, will roll and mend the roads, while the horse wagons will cut them up. Upon the whole it appears that no competition could exist between the two. The steam wagons would take all the business on the turnpike roads. I have no doubt but you will duly appreciate the importance of such an improvement, and conceive it to be your interest to appropriate the sum necessary to put it in operation. I have invented the only engine that will answer that great purpose, as well as many others for which power may be wanted. It is too much for an individual to put in operation every improvement which he may be able to conceive or invent. I have no doubt that my engines will propel boats against the current of the Mississippi, and wagons on turnpike roads with great profit. I now call upon those whose interest it is, to carry this invention into effect. All which I respectfully submit to your consideration."

Thus it will be seen that Mr. Evans not only practically applied steam to locomotion, but fully realized the advantages of his invention. The introduction of the railroad prevented the improvements that would naturally have followed so great an invention, and but little has since been done, until within the past three or four years.

Mr. Fisher has been one of the most successful in his improvements; his first experiment was in 1853, when he built a small carriage for four persons, which weighed, empty, about one thousand four hundred pounds. The cylinders were ten by four; boiler, thirty feet of surface, only twenty feet of which could be reckoned effective, or one foot of surface to about one hundred and ten pounds of total weight. It outran horses, in night races, on the Broadway pavement, and ran at a moderate speed on cobble pavements, but had not steam enough for common roads.

The next trial was in 1858, on two steam fire engines, the J. C. Cary and J. G. Storm, the carriages and engines of which were built from his design, the boilers and pumps being designed by others. These engines had heavy boilers and apparatus, and could not be regarded as steam carriages, but only as a demonstration of the practicability of working by steam. Their cylinders are fourteen by seven and a half inches; wheels, five feet; the Cary boiler four hundred and eighty feet of heating surface; that of the Storm three hundred and eighty; weight of the Cary, empty, fifteen thousand six hundred and thirty-six pounds; the Storm somewhat lighter. These engines ran well on pavements, and when fairly in motion could run on soft ground at six or seven miles per hour. The next experiment was by Mr. Fisher in 1859, when a carriage was built, which is not yet finished. Its cylinders are fourteen by seven inches; wheels, five feet; boiler, one hundred and sixty feet of surface; weight, with water and eleven men, estimated at twelve thousand pounds, or seventy-five pounds to one foot of heating surface. Two gentlemen timed it on an evening trial trip; one reported that it ran between two mile stones in two minutes and forty seconds; the other reported it within three minutes. The road was gravel, rather loose and soft on the surface.

As we have before stated, the introduction of railroads turned the attention of our mechanics to them, and steam carriages were abandoned. The railway itself does not come within the compass of our article; we will state, however, that its origin is unknown, as the remains of a stone tram-road have been found among the ruins of Thebes.

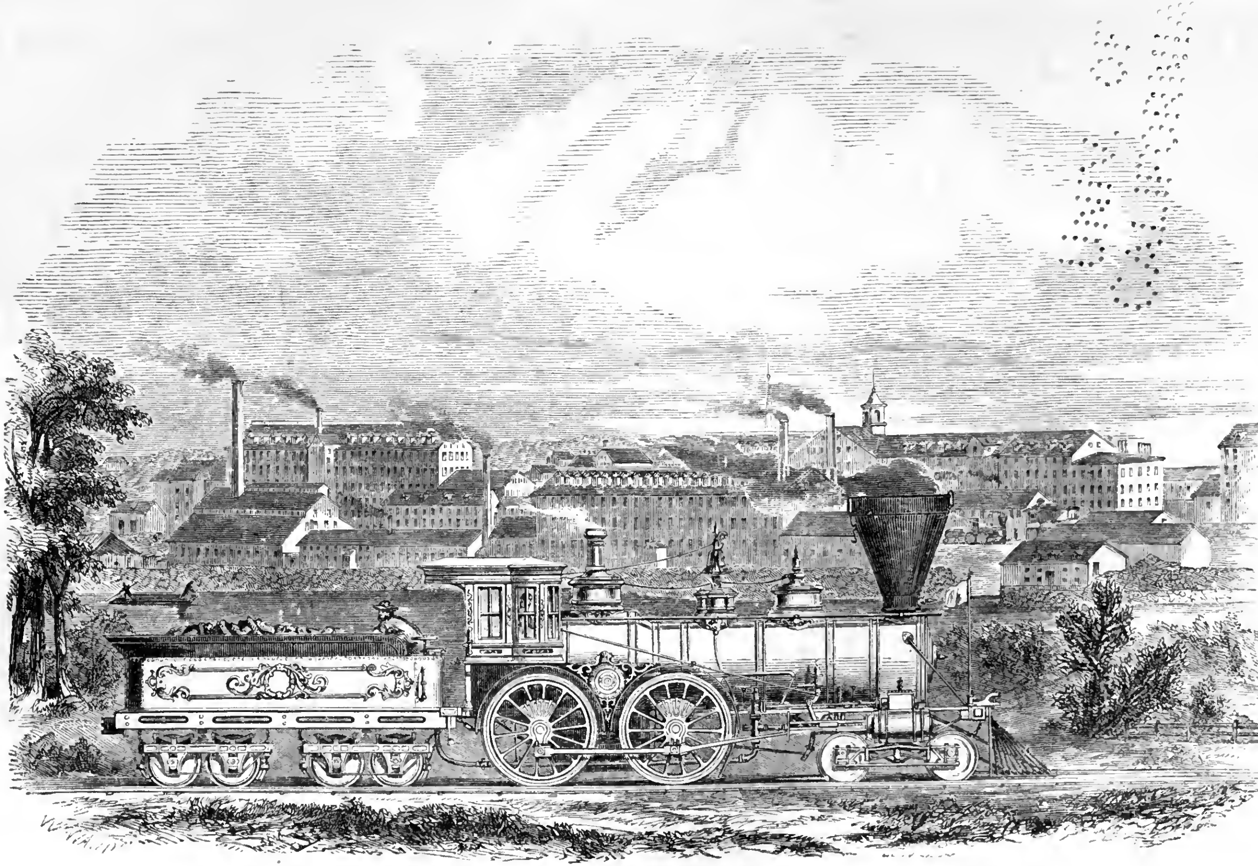
Thirty years ago they were still discussing the advantages of canals as compared with railroads in this country; it is, however, somewhat singular that, with the exception of a mile or two of canal near Cambridge, constructed by the Romans, England had introduced the entire principle of railroads long before she took up canals. As long ago as 1776, and possibly thirty years prior to that time, England had wooden rails in some of her collieries. It was not, however, until the year 1825 that the subject was prominently brought forward. The railway project from Manchester to Liverpool was the cause of this new impulse. The rails, prior to 1776, were of wood, placed about four feet apart on sleepers; these wooden rails were then covered with iron plates, and cast iron wheels were adopted instead of the wooden ones that had been used up to this time. In 1790, the edge rail was invented. From 1802 to 1806, the first effective experiments were made with the locomotive engine. It was not, however, supposed possible that the friction or adherence of the plain wheels of such carriages upon the rail could be sufficient to allow any great weight to be drawn after them, and, therefore, the cumbersome appendage of cog wheels and ratchet wheels, continuous and endless chains, propelling levers, etc., etc., continued to perplex the minds of engineers until about 1814, when it was first discovered that the adhesion of the locomotive carriage, with its plain cast iron wheels, was adequate for every purpose on ordinary railways. The improvement consequent upon this was effected by Mr. Stephenson in the north of England, and for a long time his engines, with unimportant alterations, were used where fuel was cheap. Those locomotives drew about one hundred tons on a level, at four miles the hour, performing the work of about sixteen horses. Their weight was about ten tons, and cost about sixteen thousand dollars.

The first railway in the United States was built from Milton to Quincy, Mass., a distance of two miles, in 1826. The Baltimore and Ohio was the first passenger railroad; it was opened in 1830, a distance of fifteen miles, with horse power. Next in the order of time came the Mohawk and Hudson, from Albany to Schenectady, sixteen miles; opened for travel also with horse power. The first locomotive engine upon a railway in this country, was built at Stourbridge, England, for the Delaware and Hudson Canal Company, and imported by Mr. Horatio Allen. This engine was called the Lion. Mr. Allen, in a speech not long since, gives a graphic account of the first trip: "It was in the year 1828, on the banks of the Lackawaxen, at the commencement of the railroads connecting the canal of the Delaware and Hudson Canal Company with their coal mines; and he who addresses you was the only person on that locomotive. The circumstances which led to my being alone on the engine were these: the road had been built in the summer; the structure was of hemlock timber; the rails of large dimensions, notched on caps placed far apart; the timber had cracked and warped from exposure to the sun. After about three hundred feet of straight line, the road crossed the Lackawaxen creek on trestle-work, about thirty feet high, with a curve of from three hundred and fifty-six to four hundred feet radius. The impression was very general that the iron monster would break down the road, or it would leave the track at the curve and plunge into the creek. My reply to such apprehensions was, that it was too late to consider the probability of such occurrences; that there was no other course than to have a trial made of the strange animal, which had been brought here at great expense; but that it was not necessary that more than one should be involved in its fate; that I would take the first ride alone, and the time would come when I should look back to the incident with great interest. As I placed my hand on the throttle-valve handle, I was undecided whether I would move slowly or with a fair degree of speed; but believing that the road would prove safe, and preferring, if I did go down, to go handsomely, and without any evidence of timidity, I started with considerable velocity, passed the curve over the creek safely, and was soon out of hearing of the vast assemblage. At the end of two or three miles I reversed the valve, and returned without accident; having thus made the first railroad trip by locomotive on the western hemisphere."

The first locomotive engine ever built in the United States, was built at the West Point foundry, New York, under the direction of Samuel Hall, for the South Carolina railroad. This engine blew up shortly after it commenced running, and another was built to replace it. In 1831, the De Witt Clinton was built at the same foundry for the Mohawk and Hudson (New York Central) railroad; this engine weighed four tons; it was run without load at the rate of forty miles per hour. Cylinders, five and a half inches in diameter—stroke, sixteen inches; four coupled wheels, four and a half feet in diameter. The boiler was cylindrical, with a large dome in the centre, and contained some thirty flues. In January of the same year, the Baltimore and Ohio railroad offered four thousand dollars for the best anthracite coal-burning locomotive, weighing three and one half tons, and capable of drawing fifteen tons, fifteen miles per hour on a level, with a steam pressure of not more than a hundred pounds to the square inch. The conditions were filled by an engine built by Phineas Davis, of York, Pa., in June, 1831. This engine had an upright boiler and cylinder. William T. James, of New York, who had already constructed a steam carriage in 1829, finished a locomotive in 1832; this engine was employed on the Harlem railroad, with success, for a time, but was eventually sold to the Baltimore and Ohio road, where it exploded in 1834. This engine was provided with a "spark arrester." In January, 1833, M. W. Baldwin, of Philadelphia, still one of our best locomotive builders, built the Old Ironsides, for the Philadelphia and Germantown Railroad Company. This engine weighed five tons, and was said to have been run at the rate of sixty-two miles per hour. Mr. Baldwin introduced the outside connection engine, thus doing away with the crank axle, and placing the cylinder more under the eye of the engineer.

It would be tedious to follow the construction and alterations in the various locomotives that were built by different manufacturers in the United States. We will, however, mention the most important improvements.

The truck frame, in front of the engine, was first used by Adam Hall, of the West Point foundry, in 1832, on an engine called the Experiment. The four eccentrics were first used by William T. James, on his steam carriage; they were, however, patented by S. H. Long, of Philadelphia, in 1830, and first used on a locomotive in 1833; this was the Black Hawk, built by Long and Norris, of Philadelphia, the founders of the present locomotive shop known as Norris' works. The Norris engines were the first ever exported; this was brought about by the, at that time, extraordinary fact of drawing 19,200 pounds up an incline of three hundred and sixty-nine feet to the mile, the engine weighing but 14,370 pounds; on hearing of which, the Birmingham and Gloucester Railway Company ordered several engines for an incline upon their road, where they performed successfully. Since that time, engines have been exported to England, France, Russia, Germany, Egypt, and Chili. In the latter country there are eight American locomotives. The engines forwarded to Egypt, were built by William Mason, of Taunton; and for excellence of workmanship, style, and finish, will compare favorably with any in the world. There are, at present, twenty-nine American locomotives on German roads. Messrs. Winans, of Baltimore, furnished the majority of the locomotives sent to Russia. There are now some twenty-three locomotive shops in the United States. Most of the engines are, however, built in Philadelphia, and Paterson, N. J. Hinckley and Drury's, afterward called the Boston Locomotive Works, was established in 1840. The Lowell shop began to build engines in 1835. Rogers, Ketchum & Grosvenor, of Paterson, New Jersey, commenced building in 1837. This shop is still in full operation, under the name of the Rogers Locomotive Works. This shop made several material alterations upon the English type; they enlarged the boiler in proportion to the cylinder, established the link motion, and covered more effectually the cylinders and valve chests, to prevent radiation. Rogers, also, was among the first to adopt the full-stroke pump. The locomotives built at this shop have always found a ready market. Next in order was the Taunton Locomotive Company, established in 1847, by W. W. Fairbanks, a marine boiler maker from Providence, Rhode Island. Then John Souther, formerly of Hinckley's shop, started his works in South Boston, in 1848. In 1849, the Amoskeag Manufacturing Company entered the lists with some important improvements; they were followed by the Portland, Lawrence, and Wilmarth shops, and a few years after, by Mason, of Taunton, the East Bridgewater, and the Manchester locomotive works. But since 1857, the New England locomotive shops have done but little of this kind of work; the Boston, Lawrence, and Manchester locomotive works have failed; the Amoskeag, Lowell, and Mason's shop at Taunton, have turned their attention to cotton and woollen machinery; and the business has gone almost entirely into the hands of the Paterson and Philadelphia shops. The causes of this change are various: prominent among them may be mentioned the manufacture of locomo-



AMOSKEAG LOCOMOTIVE WORKS.

tives by railroad companies themselves, at their repair shops.

The manufacture of the locomotive engine had a good effect upon our machine shops, independent of the work it furnished; as in order to construct them a variety of improved tools were made, that have greatly added to the facility for turning out other machinery. These improvements are so marked that no one who is familiar with the machine shop can help noticing them.

Coal is now rapidly superseding wood as fuel for the locomotive. It is true that some of our first engines were coal-burners, but wood has been for years the principal fuel used. The American engine has several marked distinctions from the English; what most strikes the eye of the common observer is the *cab*, or house for the protection of the engineer; this is peculiar to our locomotive. The *smoke stack* is also very different in the wood-burning engine from that in use on coal-burners. The auxiliary pump is used on some of our engines, but not to so great an extent as it should be.

A first-class locomotive engine costs about ten thousand dollars, and an average taken from one of our largest roads shows a cost of about eleven hundred dollars per year for repairs. Locomotives in this country are built much too large for the work they have to accomplish, and the attention of our master machinists having lately been much attracted to this subject, it is to be hoped that some improvements in the weight will be made. A locomotive too heavy for the work it has to do, is not only more expensive in first cost, but in the greater wear of the road. A good locomotive can draw thirty times its own weight on a level, and a paying load should not exceed twenty-five tons; bearing this in mind, why build twenty-six ton engines? There are many parts of an engine now built much too heavy; the bell, dome-casings, and cabs, for instance. It is not necessary to greatly lessen the weight of the running gear, although in some instances this is much too heavy. Wrought iron in place of cast in some cases would be lighter and much better, and steel should be substituted for iron wherever possible. The speed over the American roads is not so great as in England, from the fact that the former have more and steeper grades, and have, besides, shorter curves, to say nothing about their construction being much less expensive. Sixty miles per hour has been made upon our roads, however, but thirty is nearer an average, while in England seventy miles has frequently been attained.

Dr. Lardner, in his lately published "Economy of Railroads," thus endeavors to convey to the unpractised reader the enormous speed of a locomotive going at the rate of seventy miles an hour: "Seventy miles an hour is, in round numbers, one hundred and five feet per second, that is a motion in virtue of which a passenger is carried over thirty-five yards between the beats of a common clock. Two objects near him, a yard asunder, pass by his eye in the thirty-fifth part of a second; and if thirty-five stakes were erected by the side of the road, one yard asunder, the whole would pass his eye between two beats of a clock; if they had any strong color, such as red, they would appear a continuous flash of red. At such a speed, therefore, the objects on the side of the road are not distinguishable. When two trains, having this speed, pass each other, the relative velocity will be double this, or seventy yards per second; and if one of the trains were seventy yards long, it would flash by in a single second. To accomplish this, supposing the driving wheels seven feet in diameter, the piston must change its direction in the cylinder ten times in a second. But there are two cylinders, and the mechanism is so regulated that the discharges of steam are alternate. There are, therefore, twenty discharges of steam per second, at equal intervals; and thus these twenty puffs divide a second into twenty equal parts, each puff having the twentieth of a second between it and that which precedes and follows it. The ear, like the eye, is limited in the rapidity of its sensations, and sensitive as that organ is, it is not capable of distinguishing monotonous sounds which succeed each other at intervals of the twentieth part of a second. According to the experiments of Dr. Hutton, the flight of a cannon ball was six thousand seven hundred feet in one quarter of a minute, equal to five miles per minute, or three hundred miles per hour. It follows, therefore, that a railway train, going at the rate of seventy-five miles per hour, has the velocity of one-fourth that of a cannon ball; and the momentum of such a mass, moving at such a speed, is equivalent to the aggregate force of a number of cannon balls equal to one-fourth of its own weight."

Some years ago a curious calculation,

showing one of the advantages of the steam locomotive, was made in England. "In 1853, 111,000,000 passengers were conveyed, each passenger travelling an average of twelve miles. Twelve miles of railroad are accomplished in half an hour, whereas the old stage coach required an hour and a half to get through the distance. The aggregate time thus saved for the above number of passengers is equal to *thirty-eight thousand* years." This was seven years ago, since which time the number of passengers carried has been nearly doubled.

Mr. Fleming, on the Mobile & Ohio railroad, and some other master mechanics, have adopted the plan of paying the engineers a certain fixed salary, and then giving prizes to those who save the most fuel to the mile run. It is also customary to place the inspection of wood to be used under the engineer's care, he having the choice of the stations at which he will take in wood. With these two regulations the company get better wood at the same price, as it is directly to the engineer's interest to carefully examine the quality, quantity, and price of every load of wood he takes on. So great has been the economy of this plan, that it is strange that every one does not adopt it.

Another important item in the running expenses of the locomotive is the oil and waste. The latter is used to wipe the machinery, not only on account of the looks, but to prevent its *gumming* up with oil and dirt. The average cost of oil, waste, and tallow, taken from some of our largest roads, is seventy-five hundredths of a cent per mile run; and as engines average some fifteen thousand miles per year, we have a total cost, in three small items, of one million dollars per year in the United States alone.

Before leaving the subject of steam locomotives, we wish to speak of the Dummy engine, or steam car for city railroads. We know that this use of steam has met with great opposition from all classes of men; but what are the arguments? In the first place they say: "Oh! the steam car is much more dangerous than horses." Why? "Because it is more difficult to stop, and it goes so much faster." What is the truth? It is much easier to stop a steam car than one drawn by horses, inasmuch as we have not only the same brakes, but the power of reversing the engine in an emergency. As to the cars being run faster, our laws against fast driving are as potent in the one case as in the other; and by Darker's arrangement, it is impossible for the car to go over a given speed—the governor being attached to the brake. The second argument against steam cars is that the noise and smoke will frighten horses. The noise and smoke can both be avoided, and it has been proved that horses are not more liable to start than at the sight of a buffalo robe. The argument as to expense has been entirely thrown aside; still, but few know the great advantage in this respect that steam has over horse power. A number of our lines average seven horses to a car (in Boston they average eight), in order to have the necessary relays; seven good horses for this purpose are worth, say, eight hundred dollars; the feed, care, and stable-room of each horse averages, say three dollars and fifty cents per week; so that a line with forty cars is under the enormous annual expense, for horse-care and keep alone, of $50,960! Now then for steam. The first cost of an engine and steam generator, with all the necessary appurtenances, will be no more, if as much, as the seven horses to each car. Keeping the engine in repair would incur no more expense than shoeing horses, renewing harness, etc. It would cost no more to replace them than to replace worn-out horses. The engines, to be of sufficient capacity to overcome our steepest grades, will consume eight bushels of coke per day (a high estimate), running sixteen hours, the price of which at present is five cents per bushel; but, supposing the extra demand to cause an advance of a hundred per cent.—which is hardly likely, for even a less increase in price would cause many private families and others to cease using it—the fuel expense in one year, to a company with forty cars, would be $9,984; making the difference in cost, in one year, between steam and horses, of $40,976. Think of it! $40,976 saved to a company with forty cars, in one year (over $1,000 per car), after putting down the fuel at double its present price. Coke is preferable, because it is clean to handle, ignites quick, emits no smoke, is light and cheap, and requires a much less draught than coal. To save cumbrous and useless weight as much as possible, it is proposed to carry very little fuel, except what is on the fire, nor unnecessary extra water either, the tank and bin to be replenished at the depot each trip, while waiting its time.

Were the different companies to offer, as an inducement, to reduce the fare to *three cents*, on condition that the community would permit the use of steam, they would annihilate all groundless opposition on the part of the masses, which is every thing with us; and the enormous increase of "short rides," occasioned by the reduction of fare, would make the receipts greater than at present; and as the saving in favor of steam is quite $1,000 a year per car, the value of the stock would be increased prodigiously. If there could be any serious objection urged against using steam, in this age of improvements, with the plans of safety here laid down, other than those suggested by "old fogyism," all the advantages we have enumerated would weigh little in its favor; but when it can be so arranged as to be actually safer than horse power, we think the time has come to put it thoroughly to the test, at all events.

Among the plans for city cars that have been suggested and built, we may mention those of Latta, of Cincinnati; Baldwin; Grice & Long; and Darker, of Philadelphia. Latta's engine is in a separate car from the passengers; Baldwin's has its machinery beneath the car, and its boiler in front; and Darker places his entire engine and boiler upon the roof, connecting with the wheels on the outside, near the centre. Grice & Long's car is thus fitted: the engines and boiler are on the front platform; the engines slightly inclined, and graded to the front axle; the axle being placed at the extreme end of the car, for the purpose of making the connection, and increasing the stability of the wheels. The boiler is of the ordinary vertical, tubular type; the after part of the car is finished with a self-adjusting, vibrating truck, for the purpose of turning the short curves of city roads. The running of this car has afforded the utmost satisfaction. With a full complement of passengers, it has ascended the heaviest railway grades in Philadelphia county; some of which exceed three hundred and seventy feet to the mile, embracing sharp curves. The whole arrangement is simple and compact; can be applied to the horse cars now in use, and will give them a greater number of seats than they now afford. These steam cars burn anthracite coal, and have open exhausts; thus avoiding the two most prominent objections urged against street locomotives, smoke and noise. The *American and Gazette*, of Philadelphia, describes a trip made last March in this car, from which we extract the following:—

"The road traversed is a very rough one, built cheaply of cast iron rails, which are shorter than those of wrought iron used in the city streets; and as the material is less durable, the joints are well worn, and the travelling good for dyspeptics. There are also some sharp curves and steep grades, which are calculated to test the power of a locomotive. But with all these difficulties the car made its trip in thirty minutes, against forty-five usually taken by the horse cars. It was really agreeable travelling, too, for the car was heated by steam pipes, so that it was as comfortable inside as in a parlor. There is no escape of smoke, as the engine consumes only anthracite, and uses up its own gas; nor is there escape steam, that being carefully provided against. Thus, when the locomotive is under full headway, there is no puffing or blowing, no wheezing to be heard outside, and, in fact, nothing to frighten a horse. On the road, all sorts of vehicles were encountered, drawn by every description of horse, from the thorough-bred to the common draught horse; they were passed at the ordinary pace and without stopping, but none of them took fright; and this settles clearly enough that the steamer will not frighten horses. The car is warmed in winter by steam pipes along the floor. Yesterday was a raw, disagreeable day, and we had occasion to observe that the car was comfortably warmed by these pipes. The temperature, too, may be increased or diminished, at the will of the engineer, an important consideration in our variable climate. In summer the steam car may also be kept cool by the same agency which heats it, by simply attaching a steam fan to the engine, the fan to be stationed in the centre of the roof of the car."

Thus much for the first experiment of any note that has been tried upon the street railroad. It was, in our opinion, a decided success, and should wake up our city railroad companies to action; this old war between horses and steam is renewed, but we hope it will soon have its final quietus.

We will conclude this chapter with an anecdote of the first engine introduced upon the Baltimore and Susquehanna railroad. This road was built to run with horses, and in some of the first circulars issued by the company, the road was spoken of as being delightfully picturesque, winding among beautiful scenery, and forming a most interesting ride—rather different from the emperor of Russia's idea of a railroad, which he laid out with a ruler, by describing a straight line from Moscow to St. Petersburg. Against the wish of the president of the company an engine was imported from England in the brig Herald, about the year 1830, and was put upon the road under the management of an English engineer. While standing upon the track one day, fired up and ready to start, the president, who was absent on her arrival, came down to look at the strange animal. He was accompanied by one of the directors, who had already examined the iron steed and was desirous of exhibiting it to the best advantage. The engineer being temporarily absent, the two mounted upon the platform. "Thee sees, friend," said the director, "this lever; well, by drawing it toward thee (suiting the action to the word), the machine will retreat, and by pushing it from thee, it will advance; thus the competent man can handle it as readily as thee can drive a horse. If thee turns this little crank the steam will commence working, and the engine will start." And sure enough the engine did start, for the honest Quaker, in order fully to explain its action, had opened the throttle. Away went the iron horse, affrighting them out of all presence of mind, and increasing in velocity at each stroke of the piston, until it reached one of the picturesque curves that had so much delighted the president, where, with one bound, it left the track and turned a summersault down the embankment. Both parties were hurt, but most fortunately escaped with their lives.

CHAPTER IV.

STATIONARY ENGINES.

This is the oldest form, being but a modification of the first steam pumping engines; not being confined to space as in the locomotive and marine engine, these machines have admitted of a greater variation of form, and a better chance of artistic display than any other, consequently we have many instances of elaborate workmanship and a great variety of design. The majority of stationary engines in use may be divided as follows: the beam, the horizontal, the steeple, the oscillating, and the rotary engine. The beam engines are commonly low-pressure or condensing, and are mainly used for pumping, or where great power is required; the motion of the piston is communicated by the working-beam to the pump or crank-shaft at the opposite side of the machine. The horizontal engine is probably the most used at a high pressure in this country; its advantage is the facility with which it is put up, and its steady working; every part being firmly attached to a solid bed, requiring but little bracing to keep it in place. The disadvantage of a horizontal engine is the unequal wear of the cylinder, due to the gravity of the piston. The steeple or vertical engine has, like the beam engine, an upright cylinder, but is connected directly to the main shaft above or below. In all the above-named engines the cylinder is stationary, and the reciprocating motion is changed into rotary by means of a cross-head, slides, and connecting-rod; in the oscillating engine the cylinder vibrates upon trunions, placed sometimes at its centre, and sometimes at its end; thus allowing the piston to be coupled to the crank, and doing away with the cross-head and slides. The advantages of this engine are its reduced size and expense. In the horizontal and other engines the steam valve is moved by an eccentric, but in some oscillators the trunion box forms a self-working valve both for induction at the one side and eduction at the other. The disadvantages of an oscillator are the liability to overheat its trunions and the difficulty of keeping them tight. An oscillator costs less at the start, but requires more oil, and is of doubtful economy.

The change of the reciprocating into the rotary motion was a problem for many years, and the idea that there was a great loss of momentum in the constant stopping and starting of the piston at each end of the stroke induced many mechanics to study some method of obtaining a direct rotary motion, or, in other words, to produce a rotary piston. It was at once evident to the merest novice that a rotary engine would be in reality a rotary pump reversed, and consequently the rotary engines bear so strong a resemblance to the oldest rotary pump as to instantly strike the eye of any one who has seen the two. One of the most successful rotary engines of to-day is that of Holly, of Seneca Falls, New York, and this is only a modification of Murdoch's rotary engine, which is, in turn, a perfect copy of an old pump taken from Serviere's collection. It may be thus described: two cog-wheels fitted accurately to each other are inclosed in a case; each cog is grooved and fitted with packing, bringing it into steam-tight contact with the circumference and sides of the case. The axles of the cog-wheels are continued through the sides of the case, and geared together at each end to prevent friction upon the centre cogs; now, if revolved, each cog will act as a piston, but as the cogs in contact in the centre lap each other, the piston surface at each extreme of the case will be just double that of the centre, and this surplus of force gives motion to the two axles. The pump of which this engine is a copy was invented as long ago as the sixteenth century.

A patent was obtained in England in 1825 by Mr. J. Eve, an American. Within a cylindrical case a hollow drum was so constructed as to fit closely to the case; floats, or pistons, were cast upon its periphery, and packed to fit the cylinder; on one side of the main cylinder was a small recess filled with a small drum, that revolved in contact with the main drum, this small drum having a segment removed to receive each piston as it passed, and having its diameter so proportioned to the main drum as to revolve once between the passage of each piston or float. Other rotary engines, on a plan analogous to the above, differing only in the manner of opening the valve, have been invented, and copied from the ancients, some of which are exceedingly complicated, but they have always been unsuccessful in practice, principally from the fact that it is exceedingly difficult to pack them. If they could overcome this fault without adding friction, the rotary engine would be very valuable on account of the small space it occupies.

The demand for stationary engines, from one horse power upward, during the last twenty-five years, has been so great that now almost any machine shop is prepared to build them, and of course, while such is the case, thousands of engines are annually built that would better bear the name of steam eaters than steam engines. In some of the small engines that flood the market, the first principles of steam are practically ignored, and there are at this moment running in the United States engines that consume more coal to do the work of ten horses than a properly-constructed one would use to do the work of twenty. As an instance of the truth of this statement, we will take the engines built by Messrs. Corliss & Nightengale, of Providence, over an engine that was working to good advantage in the James Mills, Newburyport, but was removed on the representation of the builders of the new machine, that they would take five times the saving of the first year's fuel as sole payment of their engine. The James Steam Mills contained 17,024 spindles, and, including the weaving and all the preparations for making sheeting and shirtings, required a hundred and ninety horse power; their engines were condensers; cylinders, twenty-four inches by four feet length of stroke. Ten thousand four hundred and eighty-three pounds of coal per day was the average amount used during five years previous to the contract for the new engines; this included the coal used for dressing, heating, and all other purposes for which steam is used in such an establishment. The new engines were high-pressure cylinders, eighteen inches by four feet stroke. By the terms of contract under which the change of engines was made, it was at the option of the company to pay for the new arrangement the sum of ten thousand five hundred dollars cash in lieu of the saving of coal; but the choice was to be made before the new engines were put in operation. In view of the favorable results obtained by the former engines, they decided to pay in the saving of fuel. The new engines were run one year from December 3d, 1855, and the average amount of coal used per day was found to be five thousand six hundred and ninety pounds. The coal being reckoned at six dollars per ton, Messrs. Corliss & Nightengale received nineteen thousand seven hundred and thirty-four dollars and twenty-two cents. Thus it will be seen that the builders received nearly double price for their engine, and yet it cost the owners of the mill nothing for a machine that was destined to be a source of great saving in their future expenses.

The singular character of Mr. Corliss' bargains attracted much attention to his engines, as they showed conclusively the advantages thereof over the old plans. The above experiment was a comparison between his engine and what had been considered a good machine; in the following, however, we see its great advantages over a more ordinary engine. In March, 1852, Mr. Corliss contracted with Crocker Brothers & Co., of Taunton, Massachusetts, to furnish them with an engine that would do the same work they were then doing with five tons of coal per day, and yet only consume two; agreeing to forfeit one dollar per pound, for every pound per day used above that amount. This contract was successfully filled without taking out the old boilers.

Mr. Corliss' engines possessed, as may be readily supposed, several important improvements, one of which was the manner by which its speed was regulated. Watt regulated by connecting the governor with the throttle-valve; Corliss used no throttle-valve, but connected the governor direct to the cut-off. This connection of the governor was not of itself the improvement of Mr. Corliss, as that had already been done by others; but it was the manner by which this connection was made, which was at once simple and efficacious, for which he deserves credit. The use of the throttle-valve was always attended with a wire-drawing of the steam. This wire-drawing is a reduction of the expansive force of the steam, and is always attended with more or less condensation; so that every form of cut-off, used with a throttle, is more or less imperfect. By thus dispensing with the throttle-valve altogether, and opening the steam-valve suddenly, the pressure of steam in the cylinder approximates very closely to the boiler pressure. The valves in the Corliss engine are circular; and by his automatic method of varying the point of cut-off, he gains a great advantage, as he cuts off suddenly without danger of slamming, as in the use of the puppet-valve.

We do not wish to be understood to say that the Corliss engines are the best in the market; they are among the best; and we have dwelt thus long on some of their merits in order to contrast them with others. When we add the fact that one-half of the stationary engines in the United States are run by boys or men not capable of managing a modern cooking-stove, the reader can realize to some extent the economy of cheap (?) engines and cheap (?) engineers. Steam is a good slave but a bad master; and the fearful loss of life in the United States during the past forty years, from the explosion of steam boilers, is mainly due to bad management. Boilers are in constant use all over the country, carrying a pressure double—nay, triple—that for which they were intended; the safety (?) valve weighted down by old pieces of iron, stones, etc., to such an extent that the *runner* no more knows what pressure he is using, than does the stranger who is passing his door. In thousands of cases the steam-gauge, which, at least, gives the pressure when in order, is not used, or never tested; and what was intended as a preventive, becomes, by a stoppage in the connecting pipe or a derangement of its machinery, a source of treacherous security. Many a man, on being asked why he does not use a steam-gauge, will reply that they are not reliable, or that the safety-valve is good enough; and yet that same man is perhaps employing an engineer that could not calculate, to save his life, the amount of pressure he was carrying, or, the size of his safety-valve being given, tell its area in square inches. "We can point out places where the engines, beautifully designed and executed in their details, are nothing but a mass of slime and grease from bed-plate to cylinder-head, the deposit of no one knows how many weeks of inattention and neglect, while a stolid *runner* sits calmly by, as though rather admiring the state of things than otherwise. When such is the case where every thing is visible, where is the necessity of looking among the usually unsearched portions of the machine for safety and economy."

A steam boiler blew up in Brooklyn a few months ago, and we went over to examine it; we were told the engineer had run an engine for some time. Whether this was true or not, the man was one who did not understand his business, as is sufficiently evident from the following reasons: his pump was small, but sufficiently large if in good order—which it certainly was not; we took out the piston with ease, and put it back again readily, although it was entirely covered with the coarse gravel and sand thrown about by the explosion. The safety-valve was held in its place by a rod passing through a plate; this rod, originally a good fit, was so firmly rusted in its place, that all the force we could exert on the end of the lever was not sufficient to move it. We unscrewed this plate, and it required two or three smart blows of the hammer to drive the rod out. In our opinion, it would have taken not less than twelve hundred pounds in the boiler to have started that valve, allowing that it had the weight upon it that we saw. The owner stated that the valve always leaked more or less; but on looking at it we were convinced that if it rested upon its seat, it never could have leaked, as it was a ground joint and a good one. We consequently came to the conclusion that the valve was not held in its place by the weight on the lever, but simply by the rust on the valve-rod or stem, the weight at the end having nothing to do with it. The safety-valve was bolted on to the steam dome with four 5-8 bolts, and was evidently blown off at the same instant as the flue collapsed, as it was found in the shop near the engine, while the boiler was thrown at least seventy-five feet against a house.

We might name scores of other accidents resulting from similar causes, of which the above is a fair sample; but it is evident enough, from what we have already said, that there is a want in the community yet unfilled—one that should receive the careful attention of every public man. What we need is a law compelling the owners of steam boilers to have them inspected at least once a year, and properly provided with *safety-valves* and other trustworthy appliances; it also should be imperatively their duty to employ *engineers*, and not mere runners. A law framed upon the United States steamboat inspection plan would be of incalculable benefit to the owners themselves, as well as the community at large.

The gradual introduction of the stationary engine has been of infinite value to our country as it is, but if rendered safe as it might be, its value would be increased fourfold. It is now no longer necessary that the manufacturer should locate beside a waterfall, and transport his manufactured goods for miles to a market; he can establish himself beside the railroad, the steamboat, nay, in the city itself, where his customers dwell. Thus, the stationary engine tends to centralize manufactures, while the locomotive and steamboat lengthen the arms of trade.

The portable engine has lately come into general use, and, like the stationary, is made of various forms, in all of which it resembles the latter, with the exception of placing the engine directly upon, or against the boiler. These engines are used wherever it is necessary to do work sufficiently great to pay for them, but not for permanent business, such as pile driving, excavating, etc. Among the simplest of this class of engines, may be mentioned Reed's oscillator, and Hittinger, Cook & Co.'s. A portable engine manufactured at the Washington Iron Works, contains all the safety and economic appliances of the best stationary engines; a description of these portable engines will answer for this class of machines. The boiler is tubular, commonly called a locomotive boiler, and is mounted upon two large wheels at the fire-box end, and two small wheels at the smoke-box end, so fitted as to turn beneath the barrel. The steam dome is over the fire-box, and is fitted with safety-valve and steam gauge. The cylinder is fastened to a hollow frame that serves as a feed-water heater, and is placed very near the steam dome, thereby preventing radiation in the steam pipe. Upon the top of the steam chest is placed the governor. On the front of the boiler we find the smoke pipe, and, directly behind it, the main shaft and a pair of balance wheels. The next matter of interest is the arrangement of the main slide-valve of the engine, which is well known to cause much loss of power, in the ordinary construction, by the friction caused by the pressure of steam on its back. This is entirely relieved by a very simple method in this engine. The valve, which is an ordinary one, has a solid protection at each end, which rests on a roller. These rollers are made at first slightly too small, but the grinding away of the valve on its seat soon causes the projections to rest on the rollers, when all the sliding friction at once ceases, and the valve works free from friction except that caused by the stuffing-box around its rod. It is evident that this arrangement will not readily get out of order, for when the rollers wear, it brings the valve on the seat, which at once begins to wear, and the pressure once more is brought on the rollers; hence, it is self-adjusting. The rollers being removed, reduces it to the usual slide-valve.

The force pump has been a fruitful source of trouble to all those who have ever had charge of a small steam engine having a quick motion; indeed, it frequently gives trouble in larger engines, from the accumulation of air in the chamber, which prevents its suction. It is usual to have attached to the lower part of the pump, or valve chamber, a small air-cock, and, when the pump is to start, the attendant places his finger on its extremity as soon as the plunger reaches the bottom of the pump, thus expelling the air; then, on the rise of the plunger, a vacuum is formed, and the pump fills with water; the cock is then closed, and the pump left to itself. As soon, however, as air collects from any defect of packing, or otherwise, the pump ceases to work, and has to be again started as before. This difficulty is entirely got rid of by the simple contrivance of an air-trap, whose valve, opening outward at each downward stroke of the pump, allows the air to escape, accompanied with a little water, and closes by the atmospheric pressure as the plunger rises.

Within the last five years, the labor of loading and unloading vessels at our wharves has been performed by hoisting engines. These are all run at high pressure, and do the work with economy and dispatch. One of the best of these machines is made at the shop of Hittinger & Cook. The steamer Matanzas carries one on board, to use at the other end of the route. The hoisting so much resembles the portable engine, as not to require especial explanation.

In most of the steam sawmills in the United States, the fuel consists of the sawdust made at the mills, and thus the cost of running is greatly reduced; in other engines, coal is almost exclusively used. In fact, the enormous amount of wood consumed by steam engines throughout the United States, has so called the attention of mechanics to coal-burning engines, that it is not probable we shall use wood as fuel many years longer. One of the greatest fields for economy in the use of steam, now open, is the waste of combustible gases by the chimney, commonly spoken of under the term *smoke*, but often consisting of the best part of the fuel, unconsumed from the lack of oxygen, and, in some cases, lack of caloric. Tubes, to conduct atmospheric air to the surface of the fire, have been in use some time, also the perforation of the fire door; but the tubes being exposed to an intense heat, soon become of no value, and the openings at the door and sides of the fire-box only partially supply the oxygen. A Mr. Pierce, of Troy, has patented a plan for surrounding the air tubes with water, thus protecting a passage direct to the middle of the fire; we have not seen this plan tried, but think it would be a source of economy.

Stationary engines being the most plenty, it is upon them that are tried nearly all the new experiments. At the present time, the use of super-heated steam is attracting a great deal of attention. In order to understand this subject, it is necessary that we should look closely into the nature of steam itself. It would defeat the purpose of this article if we were to go into a lengthy argument upon the relative merits of the various theories that have been advanced by scientific men upon steam, and, consequently, we shall merely give our own opinions upon the subject—opinions at which we have arrived by careful study and experience, it being understood that the laws of steam are at best comparatively unknown. The analyzation of simple steam is yet to be made; we will, however, call it water converted into an aëriform state by the electrization of its particles by caloric. Simple steam does not, however, in the present construction of boilers, come into use as a motor, from the following reason: steam has the same affinity for liquids that all fluids have, forming an electro-magnetic combination to which there is no barrier; it will then absorb and hold in suspension particles of water whenever in direct contact therewith, and, consequently, all steam formed in the boiler will hold in suspension a portion of water, and become, in lieu of simple, surcharged steam. Thus, steam at 20 lbs. to the square inch holds in suspension nearly double its weight of water. What is the effect of this? First, the water thus carried off in suspension is at the maximum temperature, or equal to that of the steam containing it, and the invested heat of this water is not only wasted to a great extent, but these water particles become a very serious tax upon the real steam with which they are admixed, as follows: having been heated under the maximum pressure of the steam with which they are incorporated, they have a corresponding temperature, and as the latter, the steam, expands in the steam pipes, on its way to the cylinder, and in the cylinder itself, the pressure becoming correspondingly less, these particles flash partially into steam, but not containing the total amount of heat necessary to their constitution as elastic vapor, they absorb into the "latent" form a quota of heat from the surrounding particles of true steam, thus condensing them; for steam, be it remembered, can part with no portion of its legitimate heat without condensation (unless it be super-heat, of which presently), it being understood that the absorption of sensible heat (temperature) into the "latent" form, and which is the exact measure of the force exerted by steam under all circumstances, whether usefully realized or not, is not here meant as a loss of heat. That there is a loss by direct condensation because of the presence and action of these water particles as explained, may seem to some at the first glance a paradox, but there is in the case of steam, and between the particles of all matter, a certain impetus and momentum in the transference of that unknown something, which is their "*vis viva*," or cause of elasticity. The electrician knows this well; *vide* the "lateral discharge" and return stroke. Again, for more common place example, fasten by one extremity a straight spring, bend it, release it, it flies back, not to its original position of rest or neutral point, but far beyond, though finally it will settle there. And so it might be held that the particles of steam would make "reprisal," so to speak, of the heat stolen by the particles of water flashing into steam, as set forth; and so they do, but meantime the piston is moving on, and this heat, the source of the elastic force of the steam, cannot, it will be evident, be acting efficiently in two or more directions at the same time; but this is not all, the more watery particles in the steam, the more heat wasted by conduction to, and radiation from, the steam pipes, cylinders, etc.

Water is classed as a non-conductor of heat to a high degree, but it is a medium radiator, and it vastly exceeds steam and other aëriform fluids in both these respects. This, to a great extent, accounts for the sudden falling off of power during "priming," so well known. But there is still another, as it were, negative loss due to this water carried off in the steam, because, by its minute subdivision, it exposes an immense surface to heat, particularly radiated heat, that might be brought to act upon it, and thus quickly transform it into perfect steam, much augmenting the volume of the whole, and being generated at less cost than the first portion which held it in suspension; and it is through the avoidance of the evils before mentioned as due to these water particles, and the gain produced by their conversion into elastic steam, that so much economy is found in the use of super-heated steam, which is steam that has received an excess of heat (temperature) beyond that normally due to its pressure when in direct contact with the water from whence it emanated. The system, however, is fallacious, because pure steam, and all other known aëriform fluids, expand only about 1-540th part of their volume, at the ordinary atmospheric temperature, for each degree of Fah. additional forced upon them. Pure steam thus, say at twenty pounds to the square inch, would require to be elevated to a temperature of about eight hundred Fahrenheit to double its volume if under a constant pressure, or to double its pressure if under a constant volume (the quantity of heat being, however, very different in the two cases); whereas the mere added temperature in this case would correspond to that of simple steam at a pressure of about seven hundred and fifty pounds to the square inch, not to mention that such, and far less temperatures, would destroy all packings, prevent lubrication, cause "cutting," warp valves, etc. There are other practical defects. Although there is no difficulty in super-heating the steam to any desired extent according to the size of the super-heating vessel and the part of the smoke or fire space in which it may be located, yet it is very difficult, if not impracticable, to maintain a proper average under the influence of fluctuating fires—at one time in full glow, at another freshly trimmed, and an uneven draft, damp or dry, weak or strong; the engine at one time under full motion, and a rapid flow of steam passing through the super-heater, and at another time the engine stopped, and there being little or no flow of moist steam through it to protect it from being overheated and "burnt out," or rendered brittle and insecure. Hence, if super-heating be attempted at all, it should be to the minimum degree, and not with the expectation of an important access of power that no degree will afford, but only to an extent sufficient to supply radiation from the various parts of the engine, etc., during the travel and action of the steam, thus preventing its condensation, which, to a given extent, involves not only that much immediate loss, but the more important coactive evils due to the presence of watery particles. The great and main object, then, is accomplished by the production and use of simple (dry) steam; any modicum of water present possessing but the negative advantage of supplying lubrication, and any "super" heat, that of supplying radiation.

We have dwelt at some length upon the laws of steam, but at best we can do but little justice to the subject, and, as we have already said, this article is intended mainly as a statement of the effects rather than the causes, still we could not refrain from touching upon a subject that has already and is destined still to attract so much attention as this.

We cannot leave this branch of the subject without alluding to the new pumping engine lately erected at the Brooklyn Water Works. The impression is still generally prevalent that gravitation supplies of water for cities are cheaper and better in all cases where it is even possible to have them. It is plain, however, from numerous results throughout Europe and America, that the annual cost represented by the interest on the capital expended for gravitation supplies, except in special instances, far exceeds the annual cost of interest and maintenance incurred by properly arranged steam supplies, and that the quality of the water obtained is generally superior. In this respect, the contrast between New York and Brooklyn, which cannot be detailed here, is conclusive. This engine was built at Hartford, Conn., by Messrs. Woodruff & Beach, R. W. Hamilton, Esq., being their superintending engineer. It is a double-acting Cornish engine, with all the peculiarities of the single-acting English engine, very much modified and improved. It has three return drop-flue boilers, thirty feet long, eight feet diameter, using about fifteen tons of coal per day. The engine has a cylinder of ninety inches bore and ten feet stroke, working a lifting pump at each end of the beam, of thirty-six inches bore and ten feet stroke. The lower pump under the cylinder works through it, and each is provided with an annular barrel, fifty-four inches diameter, with double-beat covers. The working buckets have double-beat valves. In smoothness of action, light friction, and pumping power, this engine takes the first rank among the pumping machinery of the world. It is more powerful by sixteen per cent. than the celebrated Leeghwater engine at work in the Harlem Meer. This result is highly creditable to Messrs. McElroy & Wright, under whose careful study and mechanical skill its several improvements were jointly developed.

The contract required the engine to lift six hundred thousand pounds of water, one foot with one pound of coal, with a delivery of ten million gallons in twenty-four hours; and to be further capable of delivering ten million gallons in sixteen hours. But this engine has done even better than this—14,500,000 gallons being its ordinary work. Although the most powerful, this engine is not the largest in the world, the Leeghwater engine bearing the palm in that respect. The Cornish engines, of which this is in most respects a type, are generally favorites among engineers. This system rejects the use of cranks and fly-wheels, gearing, or any other absorbents of power, and independent regulators of action—three essential elements of economy. The abundant records on file of the actual results in practice, go to show conclusively, that in the facility for carrying high steam, for great expansion, and in lightness of friction, the Cornish engines have the precedence of all others. No engines carry higher boiler pressure in pumping—a feature in itself of vital importance to economy; no engines habitually work under greater expansion; and it is impossible to improve on their simplicity of motion in the working parts. These are three conclusive distinctions; and the results obtained in the Brooklyn engine, which belongs to this school, are remarkable. Here is the most powerful pumping engine on the globe, with a frictional loss between the cylinder and pumps of only seven and a half per cent. Here is an engine which has doubled its boiler pressure by the simple addition of a few tons of counter-weight to its inertia, increasing its duty thirty-three per cent., and which only requires a greater addition of weight to carry its steam gauge, its expansion, and its duty, to the highest range of the European school.

Thus it will be seen that the results obtained with this engine on so magnificent a scale, have a very important bearing on two prominent engineering questions. First, in demonstrating the economy and value of a steam pumping supply; and second, in sustaining the Cornish school of practice in the construction of pumping engines. And more than this, the Brooklyn pumping engine has demonstrated that, however good the original Cornish engines may be, American mechanics can produce as good, if not better, at home.

CHAPTER V.

STEAM PUMPS.

The great desideratum in a machine for extinguishing fires, is the rapidity with which it can be set to work, and next to this the quantity of water it will throw to a given height or distance. The machines that best filled these conditions were doubtless the American hand fire engines; but steam has now turned fireman, and in the contest between his iron arms and human muscle, we can readily determine the result. At first, time was the all-important item; all were ready to acknowledge that after the fire had attained full headway, the untiring efforts of steam were all-powerful, but as the majority of our fires were nipped in the bud by the rapidity with which the hand engines were brought to bear, it was not believed that steam would ever become economical, and rarely efficacious. An engine was constructed for the insurance companies of New York some twenty years since, but abandoned as too expensive; it was located in a house containing a boiler, wherein steam was constantly kept up at a low pressure, and so arranged as to discharge its water into the engine on an alarm of fire being given; beneath the boiler of the engine, shavings and light fuel were kept constantly laid, so that by the time the machine reached the fire it would have steam up and be ready for use. This was planned by Ericsson, who also planned the Braithwaites engine, used in England. The latter had two cylinders of about six inches in diameter, one for steam and the other as a pump; they were placed horizontally. This engine would deliver nine thousand gallons of water per hour to the height of ninety feet. The time consumed in getting to work from cold water was eighteen minutes. An engine built for the Prussian government in 1832 had two steam cylinders of twelve inches in diameter, with fourteen inch stroke, and two pumping cylinders of ten inches diameter. With a steam pressure of seventy pounds per square inch, this engine threw an inch and one quarter stream one hundred and twenty feet perpendicular; and an average duty was called ninety tons per hour. She consumed three bushels of coke per hour.

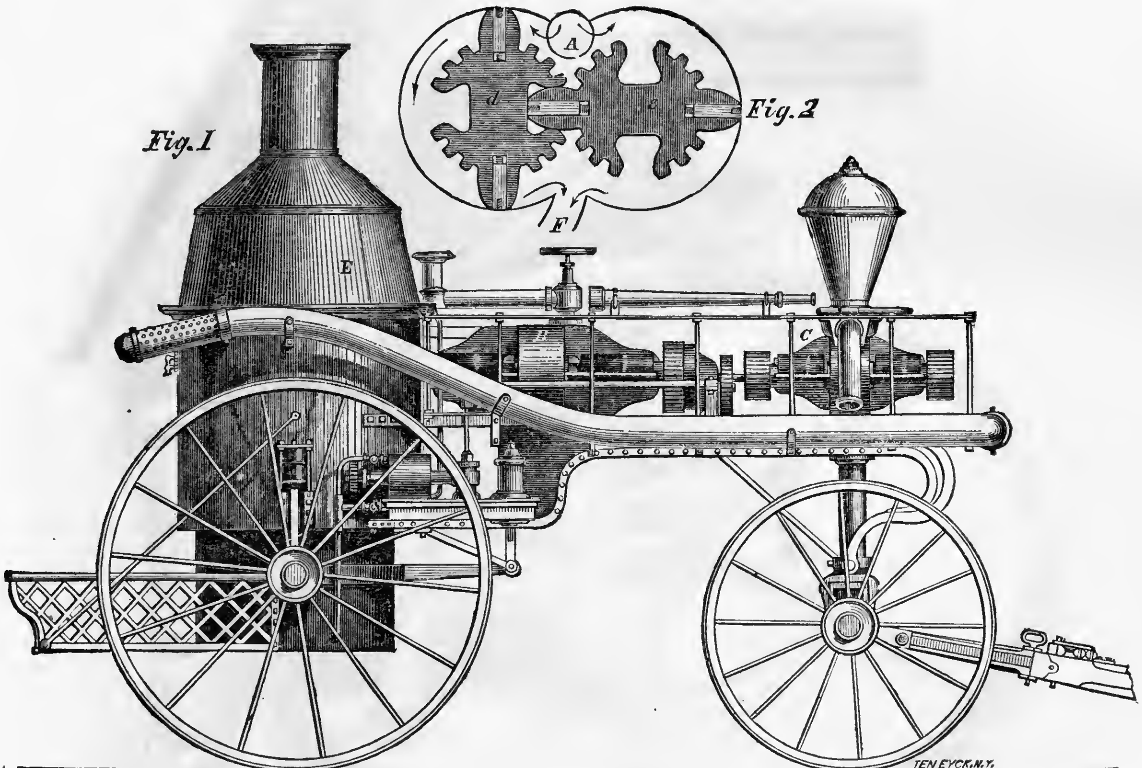
Such were the first steam fire engines. Experiments were frequently tried in the United States, but the whole subject remained in doubt until the year 1852, when the first public trial was made in Cincinnati. A steam generator, or boiler, which had been made for the purpose, was placed in connection with a steam cylinder and the pump of a fire engine belonging to the city, the whole mounted on suitable wheels and frame. A committee of the city council witnessed the experiment. From their report it appears that steam was raised from cold water, the engine started, and water discharged from the nozzle to the distance of one hundred and thirty feet, through three hundred and fifty feet of hose, in four minutes and ten seconds from the time that smoke was seen to issue from the chimney. The demonstration was convincing, and did convince. The city council contracted for a steam engine to be built on the same plan, and this engine, when completed, was placed in service under the charge of a company organized and put under pay by the city. Thus the first paid fire company, to operate with the untiring energy of steam, was brought into existence—the first of the kind in any age or country. Steam, whose resistless power had been so extensively used in the fabrication, development, and transportation of property, was at last compelled to aid in its preservation from fire. Its superiority over muscular power, acknowledged for other purposes so numerous, was to be asserted against conflagration; and a city not a century old, west of the Alleghanies, attracts the applause of intelligent men everywhere, and the pride of western men, as the scene of this achievement.

After this successful experiment and the organization of the paid department, Miles Greenwood was appointed chief engineer, and it is to his energy and perseverance that we owe the success of the steam fire engine. These steamers were constructed by Messrs. A. & B. Latta; the first in service was called the "Uncle Joe Ross." The circulation in the boiler is kept up by pumping, and thus steam is generated in a very short space of time; it is not, however, unattended with danger. After the success of Latta's engines, several manufacturers went into the business. Reaney & Neafy, of Philadelphia; Lee & Larned, of New York; Silsby & Mynderse, of Seneca Falls; the Amoskeag Manufacturing Company; the Boston Locomotive Works, and several others. Reaney & Neafy used what is commonly called the locomotive boiler; their engines gave good satisfaction, and at a trial in Boston, in 1858, they received the prize over three competitors. Of the Lee & Larned self-propeller we have already spoken (J. C. Cary and J. G. Storm); they, however, build a light hand engine, and have heretofore furnished all the steamers for New York city. Their boiler is of the upright annular form, Cary's patent, and their pump is rotary, patented by the same man.

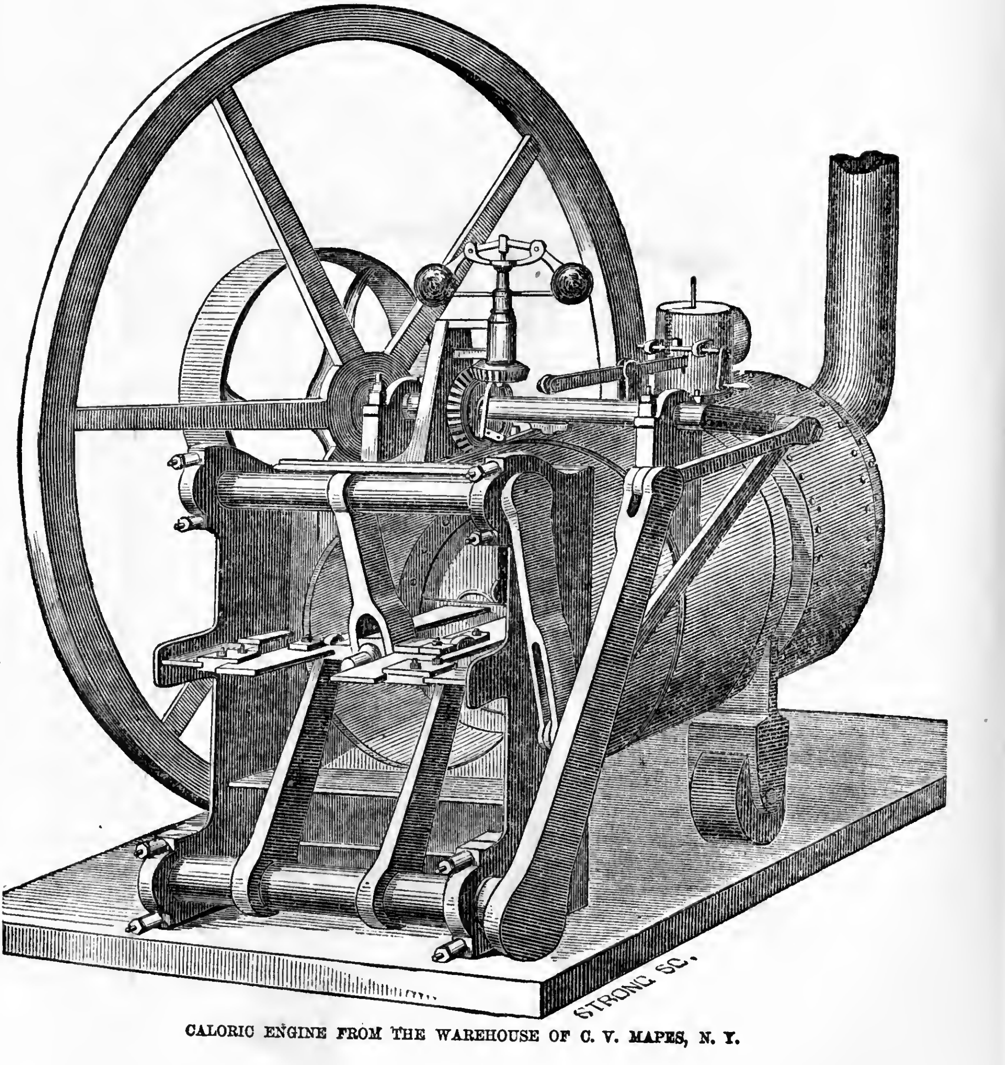
The Amoskeag steam fire engine has some peculiar features, among which may be named the vertical cylinders and pumps, by the use of which they avoid to a certain extent the shaking that is so objectionable in some of the other machines; also the arrangement of their gauge cocks so as to cover the whole side of the boiler and show at once the height of the water, which is used in this boiler at a very low point in commencing, thereby enabling them to get up steam very rapidly. At a trial in New York in September, 1860, they obtained a working pressure from water at 90° Fahrenheit in three and one-half minutes. These machines have thrown a one and three-quarter inch stream two hundred and twenty-five feet high. They weigh about six thousand pounds, and are intended to be drawn by horses. The Selsby & Mynderse engines are entirely different from any other in their construction and operation; the engine and pump are both rotary, and are built after Holly's patent; we have already spoken of this engine under the head of Stationaries. The weight of these machines is as follows: to be drawn by men—four thousand five hundred pounds light; five thousand one hundred pounds with fuel, water, suction hose, etc., all ready for service; this size is warranted to force a one and one-eighth inch stream two hundred and twenty-five feet, or two, one hundred and eighty feet, with a steam pressure of from forty to sixty pounds. To be drawn by horses—five thousand six hundred pounds light; six thousand three hundred ready for service; forces a one and one half inch stream two hundred and twenty feet, or two one inch streams the same distance. These machines will get to work in from four to six minutes. The best work ever done by this style engine was in Providence, R. I., where an engine weighing six thousand two hundred pounds, threw a one and a quarter inch stream two hundred and fifty-five feet horizontal. One great advantage of the Holly pump is that it runs steadily, no chocking being required to keep the engine in place while on duty, as is the case with all engines having reciprocating pumps.

Other steam fire engines, for the use of factories and large buildings, not intended to be transported, have been in existence for a greater length of time; these machines are also used as auxiliary pumps for supplying water to the boilers of larger engines, and are generally called "doctors," or "donkeys." Among the best of these are Worthington's and Woodward's steam pumps. The importance of an auxiliary pump, in all cases, cannot be too much dwelt upon. If the pump be attached to the main engine, it is evident that on the lack of water in the boiler, the main engine must be started. This is not always possible. A sudden break down in a mill would necessitate the uncoupling of the shafting before the boiler could be fed. The lack of water at a station when waiting for a train, obliges the engineer to run back and forth upon the road; and if a boat stops at a wharf, or is enveloped in a fog, the power that works the pump ceases with the engine. But how is it when the engine itself breaks down, or the locomotive is embedded in a snow bank, as is sometimes the case? Why, the engineer must draw his fires to avoid ruining his boiler. Bearing these facts in mind, the advantages of an extra steam pump are obvious.

The Worthington pump is exceedingly simple in its construction; as the reciprocating motion in the steam and water cylinder is the exact motion required, the cross-head, slides, and balance wheel are dispensed with as useless. In the Woodward, however, the connecting-rod, crank, and wheel are retained to give motion to the valve, which in Worthington's pump is moved by an arm attached to the piston rod. Both of these pumps are favorites, and it is difficult to judge which is best. The importance of these steam pumps as auxiliaries is not, however, their only advantage. On board of our steamboats, such pumps as are provided in case of fire are often rendered of no avail by the necessity that exists of stopping the progress of the boat in order to check the current of air, which otherwise would increase the flames. And let a fire engine be kept on board for the single purpose of extinguishing fires if they happen—does not our common experience teach us that in so imminent a danger, when all are seeking personal safety, and unwilling to await the issue of a doubtful effort for the general preservation, such a machine will be found a very questionable dependence? Will they not be difficult of access at the moment, or out of order, from rust or disuse, when most



SILSBY'S FIRE ENGINE, HOLLY'S PATENT PUMP—CHAS. W. COPELAND, AGENT, 122 BROADWAY, N. Y.



CALORIC ENGINE FROM THE WAREHOUSE OF C. V. MAPES, N. Y.

needed? And does the confusion, which is always attendant upon such an occasion, allow of reasonable hope that they will be found and repaired in time to be of use?

These are questions which can, perhaps, be best answered by those who have witnessed the scene of a steamboat on fire. But with the "donkey" engine, the case is quite different; being constantly in use, it is always in order, and in case of fire it can at once be brought to bear upon the flames; it is also always at hand in case of a leak that overpowers all other available pumps; and, in fact, its advantages are so great that no boat, locomotive, or stationary engine should ever be run without one. For large pumping operations, also, it is believed that the Worthington pump has many advantages. The power is direct, all the motions are rectilinear, the friction is not great, nor is the wear excessive. A steam and a pump cylinder attached to one frame, with two pistons, two valves, and two rods, comprise the whole machine. The economy of the donkey engines is obvious where steam is only employed for boiling, or for warming buildings, and where the large and costly engines usually provided in such cases, are used solely for driving a pump to supply the boiler. The steam used to drive it, whether of high or low pressure, is, of course, just adequate to the required work of forcing water into the boiler against the same pressure.

The Worthington pumps are made of a great variety of sizes, from the miniature ones used as feeders on the Lee & Larned fire engines, up to the huge pumping engines for water works. The only fault we have ever heard found with them is the trouble of starting; this cannot, however, be very great, inasmuch as a pump, to be efficacious as a feeder for a fire engine, must be readily started or it would be almost valueless. The Woodward pump has much more brass used in its construction than any other, and is therefore not so liable to rust. The Holly pump has been constructed as an auxiliary engine, and, in fact, on some of their larger machines a small one is used as a feeder; it occupies but very little space, and is well spoken of by those who have used it. A pumping engine manufactured by Messrs. Carpenter & Plass, of New York, has been lately introduced, and has the advantage over the Worthington of starting at once on opening the throttle; it being fully as simple. Other pumps of this class are manufactured all over the country, but none are so well known as the ones we have named. On some of the western steamboats they use small engines of the ordinary construction attached to the common force pump, but in no case are they so compact, easy of repair, or durable as the above-named steam pumps.

CHAPTER VI.

MISCELLANEOUS.

In the former chapters we have set forth the various forms in which the adaptation of steam is most familiar to the community; in all of which steam was used as a motor only; and before dismissing this portion of the labor of steam, we will allude briefly to some other machines, destined, perhaps, to effect as great a revolution in other branches of industry, as the locomotive and steamboat have in transportation, and the stationary in manufactures. Agriculture—that wide extended base, upon which we have built up this great fabric of commerce, manufacture, and trade—has been the last to experience a direct benefit from steam. The farmer is pre-eminently conservative, to which the monotonous routine of his business predisposes him; but the course of the giant worker, steam, is irresistible, and he, too, at last accepts its aid. For some time past the portable engine has been introduced to assist the farmer in the laborious duties of his calling, and soon will the iron horse be chained to the plough, swing the gleaming scythe, sow, reap, thresh, and winnow, while the husbandman will guide and direct the iron arms which do his bidding uncomplainingly. Already has the shriek of our new friend been heard upon the western prairie field, and the smooth-turned furrow attested his strength, but as yet he takes not kindly to his new-found toil, and the brains of a score of inventors are at work to teach him this new duty. "God speed the (steam) plough," say we.

But this great problem, the education of steam to its new duty, presents many difficulties. There are three kinds of engines—the locomotive, the portable, and the stationary—capable of being employed in steam cultivation; and there may, consequently, be three kinds of steam cultivators invented, each characterized, in its general features, by the kind of engine employed; though under each class there may be many modifications of parts, rendering the members of the same class as widely different as those of different classes. These varieties would be determined by the structure, form, or size of the engine itself; by the mode of conveying the power to the tools or implements with which it works; and by the nature of the tools or implements it uses. First, then, the locomotive steam plough; this may be employed to draw a gang of ploughs after it, or by a series of knives, cutters, or some form of cultivator, turn up the ground as it passes. The moving of this great mass, however, consumes much of the power, and the difficulty presented by steep grades is very great. The mere sinking of the wheels may be obviated, as it is in the Fawkes engine, by broad wheels, but even these sometimes slip. In Boydell's engines the machine lays and takes up alternately a succession of rails, upon which to roll. Hacket proposed to lay a temporary rail, but found it very expensive. The use of legs, or pushers, has also been tried in England, but was not successful.

The portable engine has been used in several ways. As a cultivator it was mounted upon a wagon drawn by horses. As a plough it has been placed by the side of the field, working a gang of ploughs by chains and cables; and after finishing one field, easily transported to another; this was called in England the Wolston system, but is at best very slow. The portable engine has also been used with anchors, and to warp, or draw itself along by stretched ropes. Each of the above methods of employing steam has its peculiar difficulties and defects. In the first one, two horses would be required to draw an engine of the lightest construction over safe ground, and up and down hill; and the advantage of the machine over animal power alone, would be only the difference between its work and what the team would do without it. The inventor, however, calculates that with an engine of two horse power, and of suitable construction, working a revolving axle, carrying tires armed with a kind of short spade toward their points, he can do the work of twelve horses, giving the work of ten horses and their attendants for the cost of feed and repairs, pay of attendants, interest of capital, etc. In the Wolston method the mode of transferring the power is indirect, the apparatus is complex and clumsy, and its success, thus far, has been but small. In the third plan, or that of the warping engine, the inventor asserts that he requires an engine of less than one-half the weight, power, or cost of any locomotive; that he avoids all indirect strain upon his cable, by getting the engine to warp itself from one side of the field to the other, by means of a single rope passing a couple of times round a drum; that the anchor at either side can be removed and passed forward six or eight feet, by one man, while the engine is travelling across the field; that, when using rotary cultivators, he has but little strain upon his cable; and, lastly, that when he is drawing ploughs, etc., he has the whole traction power of his cable to prevent his being brought to a stand by his wheels slipping. The stationary engine has been used to some extent, but we do not think it has sufficient merit ever to come into practical use.

As a motor for a dredging machine for deepening our rivers and harbors, steam has been in use since the time of Oliver Evans; and as an excavator it has long ago distanced human opposition. The millions of dollars that are annually expended in excavating earth, have attracted the attention of inventors to devise modes of aiding the operation by machinery, and large and costly machines have been made for this purpose in certain situations, especially in deep cuts of soft sand, which work well, and perform the labor of many men. Among many others, Messrs. Goodale & Marsh patented last year a machine that not only acts as an excavator, but transports the earth to the desired place of deposit, it being intended to work in ground free from large stones, or nearly so, and where the hills are not too steep for the ascent and descent of a locomotive running on broad wheels on the ground. This machine will prove particularly useful in the west.

Steam has always benefited the farmer by bringing him nearer to a market, and inasmuch as it reduces the expense thereof, it necessarily adds to his profit. The handling of the large amount of grain that annually passes through the large warehouses of our western cities, is of itself no small item, and here, too, steam lends its assistance, being adapted to the large steam elevators of Chicago. It has benefited the blacksmith indirectly by blowing his furnaces and driving the trip hammers, and directly within the past ten years in the immense steam hammers, where it is so much under control as to give a blow of several tons weight, or crack a walnut in the attendant's fingers without harming him. For this advantage we were at first indebted to England; but we are improving upon the model, and steam hammers will soon come into general use, of American manufacture alone. An enormous steam hammer on Naylor's principle was lately sent to Australia. The hammer is not only lifted by the pressure of steam from below, but the gravity of the falling hammer is assisted by the pressure of steam from above. The work is finished at one heat, saving both the fuel and time of second heats, also consequent deterioration and waste of iron. The effect of the blow of this hammer will be equal to the momentum acquired by sixteen tons making forty blows per minute. The hammer can be made to work double or single, acting instantaneously; and by the adjusting valve gearing, the length of stroke and force of blow can be changed instantly. In all gravity hammers the effect of the blow is dependent on the weight of the hammer, multiplied by the height of its fall, and consequently, the greater the distance it falls, the greater the force of the blow, and the slower is the speed of working. In the double-action hammer, thrice the force of blow can be given at double the speed. The principal dimensions and weights are: timber foundation, twenty-six feet by twenty-four feet six inches, depth, thirteen feet; cast iron anvil block, base eleven feet six inches by nine feet six inches, thirty tons weight; base plate to receive standards, nineteen feet six inches by fifteen feet six inches, fourteen tons weight; standards, ten feet six inches apart, weight fifteen tons; height from ground to top of steam cylinder, twenty-one feet six inches; weight of all, about seventy-five tons. Steam to work this hammer is generated from the furnace in which the work to be operated upon is heated, the boiler forming the chimney, and the heat passing up four flues in the same, thus economizing fuel and avoiding the expense of a brick chimney. The boiler is six feet six inches in diameter, and thirty feet long; weight, fifteen tons. The weight of the whole apparatus, including boiler and mountings, is about one hundred tons. This apparatus was constructed in England.

Steam has also been applied to cranes with great success. One of Morrison's steam cranes was recently loaded with forty-five cwt., the steam cut off from the boiler, and the load left to hang from the crane by the power of the steam already in the crane cylinder. After hanging for half an hour, the weight had descended only four inches. Many other applications of steam as a motor might be enumerated if space would allow, but we must now turn to the multifarious duties of steam in the useful arts. One of the most important of its applications is its use as a vehicle for transferring and uniformly distributing heat. Its large capacity for caloric gives it great efficiency for this purpose, as it holds and will communicate as much heat as a mass of red-hot iron, and will transmit this heat to a great distance, which iron will not do, for the heat will remain latent until the steam reaches its destination and becomes condensed. In order to apply steam to the warming of buildings, it is only necessary to use a close boiler, from the top of which a steam pipe can be carried to the top of the building; the boiler being placed as low as possible. This steam pipe is at the top connected with a series of larger ones, placed with a slight inclination near the floor of each room, connected each with the one above it, at its highest end; thus giving facility to the descent of the condensed water, which is so directed as to re-enter the boiler near the bottom. By such an arrangement, properly constructed, the entire caloric produced by the furnace will be distributed over the building. The small, or steam pipe should be made quite strong, and should have at least an area of one square inch for every six gallons of water evaporated per hour in the boiler. It will require occasionally an addition of water to supply accidental waste, and a ball-cock connected to the feed pipe would be useful; but by all means have a safety-valve upon the boiler.

The extent to which buildings are now heated by steam in this country is very great, and since the introduction of Gold's apparatus, and some others whose names we do not remember, steam heaters have been added with great advantage to private dwellings. They are certainly much more healthy than hot air, and, properly arranged and managed, need not be more expensive. The pressure is merely nominal, and therefore not a source of danger; the only disadvantage, that of leakage, is no greater than in the use of gas pipes. For large factories, steam as a heater is invaluable; and for warming hot-houses, nothing can supply its place. It gives an equal heat, and is devoid of that dryness so injurious to plants. To warm a greenhouse by steam, there is required the boiler of a steam engine, reckoned at one horse power for every thousand feet of glass. It is advisable, when heating a hothouse by steam, to surround the pipes with stones; these stones absorb the heat, and if from carelessness or inattention the steam goes down, they will continue to radiate heat for some time, thus preventing the sudden cooling of the place.

It is sometimes necessary to boil liquids in vessels of wood, as in brewing, etc., and to use heat in evaporating thickened liquids, strong solutions, etc., where the direct application of fire would be destructive; there, also, we see the utility of steam. The common manner of making glue is an instance of this; elevate the bottom of the glue-pot and cover the receptacle for boiling water, and you have at once a steam oven. This plan has been extensively used in making salt. Or, introduce a pipe in the form of the worm of a still into the vat containing the solution, and allow the steam to pass through the pipe. The steam pipe can then be of iron, copper, lead, or tin, as the nature of the solution may require; copper is in all cases the best where it can be used. Another process of a similar nature was invented by Mr. Goodlet, of Leith; it consists of pumping the solution through a spiral pipe passing through the boiler, thus bringing the solution to the steam, instead of the steam to the solution. Steam kilns for drying grain have also been used upon the same principle. Dry houses, for lumber to be used in the pattern room, are added to our machine shops. The process of drying printed cloths and fabrics of various kinds, also the warp after it is sized, is in use in all our principal manufactories, and adds materially to the economy and expedition of their production. The process of drying cloths illustrates this. Steam is conducted through the axis of a cylinder, which is revolved by suitable machinery; the cloth is then made to pass over it in contact with its periphery; if necessary, several cylinders are placed in a line, and the cloth passes over the first, under the second, and so on. Paper is thus dried: the wet pulp laid out on the web of wire cloth is gradually strained as it approaches the cylinders, around which it winds, until it comes off dry and ready for cutting; this operation is singularly interesting.

Cooking by steam was the invention of Denis Papin, of France, as long ago as 1680; the most important of whose experiments were the extraction of gelatine from bones, and the manufacture of essence of meat, soups, etc., suitable for long sea voyages. From a work published by him in 1681, we extract the following: "I took," says he, "beef bones that had never been boiled, but kept dry a long time, and of the hardest part of the leg; these being put into a little glass pot with water, I included in the engine, together with another little glass pot full with bones and water too, but in this the bones were ribs, and had been boiled already. Having prest the fire till the drop of water would dry away in three seconds, and had ten pressures, I took off the fire, and the vessels being cooled, I found very good jelly in both my pots; but that which had been made out of ribs had a kind of a reddish color, which I believe might proceed from the medullary part; the other jelly was without color, like hartshorn jelly; and I may say, that having seasoned it with sugar and juice of lemon, I did eat it with as much pleasure, and found it as stomachical, as if it had been jelly of hartshorn." Mutton bones are better than beef bones; and he infers, first, that one pound of beef bones affords about two pounds of jelly; second, that it is the cement (gelatine) that unites the parts of the bones, which is dissolved in the water to make it a jelly, since after that, the bones remain brittle; third, that few glutinous parts are sufficient to congeal much water, "for I found that when the jelly was dried, I had very little glue (gluten?) remaining; fourth, I used it to glue a broken glass, which did since that time hold very well, and even be washed as well as if it had never been broken; fifth, it is heavier than water, and sinks to the bottom; sixth, hartshorn produces five times its weight of jelly.

"From all these experiments, I think it very likely that if people would be persuaded to lay by bones, gristles, tendons, feet, and other parts of animals that are solid enough to be kept without salt, whereof people throw away more than would be necessary to supply all the ships that England has at sea, the ships might always be furnished with better and cheaper victuals than they use to have. And I may say that such victuals would take up less room, too, because they have a great deal more nourishment in them in proportion to their weight. They would also be more wholesome than salt meat. Vegetables, such as dried peas, may also be cooked by the steam of salt water without becoming salt."

We have already mentioned that Denis Papin invented the safety-valve; it was in the construction of this digester that he used it; he thus speaks of it: "To know the quantity of the inward pressure, you must have a little pipe open at both ends, this being soldered to a hole in the cover, is to be stopped at the top with a little valve, exactly ground to it. This must be kept down with an iron rod, one end of which must be put into an iron staple, fastened to the bar, and the other end kept down by a weight, to be hung upon it nearer or further from the valve, according as you would keep it less or more strong, after the manner of an ordinary Roman balance or steelyard."

Papin's method of determining the temperature is somewhat curious: "To know the degree of heat, I hang a weight to a thread about three feet long, and I let fall a drop of water into a little cavity made for that purpose at the top of it, and I tell how many times the hanging weight will move to and fro before the drop of water is quite evaporated!" As nearly all that we at present know about cooking, and extracting jellies by steam, is derived from the experiments of Denis Papin, we will close this portion of the subject by adding his description of one of them: "Having filled my pot with a piece of a breast of mutton, and weighed five ounces of coals, I lighted my fire, and by blowing gave such a heat that a drop of water would evaporate in four seconds, the inward pressure being about ten times stronger than the atmosphere. I let the fire go out of itself, and the mutton was very well done, *the bones soft*, and the juice a strong jelly. So that, having had occasion to boil mutton several times since, I have always observed the same rule, and never have missed to have it in the same condition, which I take to be the best of all.

"Beef required seven ounces of coal and the same heat, and the beef was very well boiled, although there were more parts of the bones not quite softened. Lamb, rabbits, and pigeons, mackerel, pike, and eel, were subjected to the same process; whence I infer that the bones of young beasts require almost as much fire as those of old ones to be boiled; that rabbit bones are harder than those of mutton; that tough old rabbits may be made as good as tender young ones by this means; that pigeons may be best boiled with a heat that evaporates a drop of water in five seconds; that mackerel was cooked with gooseberries, in a digester, the fish being good and firm, and the bones so soft as not to be felt in eating. I particularly recommend as an excellent dish cooked in this manner, cod fish and green peas."

Another application of steam that has proved very valuable on ship-board, is its condensation after having been evaporated from salt water, to supply the wants of passengers and crews when from accident or an unusually long voyage the regular stores are exhausted. The reader is probably aware that when salt water is evaporated, the steam therefrom is as pure as if taken from fresh, and would be as healthful and palatable as any other were it not from the fact that it does not contain the usual quantity of atmospheric air which has been expelled by heat. If, however, it is allowed to fall in the form of rain, or is poured from one vessel to another, it very soon absorbs a sufficient quantity and becomes as good as rain water, which, in fact, it is.

The application of steam to soften wood, so as to admit of its being bent into various shapes, is old; but by compressing the wood while being bent, so as to prevent the loosening of its fibre, great improvement has been made, and in the manufacture of furniture this has been of great service. There is also a Ship Timber Bending Company in Brooklyn, L. I., who are doing a large business in that line; the timber thus bent being quite as good as if of natural growth.

Steam bakeries, as they are called, show no new application thereof, as they simply consist of dough-raising and other machines driven by a stationary engine; we mention them simply to show how extensive are the uses of steam.

CHAPTER VII.

CONCLUSION.

To understand fully our indebtedness to the inventors and improvers of the steam engine, we must compare the past with the present. We must remember the North River sloops, the slow ocean packet ships, the lumbering coach; then the canal boat, the horse boat, the horse railroad; followed, but not yet entirely superseded, by the steamboats of Fitch, Fulton, Stevens, and a hundred others—each an improvement on the last—until months are crowded into weeks and weeks into days. If it is true, as some have said, that the duration of human life is less in each succeeding generation, it is incontestable, on the other hand, that the amount possible to be accomplished by each man in the same amount of time is increased many-fold. We have shown what has been done by steam; but are we now to stop and fold our hands at the request of the few old fogies who have been hurried along against their will, and now wish to sit down and take breath when the great work has but just commenced? No! American genius is the engineer of this locomotive, "Progress;" his hand is on the throttle-lever, which he opens wider each day. Conservatism may act as brakeman, but has no power to stop the train unless the engineer aid him. His bright, clear eye looks out upon the straight track—for the path of progress is only warped by foolish or selfish men—and conservatism may *brake* up and retard, but not stop the train. It will, it is true, take more steam to draw the load, while old fogies thus act as a drag, and they may rest assured that their action only renders the course of progress more dangerous, but will never stop it.

Lay down this vain opposition, then, and add your voice and your purse to aid the advance of steam; send your horses into the country, or retain them only for pleasure rides of invalids; pave your streets with iron, and harness steam to your drays and cars. We may not live to see it, but it is our firm belief that the time will come when the foolish excuse that steam will frighten horses in our cities will be no longer urged, for there will be no horses to frighten. You say that we are enthusiastic; so was John Fitch; does it then follow that he was wrong? You try to urge that there is more danger in steam than by the old mode of travelling, but this has long ago been proved false; and if there still are accidents from boiler explosions, it is your fault that they have not long since ceased. Pass a law in each state providing for the inspection of all steam boilers, and the examination of all engineers, and impose a heavy fine on all who hire an engineer who has no certificate. Do not make this a political movement, but see that the board of inspectors is composed of experienced engineers, men who can themselves pass an examination of the most strict nature; and bear in mind also that steam requires close attention, and that there is not one man in a hundred that can have the care of it, and at the same time have his mind distracted by other duties, without endangering the whole neighborhood. Powder mills are always located apart from other buildings, for a careless act would scatter destruction around; well, some of the boilers in New York at this present moment are worse than powder magazines, and yet they are located in the most densely populated parts of the city, and beneath sidewalks trod hourly by thousands. The engineer (?) saws wood, grooms horses, or works at the bench, while his pump clogs, and the water gets low in the boiler; or, interested in other work, he forgets to put the pump on, and soon after—longer, perhaps, than he is aware—he lets in the water, and wakes to find himself in a neighboring yard, or never wakes to see the effect of his employer's false economy. Under such management, who can wonder at the accidents we read of weekly; or, rather, what man conversant with the laws of steam does not wonder that there are no more "terrible calamities" to be recorded?

It is comparatively easy to understand the great advantages that have accrued to navigation and land transportation from the use of steam, for its effects are constantly before our eyes; but improvements from the use of steam in stationary engines are less apparent, although full as great. Even in the immense manufactories of Manchester and Lowell, where the water power seems almost unlimited, we find the steam engine at work; and all the water power of the United States combined would not be sufficient to carry out one branch of manufacture in all its details. If we now compete with foreigners in the manufacture of cotton goods, in spite of the low price of labor abroad, it is not only owing to our great improvements in cotton machinery, but also to the competition of our steam mills. And the steam press! Tiny jets of steam puff forth from the offices of our smallest job printers, and ponderous engines work the six, eight, and ten cylinder presses of our large dailies. Ask the proprietors of those papers what they could now do without steam? The *New York Herald* has two engines to do the press-work; one built by Hoe is a beam engine of twenty-five horse power, the other is an upright engine of fifteen horse power, making in all forty horse. With these two engines they consume about one ton of coal per day, and throw off an average of 75,000 impressions. The office is, however, capable of doing much more than this, its utmost capacity being 48,000 impressions per hour. The engine rooms are very well fitted, and have two of Woodworth's donkey pumps; the one to supply the boilers with water, and the other, to be used in case of fire, is connected with hose in every room of the building.

The first steam mill that was erected in England was mobbed by the populace. They feared this giant competitor; they were afraid it would take food from their mouths; and we are sorry to say that this old feeling of the laboring classes is not yet entirely eradicated; educated Americans, who should know better, can yet be found to condemn machine labor. Last year Broadway was swept by a machine that would in time have been replaced by steam, but New York has taken a retrograde step, and politics have so strong a hold upon her citizens that progress must bide her time. Has the introduction of machinery hurt the laboring classes? That is the question! Are our laboring men worse off than before the introduction of steam? Look at the facts and the answer is plain. A few coachmen were thrown out of employment to make room for hundreds of employees upon the railroad, to say nothing of the thousands benefited by their construction, and that of the cars, locomotives, station-houses, etc. A handful of weavers and spinners have been temporarily removed, to be reinstated, with thousands of their fellow men and women, at full as good pay as before. Head has aided hands everywhere, and those who have kept up with the age of improvements have been, as they should be, the ones to profit by its advantages. But great as have been the improvements in our stationary engines, there is still much to do; we are not, in fact, living up to what we already know. The ordinary average of duty performed by our best stationary condensing engines is one horse power to four pounds of good coal consumed, while in marine engines it requires the consumption of four and a half pounds to the horse power; and yet engines are running that consume but two pounds to the same work. With these facts before their eyes, men continue to purchase the former, instead of looking for an improvement upon the latter; for even these results can be improved upon, as in our best boilers there is much of the combustible gases wasted, and much of the water evaporated into steam is condensed before it reaches the cylinder; any perceptible heat from the engine while working is, of course, so much loss of fuel. Bearing this in mind, enter an engine or fire room, and you will realize the loss from that source alone.

The first difficulty is being fast overcome by admitting atmospheric air above the fire, which unites with the gases as they rise, and furnishes the oxygen necessary for their combustion; it is now necessary to get rid of the heavy, incombustible gases, and this will soon be done. The radiation of heat can be prevented almost entirely by inclosing the boiler, cylinders, steam-pipes, etc., in some non-conducting substance; this is technically called "*jacketing.*" Other improvements in the steam engine are being made every day, and we believe that the consumption of only one pound of coal to the hors epower will soon be accomplished.

In view of all the facts that have been adduced to prove that the steam engine is the best of all motors, can it be possible that there are still those who are sceptical on the subject of its utility? Alas, yes! You will find them among those who object to the use of steam in our streets to replace the horse cars; men who believe that new inventions must necessarily be humbugs, because in a few instances they have failed, and who cannot see that the greater number have added to their wealth, their comfort, and their pleasure. The greater number, say we? We might have said all; for if the first invention fail, it paves the way for another and better, and many of the failures of inventors stand as sign-boards to show the false paths. You will find these incredulous men in the same position to-day as were the throng of spectators who stood in Brown's ship-yard when the North River was fired up for the first time, loudly calling it "Fulton's folly." Its great success soon quieted them for the time, but it was for a time only. A succession of surprises from that day to this should, it would be thought, have forever quieted them, but they "still live," and will only accept progress as a fact after repeated successes make it impossible to doubt; meeting each new plan with the same incredulity.

In speaking of the accessories of the steam engine, there is one point we omitted: many boilers are unprovided with steam gauges. In a conversation with a proprietor of a steam engine some time since, we asked him why he did not have a gauge upon his boiler. "Oh!" said he, "that is all nonsense; my safety-valve is weighted at one hundred, and my boiler would easily carry twice that steam. I have been without one for three years, and don't need it." We asked him if his engine was always competent to do his work, and if the latter was always constant. "Yes," he replied, "the engine will always do the work, but it is just all it will do. As for the work being constant, it is far from that; some days we do not run but half of our machines, and then the safety-valve tells its own story by 'blowing off.'" "Yes," we replied, "and it tells another story, which is 'loss of fuel.' Had you a steam gauge, the engineer would know how to fire, and in less than three months you would be able to pay for a gauge out of your savings." "Pooh! nonsense," he replied. Insisting upon the truth of what we said, we prevailed upon him to try it for a month with, and without a gauge, and so well satisfied was he with the result that he now says a gauge is worth two hundred dollars per year to him. This may have been an extreme case, for the engineer always knew when he came in the morning what machines were to be run, and he soon had an exact knowledge of the amount of steam required to drive them, and, therefore, regulated his fires by the gauge. Gauges will get out of order, we know, but they must be tested at least every three months by some standard, and repaired if wrong. Who wonders if so delicate an instrument should get out of order under one hundred pounds pressure for two or three years? and yet we can point to a gauge in use in this city that has not been tested for four. It is unnecessary to add, the proprietor "don't believe in gauges;" he probably expected it to last a life-time.

With regard to low water detectors, that whistle when the water is dangerously low, they must be used with great caution, for if out of order they would be a source of positive danger by the fancied security of the runner. After all, the only safeguard is a boiler in good order, and a competent engineer to take care of it; be sure on these two points, and nothing is better than steam to do your work. Those owning small engines object to paying the price of such men. Is it not better to pay more per day for absolute safety than to risk an explosion that will destroy all your property, and possibly your life and the lives of your workmen? If your work is not sufficiently profitable to pay a competent man, *sell* your engine and run your mill by horse power; better have a *mule* to turn the driving wheel than run the engine. But it will afford it; nay, in nine cases out of ten a good man will save more than his salary amounts to in fuel and repairs alone.

And now a word to engineers. You who are upon our steamships and locomotives think that such a law would be of no benefit to you; but you are very much mistaken; once passed, it would give employment to hundreds that are now competing with you for a position that is only sought because it offers better wages than stationaries can under the present system; under the same pay, men would prefer to run land engines, and be near home. Therefore, it is a duty you owe yourselves to insist, wherever you exercise the rights of suffrage, that your representative shall advocate such a law; make it the *sine qua non* of your vote. And you, engineers in name only, if you wish to retain your present positions, study your duty; learn why you do what you now mechanically perform; find out what pressure you are carrying, for yourselves, and do not trust to the marks on your safety-valves; read works on steam, and satisfy yourselves if they are true by, as far as in your power lies, testing them, for all that is printed is not necessarily true, as you will very soon discover. Above all things, be one to form an engineers' society, and discuss with men of experience the knotty points which will rise in your mind when you once begin the study of this potent vapor.

We cannot finish this article without referring briefly to another motor, which has for the last four or five years attracted some attention: we allude to the caloric engine. Mr. Ericsson, of whom we have already spoken, is the inventor of this machine. The power made use of is the expansive force of heated air. For small engines this motor has been used with success, but in all Mr. Ericsson's experiments on a large scale it has failed. As there is no danger of explosion from the lack of water, the caloric engine has been of value on the southern plantations, as any one can run it, it being only necessary to make a fire, and see that the machine is oiled and kept in repair. We do not believe, however, that it will ever supersede steam as a motor, even for small engines. Since Mr. Ericsson's invention, others have followed with various improvements, and much ingenuity has been displayed upon the subject; we hear occasionally of some great success of a caloric engine, but it never results in any thing permanent. The details of the caloric are different from those of the steam engine, and the heavy boiler is done away with, but they are not as cheap if the cost of the boiler be excepted, and are much more liable to get out of repair; still, if properly taken care of they are useful, as we said before, in situations where but little power is required, and water scarce. Mr. Holly, so well known as "Tubal Cain" of the *New York Times*, says, in speaking of the caloric engine: "We only wish it was a better rival of steam in every particular, that it might compel the makers and users of boilers to employ better materials, better forms, and greater care in the management of the subtle motor—steam. And as its mechanism improves, as we believe it will, to some extent, year after year, it will better serve the public by compelling us to improve the smaller varieties of the steam engine, which, we believe, can also be made perfectly safe. The hot-air engine requires no constant or professional attendance, and for this reason is a valuable motor in cases where an occasional or auxiliary power is required. And for small purposes, the saving of engineer's pay more than balances the increased cost of fuel and repairs."

Undoubtedly small steam engines and boilers can be made perfectly safe; in fact, they should be the safest, and will be so, when the public will not look to the mere first cost alone, but will only buy engines of the best builders, and pay a fair price therefor; another result that we hope to see brought about by an inspection law. Nor is this by any means a small matter, for the unthinking man would be astonished at the amount of small stationaries that are now running throughout the country. In New York there are engines or boilers in every street; at our hotels and public buildings, in our printing offices, carpenter shops, as well as in all the larger manufactories and machine shops, engines of from two to five hundred horse power are daily running. Machinery of all kinds is driven by steam, from the large lathes and planers of our machine shops to the sewing machines of the clothiers; manufacturing crinoline in one place, and forging huge masses of iron in another, the busy hum of steam-driven machinery resounds on every side. Stand and look at the ten-cylinder press, and think of Franklin working at his old wooden one. Compare the speed of the former with the country press of only a few years back, if you would realize this great improvement. Has this hurt the printers as a class? Figure up the gross amount now paid to compositors, and compare it with the amount paid fifty years ago before you answer. Philadelphia is known as a manufacturing city, and one which is probably destined to be the greatest in this country. To what does she owe her prosperity? To the stationary engine, for she has no water power. We have already said, and we repeat, that imperfect though the steam engine may still be, it is by no means certain that water power is cheaper, and there is one disadvantage in the latter that is often overlooked, it is that of monopoly. The rich company who own the water power let it out at their own price, for there is no competition; but with the steam engine it is very different; if the price asked for power by your neighbor be too great, you can readily purchase an engine of just the power you require, and run it independently. But the greatest advantage of the stationary engine is that it can be used by the manufacturer at the door of the consumer, and the goods produced will be thus under his direct inspection.

Steam enters into the manufacture of every thing around us. The paper we write upon was dried by steam, our tin paper-cutter was rolled by steam, the chair we sit upon was turned and bent, the carpet was perhaps wove or at least dyed, and the wood work of the very room we are in, were all done by steam. Steam can warm our dwellings, and prepare our food. It tunnels mountains, and makes pins, cards, spins and weaves, coins our money, braids, twists, sews, washes, irons, and, in fact, enters into every branch of industry. It has added more than any thing else to the wealth, power, and prosperity of our country. Think of this the next time you are asked to aid in any steam project, and as Americans have heretofore been among the first to perfect the steam engine, may they ever be the ones to educate it to new branches of labor. Be not satisfied with past improvement, but look forward to changes as great for the next twenty-five years, as there have been in the last half century.

APPENDIX.

EXPERIMENTS OF THE UNITED STATES GOVERNMENT.

In our introductory chapter we spoke of the use of steam expansively. Soon after the article was written, results were obtained by a series of experiments under the auspices of the United States government, that tend to the material alteration of engineering practice. As we had yet time, before this work went to press, we thought that some of the results, together with their bearing upon steam machinery, would prove acceptable.

Chief Engineer B. F. Isherwood, while trying some experiments in superheating steam, found that the results obtained by the use of steam expansively were by no means even an approximation to those theoretically claimed, and that a sufficient allowance was never made in calculating the increased loss from condensation. His experiments attracted considerable attention from engineers and steam-engine builders, and a petition, signed by some of the most prominent of them, was sent to the Hon. Isaac Toucey, the Secretary of the Navy, early in the fall of 1860. In reply to this memorial an experimental board was appointed, consisting of Chief Engineers Isherwood, Long, Zeller, and Stimers; and the United States steamer Michigan, then lying in her winter quarters at Erie, Pa., was placed at their disposal. She was made fast to the wharf, and so loaded as always to remain with a fixed draught of water, the coal burned being kept upon the wharf and brought on board as fast as used. Each bushel of coal was weighed, together with the ashes, clinkers, etc. The feed water was accurately measured in a large tank prepared expressly for that purpose. Every valve upon the two engines of the Michigan was carefully tested and proved tight, as were also the pistons, stuffing boxes, throttles, etc. The steam gauges consisted of two spring and two syphons, and were in good order. Indicators were placed upon each end of both engines. Thermometers were placed in the hot well, the feed-water tank, the engine room, upon the deck of the steamer, and in the water over the side. Diagrams were taken from each end of the cylinders alternately every half hour, and the average height of the barometers and all the above-named instruments was duly noted every hour by the officer on duty. A large number of experiments were tried, each of which occupied seventy-two hours. The fires were started and steam raised to a certain point (20 lbs. per square inch) before the experiment was commenced; and at its expiration the fires and pressure were brought to as nearly a similar condition as possible. In fact every care that experience and scientific ability could suggest was used, and we believe that any one who will examine the tables prepared by this board, will acknowledge that the nicest possible accuracy marked their entire labor. The experiments lasted about three months; one cylinder was tried at almost every point of cut-off with the initial boiler pressure at 20 lbs., and also with the initial cylinder pressure at the same point.

The deductions by the committee were, that at seven tenths of the stroke they obtained the maximum results; that cutting off steam at any shorter point than this is a loss, as proved both by the water and coal consumed; that the loss by condensation in the cylinder, and increased friction and back pressure, is generally greatly underrated; and that the use of a cut-off is no advantage over the common throttle valve in the majority of cases, and never sufficiently so to pay for its increased expense and the trouble attendant upon its use. These are a few of the most prominent of their deductions. They are contrary to the received opinions of most of the engineers from the time of James Watt to the present day, and from this fact are decidedly unpopular. We therefore do not expect in an article so general in its nature as this to convince the sceptical reader, but merely to state a fact that time will prove to the world. The following table is a digest of the first experiments, but in order to get the entire data of the series, we shall be obliged to wait for the printed report of the board, which, if the present troubles at Washington do not prevent, will probably appear before the end of the present year; and to that we refer those sufficiently interested in the subject to wish to look further.

ONE ENGINE—BOTH BOILERS.

	Point of cutting off from commencement of stroke			
	One third.	13-14th stroke.	Two thirds.	One sixth.
Date of commencing	9 P.M., Dec. 5.	3 P.M., Dec. 10.	8 P.M. Dec. 18.	10 P.M. Dec. 16.
Duration of experiment	72 hours.	72 hours.	72 hours.	80 hours.
Pressure of steam in boilers in lbs., per square inch	20	20	20	20
Inches of vacuum in condenser	25.5	25.9	25.9	26
Lbs. per square inch of vacuum in cylinder	11.5	11.5	11.15	11.7
Mean effective pressure on piston, in lbs. per square inch	20.5	30.2	28 4	132
Revolutions per minute	11	13.6	14.3	9.
Indicated horse power	111	201	200	58.7
Lbs. of feed water per hour per horse power	43.3	42.7	37.9	54.25
Lbs. of coal per hour per horse power	5.85	5.46	4.89	6.64
Cost of power by these experiments, full stroke being unity.	1.07	1.00	0.89	1.27
Cost of power as usually calculated, full stroke being unity.	0.50	1.00	0.79	0.37

What interests the ordinary reader is this: accepting that the deductions are true, and that it is more economical to use steam at nearly full stroke than by cutting it off early in the cylinder, the following advantages will accrue—first, we shall build our cylinders smaller, costing less to construct and occupying less room, both of great importance to the marine engine—second, the other parts of the engine having a regular strain, instead of alternately crowding and being moved by the balance wheel, will bear to be much lighter. And, lastly, we are forever rid of expensive and complicated cut-off gear.

We cannot close this part of our theme without alluding to the course of Mr. Toucey in this mater. The experiments were so expensive that without government assistance they would probably have never been accurately tried, and the manner in which they were conducted will reflect as much credit upon the American government as was ever conceded to the French Academy for their celebrated experiments upon temperature and pressure. May the successors of Mr. Toucey ever show as much public spirit as he has done in this respect, and devote some of the public money to the advancement of steam engineering that has done so much for our prosperity.

COTTON MANUFACTURES.

CHAPTER I.

ORIGIN—HAND WORK—INVENTIONS.

The use of cotton as a material for human clothing has been known since remote ages, not only in Asia, but among the ancient inhabitants of America. The kind of cotton used in the United States is a native of Mexico, and it was the principal material for clothing in use with the Mexicans at the time of the discovery of this country. They had neither hemp, wool, nor silk, but they wove the cotton into large webs, as delicate and as fine as those of Holland. These they ornamented with feathers and fur, wrought into the fabric in the form of animals and flowers. Cortes sent a number of these magnificent robes to Charles V. The art was apparently lost in the strife that followed, but the material transplanted to the United States about the time of the organization of the new government, has become a bond which holds modern Europe in dependence on American industry; a dependence which they would gladly shake off if they could, but which only becomes more hopeless in their efforts to do so. The cotton culture has produced a web which holds the lion in its toils, and his efforts to free himself, gigantic as they may be, only make his impotence more apparent.

The growing and manufacturing of cotton by machine took date from the organization of the United States government, and its progress has been as follows:—Yds.

	United States crop. lbs.	Cotton of other sources. lbs.	Total supply. lbs.	Price, Liverpool. cts.	Yards cloth.
1800,	9,532,263	45,671,170	54,203.433	48	162,610,299
1859,	2,162,000,000	199,446,616	2,361,444,616	6	7,064,333,646

The cotton from other sources is that imported into Great Britain from other places than the United States. The increase of supply is nearly all from the United States. The usual weight of cloth being three yards to the pound, the quantity of cotton spun would give in cloth the large number of yards seen in the table. This production employs a vast capital in the transportation, manufacture, and sale of the fabric. More people are now directly dependent upon the manufacture for support, than there were in the United States at the formation of the government. In the United States this year, 978,043 bales were manufactured, or equal to 1,470,000,000 yards of cloth, or forty yards to every person in the Union. The value of this must be $140,000,000. This has been the result of seventy years' progress from very small beginnings, and this marvellous growth has resulted from the extraordinary inventions that have not ceased to succeed each other, and of which we shall give a brief sketch.

The manufacture of cotton by hand originated in India at a time too remote for record, and it has there existed down to the present time in a rude state as far as machines are concerned, yet of an unapproachable and almost incredible perfection of hand production. Ancient writers speak of the "fairy-like" texture. Tavernier, two hundred years since, describes a calico that you "can hardly feel in your hand, and the thread is scarcely discernible." The Rev. William Ward states that muslins are made so fine that four months are required to make one piece, which is then worth 500 rupees ($250). "When this is laid on the grass, and the dew is on it, it cannot be seen." These are marvellous productions, doubtless, but they are possible only as a result of the organization of the people. They possess an exquisite sense of touch, and that gentleness and patience which characterize only an effeminate race. Even with them a long training is required in each district to perfect the cloth peculiar to it. This is a kind of industry that does not minister to the wants of a vigorous people in other climes. From India the manufacture spread to China, in the eleventh century, and found its way to Europe with the Mahometan conquests.

It was for a long time supposed and asserted by many philosophers that the Egyptians made cloth of cotton, and the mummy wrappers were asserted to be of cotton. It was not, however, until of late years, that the error was proved. The microscope reveals the fact that the fibres of cotton and flax are quite different. The latter is round and jointed, like a sugar cane, while cotton is flat and twisted. The mummy cloths are all of the first description, and there are no signs of a cotton manufacture in Egypt.

It spread through southern Europe sluggishly, and is first mentioned in England in 1641; but it made little progress until a century later. There were two obstacles to progress—want of the material and want of machines to manufacture effectively. The quantity of cotton imported into Great Britain early in the seventeenth century was about one million of pounds.

Up to the time of the American revolutionary war, the cotton manufacture in England in all its branches was in a very primitive state. At that date a series of inventions and discoveries took place, that rapidly carried the cotton manufacture to a magnitude second to no other industry, and gave it the impulse which, as we have seen, has not yet ceased to act. The cleaning, carding, spinning, weaving, dyeing, and printing were all conducted in slow and expensive methods, by which a great number of people were required to produce small results. The only source for the raw material was then the West Indies. The quantity derived thence was about 40,000 bales, or 4,000,000 pounds, and this was wrought up by hand processes.

The object in carding and spinning is to draw out the loose fibres of the cotton into a regular and continuous line, and after reducing it to the requisite tenuity, to twist it into a thread. By the early method, after the cotton was cleaned, it was carded between two flat cards held in the hand. A small quantity of the cotton placed on one was, with the other, combed as straight as possible. The fleecy roll that resulted was called a sliver. This roll, or sliver, was then applied to the single spindle, that was driven by a wheel set in motion by the other hand of the operator; as it received a twist, it was drawn out into a thick thread like a candle-wick, called a roving, and was wound on a cop. This roving was again drawn out and spun into a thread. Thus, in two operations, a single irregular and imperfect thread grew slowly in two hands. In this manner all the cotton yarn used was made, in cottages and private houses, mostly by females. The weaving was also done by hand looms; but such was the slow process of spinning, that the weaver's time was largely employed in going round to buy up yarn. They competed with each other in this, and the yarn thus cost more than it should. One fine morning Mr. James Hargreaves determined to emancipate himself from the spinners, by putting into practice an idea that had occurred to him. This was, to spin in his own house, and to make one wheel drive eight spindles, and to draw the rovings by means of a clasp held in the left hand of the operator. That was the first spinning-jenny, patented in 1767. In 1769, Arkwright added the important discovery of rollers, or drawing frames. This was one of the most important inventions. It consisted in causing the roving, on its way to the spindle, to pass between a pair of rollers about four inches long and one in diameter. These held the roving so firmly between them that it could pass only at the speed of their own revolution. From these the roving passed between two other rollers, which revolved twice as fast as the first pair. The effect was that between the two sets, the roving was drawn out to double its former length, and, of course, half its tenuity. The rollers thus supplanted the drawing by hand. By this mode of drawing the cotton, the fibres are straightened and made parallel; and the improvements that have since been made in the same direction are to increase the drawings and doublings, or the placing of several slivers together to be drawn down into one. In 1784, Crompton combined these two inventions into a third, called the mule-spinner. The machine of Arkwright was called the water-frame, because it was first driven by water power. The defect was, that it spun thread for warps only. It could not spin fine threads, because these could not bear the strain of the bobbins. This the mule remedied. Instead of the spindles being stationary, and the rovings movable, the former were placed upon a movable frame which runs out fifty-six inches, to stretch and twist the thread, and runs in again for it to wind upon the spindles. The thread is thus treated more gently. The effect of this machine is best understood by the fact that a "hank" of thread measures 840 yards, and it was before supposed impossible to spin 80 of these hanks from a pound of cotton. The new machine spun 350 hanks to the pound, thus forming a thread 167 miles in length! This mule was improved to carry 130 spindles; and when water power was applied, in 1790, it carried 400 spindles. These mules, at the present day, carry 3,000 spindles, and are now self-acting.

The process of carding had also in this period undergone great improvements. The first improvement made in the old hand cards was to make one of them a fixture, and of a larger size than the other. The workman could thus work more cotton in the same time. He then proceeded to suspend the movable card by a pulley, with a weight to balance it. The next advance was to make the movable card a cylinder covered with cards, and turned by a handle, in a concave frame, lined also with cards, which was simply the fixed card curved to adapt it to the cylindrical form of the other. The lower part was let down in order to remove the cotton, by means of a stick with needles in it like a comb. The next improvement was in 1772, to attach an endless revolving cloth, called a feeder, on which the cotton was spread, and by it conveyed to the cylinder. The next step was to take the carded wool off the cylinder by means of another cylinder revolving in an opposite direction, and called the doffer. This being entirely covered with cards, gave a continuous fleece of cotton, which was in 1773 removed from it by means of a steel blade like a saw, working by short strokes. This broad fleece then passed through a funnel, by which it was contracted into a ribbon; it then proceeded through two rollers, that compressed it and let it fall into a deep can. The carding machine by these means approached perfection, but there was necessary to it the marvellous American invention of the card-making machine, which made the cards so perfectly and so cheaply as to make the cylinder carding possible. The concave frame in which the original cylinder revolved, was soon replaced by smaller cylinders covered with cards and revolving in a direction contrary to the main cylinder. Between the action of these, the cotton was more perfectly combed out.

The carding and spinning of yarn thus had become developed in a manner to meet the wishes of the weavers, but now genius was directed to the loom, and in 1785 the power loom was invented by the Rev. Dr. Cartwright. This was improved upon, until in 1803 a new loom was patented by Mr. Horrocks. These looms but slowly supplanted hand looms, notwithstanding their great superiority. The great obstacle to the success of the power loom was that it was necessary to stop it frequently to dress the warp as it came from the beam. The dressing is a size of flour and water, now used cold; the object of it is to make the thread smooth, like cat-gut. The inconvenience of the frequent dressing was remedied in 1802, by the invention of the dressing machine. By this machine the thread is wound from the bobbins upon the weaving-beam, and in its passage it passes through the starch. It is then pressed between rollers, and passing over hot cylinders to dry it, it is brushed in its progress. When wound upon the beam it is ready for weaving. The power loom thenceforth grew rapidly in favor. Before the invention of the dressing machine, one man was required to each loom; afterward, a girl of fourteen tended two, and produced with them three and one-half times as much cloth as the best hand weaver. Improvements were made, until, in 1833, a weaver fifteen years old, aided by a girl of twelve, would weave eighteen pieces of nine-eighths shirting of the same quality of which, in 1803, it required a grown man to make two in a week.

While these improvements in machines were made, there were discovered processes of bleaching quite as important. This process previously required six to eight months to steep in lyes and bleach upon the grass. By chemical discoveries, a bleaching powder, composed of manganese, salt, sulphuric acid, and lime, is effective in bleaching the rough, gray, and dirty fabric that comes from the weaver, in a few hours. Every thing is done by machinery and chemical agents.

The printing of calico was introduced into England in the seventeenth century, but made little or no progress until its introduction into Lancashire in 1764, when it was taken up by a farmer, Robert Peel, grandfather of the late prime minister of England, Sir Robert Peel. When he began to print, he had the cloth ironed out by one of his family, and used a parsley leaf for a pattern. The method was to cut the pattern upon blocks of sycamore, like an ordinary wood engraving. On the back of the block was a handle. The color was contained in a vessel, over which was stretched a woollen cloth, in contact with the liquid. To this the surface of the block was applied, and it was then laid upon the white cloth ironed out, and struck with a mallet; the figure was thus impressed. The block was then applied in a fresh place; so that a piece of calico twenty-eight yards, required 448 applications of the block. To make more delicate figures, copper plates were employed, with the press used for copper-plate printing. The copper-plate method was quite as slow as the block method. In 1785, cylinder printing was invented. A polished copper cylinder, three feet in length and four inches in diameter, is engraved with the figure on its whole surface. It is then placed in the press, and as it revolves, the lower part passes through the coloring matter, which is scraped from the surface as it rises by a steel blade nicely adjusted lengthwise. This blade is called the "doctor." The cloth passes between this roller and a large cylinder, and receives the impression by a continuous motion. Thus, two or three minutes now sufficed to do what required before 448 applications. Almost any number of these cylinders may be used at the same time in the same press, and with different colors. Thus a five cylinder press will do what would have required 2,240 applications by the block; in other words, a man and a boy could now do what before would have required 200 men and boys.

An American invention here made an important change in the printing. Mr. Jacob Perkins, of Massachusetts, invented the process of transferring an engraving from a very small steel cylinder to the copper. Before this, the whole of the copper cylinder required to be engraved, at great expense, and when done would print about 1,500 pieces of cloth before it was worn out. By the new mode, a steel cylinder three inches long and one in diameter, is prepared by being softened that it may be easily cut. The pattern to be engraved is so arranged and made to agree with the circumference of the copper cylinder, as to join and appear continuous when repeated. When this is cut upon the steel it is hardened, and then, by great pressure against another soft cylinder, the figure is made on it in relief, or raised upon its surface. This being hardened, transfers by pressure the design upon the whole of the copper cylinder. The engraving is thus multiplied fifty-four times, and may be renewed at short notice when the cylinder is worn. This was a most important step in advance. When many colors are required in the same pattern, portions of it are engraved upon separate dies, and the number of colors may be multiplied by adding cylinders.

We have thus sketched the state of affairs down to about the period of the introduction of the manufacture into the United States, which was about the period of the formation of the government. The imports of the raw material into Great Britain at that time, will show the rapidity with which the trade developed itself.

COTTON IMPORTED INTO GREAT BRITAIN.

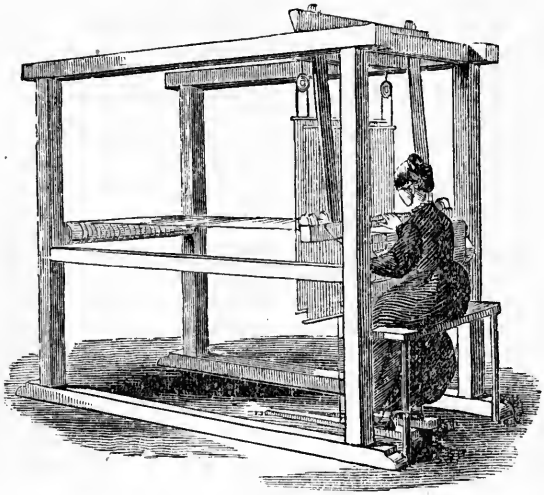
1775	4,765,589 lbs.	1786	19,900,000 lbs.
1781	5,198,777 "	1789	32,576,023 "

The cotton was derived as follows in 1786: British West Indies, 5,800,000 lbs.; French and Spanish do., 5,500,000 lbs.; Dutch do., 1,600,000 lbs.; Portuguese do., 2,000,000 lbs.; Turkey, 5,000,000 lbs. The United States contributed nothing. They did not then grow cotton.

The American invention of the cotton gin was more important than all the inventions we have described, for the reason that without it, and the American supply of cotton made possible by it, all the ingenuity of the English would have failed for want of material to work on. The sources of supply above mentioned have not increased in capacity. England has derived some cotton from India, but not so much in the raw state as she sends thither in goods, and the United States alone keep her mills in motion. While they have done this they have also developed the manufacture in a marvellous manner. We will here enumerate the dates of the above described inventions, in order to show that it was in the midst of the excitement they produced, that the manufacture was transported to America.

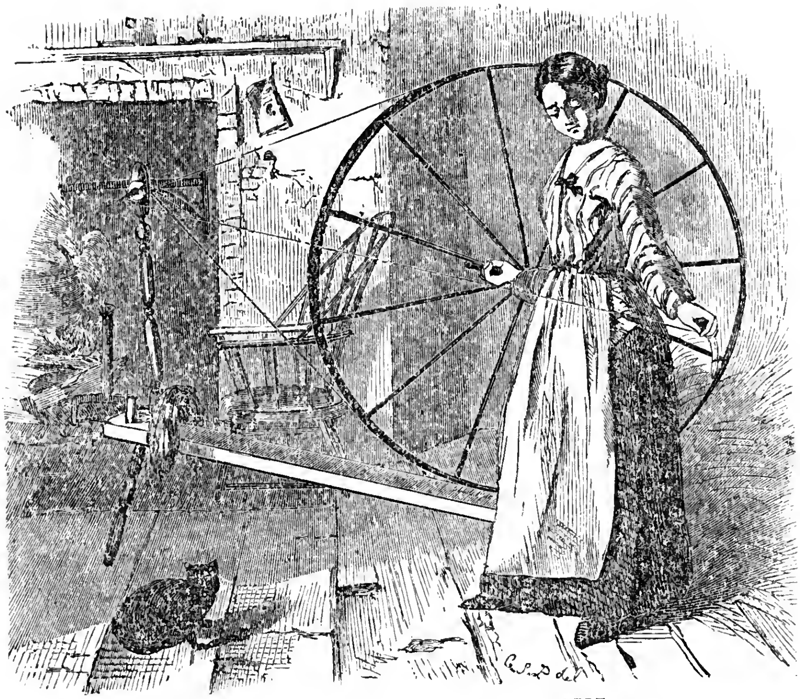
Hargreaves' jenny	1767
Arkwright's rollers	1769
Crompton's mule	1784
Feeding for carder	1772
Doffer " "	1773
Cartwright's loom	1785
Water power used	1790
Cylinder printing	1785
Dressing machine	1802

It was at the period so prolific in inventions, and when the use of cotton had so increased in England, that the manufacture was commenced in the United States. The first mill was at Beverly, Mass. It had a capital of £90,000, and was organized in 1787, for the manufacture of corduroys and

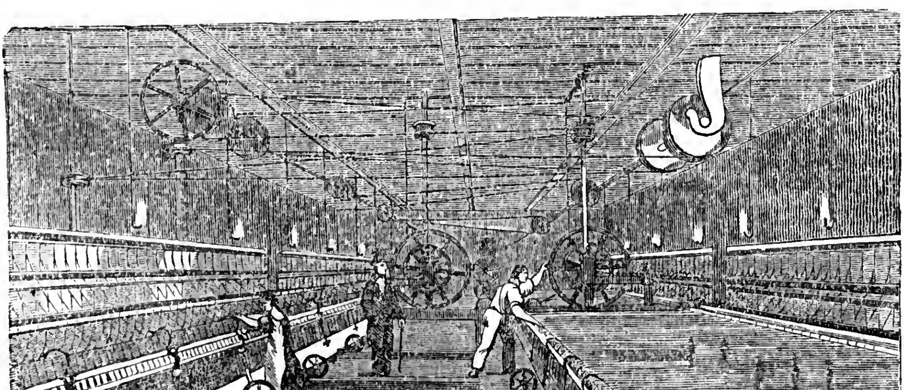


HAND LOOM.

POWER LOOM. ONE GIRL ATTENDS FOUR.



SPINNING BY HAND WITH A SINGLE SPINDLE.



A MULE SPINNER, OPERATED BY ONE HAND, CARRYING 3,000 SPINDLES, DOING THE WORK OF 3,000 GIRLS.

bed ticks. The capital was swallowed up in fifteen years. The machines were very rude, inasmuch as the new inventions in England were then unknown here.

CHAPTER II.

MANUFACTURE IN AMERICA—SPINNING—PROGRESS.

Samuel Slater was an apprentice to Jedidiah Strutt, the partner of Arkwright. He served his time, and when of age departed for America, where he arrived in 1789. In the following year, he entered into partnership with Almey and Brown to start a factory at Pawtucket. Here, then, were put up, in the best manner, the whole series of machines patented and used by Arkwright for spinning cotton. There had been previous attempts at the spinning of cotton by water power, and some rude machines were in existence for spinning the rolls prepared by hand, in private families; but the machines that had been invented in England for the purpose were entirely unknown here until put up by Slater. Those machines were so perfect that, although put up in 1790, they continued to be used forty years, up to 1830, when they formed part of an establishment of two thousand spindles, which still exists in Pawtucket under the name of the "old mill." Slater's business was prosperous, and he amassed a large fortune. He died in 1834. His son and heirs still carry on the business. It is to be remarked that his business was confined to the spinning of cotton. The business, of course, spread as soon as it was found to be profitable; but, up to the war of 1812, the New England interests were commercial, and when the war broke out there was an immense rise in the value of goods, which gave to all existing spinning interests a great advantage. Cotton cloth sold at forty cents per yard; and Slater held almost a monopoly of the supply of yarn to make it. Mr. Slater had, in 1807, in connection with his brother John, who brought over important knowledge of the recent improvements in machinery, erected a mill at Slatersville, near Smithfield, R. I. Mr. Slater established a Sunday school for his operatives, and this is supposed to have been the first in New England.

It will be observed that Mr. I. Slater got his mill into operation at the same period that the federal government was organized under the new constitution, a most auspicious event. The manufacture did not fail to attract the attention of the new government, and Alexander Hamilton, secretary of the treasury, in his famous report of 1791, remarks:—

"The manufacture of cotton goods not long since established at Beverly, in Massachusetts, and at Providence, Rhode Island, seems to have overcome the first obstacles to success; producing corduroys, velverets, fustians, jeans, and other similar articles, of a quality which will bear a comparison with the like articles brought from Manchester. The one at Providence has the merit of being the first in introducing into the United States the celebrated cotton mill, which not only furnishes material for the factory itself, but for the supply of private families for household manufacture.

"Other manufactories of the same material, as regular businesses, have also been begun in the state of Connecticut, but all upon a smaller scale than those mentioned. Some essays are also making in the printing and staining of cotton goods. There are several small establishments of this kind already on foot."

The same report proposes, as an aid to the factories, to remove the duty of three cents per pound on the import of raw cotton, and to extend the duty of seven and a half per cent. to all cotton goods. It also remarks that cotton has not the same pretension as hemp to protection, as it is not a production of the country, and affords less assurance of an adequate supply. These few facts afford an idea of the notions then entertained of that cotton which has since overshadowed all other interests.

The old mill of Samuel Slater, Esq., the first building erected in America for the manufacture of cotton yarns, is a venerable wood-built structure, two stories in height, bearing numerous evidences of its antiquity, having been erected in 1793. Two spinning frames, the first in the mill, are still there, and are decided curiosities in their way. It is almost incredible to believe that this old building, time-worn and weather-browned, was the first to spread its sheltering roof over the young pupil of Arkwright, and that those dwarf frames, rusty and mildewed with inactivity, are the pioneer machines of that immense branch of our national industry—the manufacture of cotton goods. It may be remarked that down to 1828 the exportation of machines of all kinds, and also wool, was strictly prohibited in England, for fear other nations should benefit by English mechanical genius, of which they supposed they had a monopoly; when, however, they found that the balance of genius was on this side of the pond, they liberally removed the prohibition. Mr. Slater, the father of American cotton manufactures, was so closely watched at the English custom-house, that he could not smuggle over a drawing or pattern. He had, however, acquired a full knowledge of the Arkwright principle of spinning, and from recollection, and with his own hands, made three cards and twenty-two spindles, and put them in motion in the building of a clothier, by the water-wheel of an old fulling-mill. Sixty-seven years have since elapsed, and the business has in that period increased beyond all precedent in the history of manufactures. Our rivers and wild waterfalls, that then flowed and murmured in solitude, are now propelling thousands of mill-wheels, and millions of shuttles and spindles. In the business, hundreds of fortunes have been made, thousands of citizens earn a subsistence and find constant employment, while millions are clothed in different portions of the globe. A wonderful revolution has that old mill produced on the shores of the new world. When Gen. Jackson visited the mill, and complimented Slater on his having been the first: "Yes," he replied, "here I gave out the psalm, which is now sung by millions."

The machines for the spinning of cotton thence spread into several states, and continued to attract capital. The extent to which this was carried became evident in 1810, from the facts collected by the secretary of the treasury, Albert Gallatin, Esq. The manufactures of cotton and wool were then principally confined to families; and Mr. Gallatin thought it probable that about two-thirds of the clothing (including hosiery), of the house and table linen worn and used by the inhabitants of the United States, not residing in cities, was the product of family manufactures. The number of cotton mills returned to the secretary, which were erected at the close of the year 1809, was eighty-seven, sixty-two of which (forty-eight water and fourteen horse-mills) were in operation, and worked at that time 31,000 spindles. The other twenty-five, it was supposed, would be in operation in the course of the year 1810, and, with the former, would probably work eighty thousand spindles at the commencement of the year 1811. He estimated the amount of capital that would be employed in these mills at $4,800,000, the cotton used 3,600,000 lbs., the yarn spun at 2,880,000 lbs., valued at $3,240,000, the men employed 500, and the women and boys 3,500.

By the returns of the marshals of the census of 1810, the number of cotton factories was 168, with 90,000 spindles; but from most of the states no returns were made of the quantity of cotton used and the yarn spun. Massachusetts had 54, most of them, no doubt, small, having in the whole only 19,448 spindles, consuming but 838,348 pounds of cotton, and their produce valued at $931,916. Rhode Island had 26 factories, with 21,030 spindles, and Connecticut 14, with 11,883 spindles. These were for the supply of yarn to be used in hand looms exclusively.

In this position of affairs the war took place; but just on its eve Mr. Francis C. Lowell, of Boston, returned from Europe, where he had inspected the great improvements in machines for cotton manufacturing, and had formed the project of establishing the manufacture in this country. He associated with himself in the enterprise his brother-in-law, Patrick S. Jackson, and they set about it. The country was then at war with England, and there was no possibility of getting either models or machines thence, nor even drawings. The memory of Mr. Lowell was all that was to be depended upon for the structure of the machinery, the materials used in the construction, even the tools of the machine shop. The first object to be accomplished was to procure a power loom. To obtain one from England was, of course, impracticable; and although there were many patents for such machines in our Patent Office, not one had yet exhibited sufficient merit to be adopted into use. Under these circumstances but one resource remained—to invent one themselves—and this these earnest men at once set about.

Unacquainted as they were with machinery in practice, they dared, nevertheless, to attempt the solution of a problem that had baffled the most ingenious mechanicians. In England, the power loom had been invented by a clergyman, and why not here by a merchant? After numerous experiments and failures, they at last succeeded, in the autumn of 1812, in producing a model which they thought so well of as to be willing to make preparations for putting up a mill for the weaving of cotton cloth. It was now necessary to procure the assistance of a practical mechanic, to aid in the construction of the machinery, and the friends had the good fortune to secure the services of Mr. Paul Moody, afterward so well known as the head of the machine shop at Lowell. They found, as might naturally be expected, many defects in their model loom; but these were gradually remedied. The project hitherto had been exclusively for a weaving mill, to do by power what had before been done by hand looms. But it was ascertained on inquiry that it would be more economical to spin the twist than to buy it, and they put up a mill for about 1,700 spindles, which was completed late in 1813. It will probably strike the reader with some astonishment to be told that this mill, still in operation at Waltham, was probably the first one in the world that combined all the operations necessary for converting the raw cotton into finished cloth. Such, however, is the fact, as far as we are informed on the subject. The mills in this country—Slater's, for example, in Rhode Island—were spinning mills only; and in England, though the power loom had been introduced, it was used in separate establishments, by persons who bought, as the hand weavers had always done, their twist of the spinners. Great difficulty was at first experienced at Waltham, for the want of a proper preparation (sizing) of the warps. They procured from England a drawing of Horrocks' dressing machine, which, with some essential improvements, they adopted, producing the dresser now in use at Lowell and elsewhere. No method was, however, indicated in this drawing of winding the threads from the bobbins on to the beam; to supply this deficiency, the machine called the warper was invented, and there was now no further difficulty in weaving by power looms. The "double speeder," answering to the fly frame for spinning roving, was then added. Mr. Moody then invented the machine called the filling throstle, for winding the thread for weft from the bobbin on to the quills for the shuttle. The manufacture, as far as machinery went, was now on a permanent basis. The difficulty that presented itself was in operatives. There was here no such pauper class as that from which the English mills were supplied, and the factories were to be recruited from respectable families. By the erection of boarding-houses, at the expense and under the control of the factory; putting at the head of them matrons of tried character, and allowing no boarders to be received except the female operatives of the mill; by stringent regulations for the government of these houses—by all these precautions, they gained the confidence of the rural population, who were no longer afraid to trust their daughters in a manufacturing town. A supply was thus obtained, of respectable girls; and these, from pride of character, as well as from principle, have taken care to exclude all others. It was soon found that apprenticeship in a factory entailed no degradation of character, and was no impediment to a respectable connection in marriage. A factory girl was no longer condemned to pursue that vocation for life; she would retire, in her turn, to assume the higher and more appropriate responsibilities of her sex; and it soon came to be considered that a few years in a mill were an honorable mode of securing a dower. The business could thus be conducted without any permanent manufacturing population. The operatives no longer form a separate caste, pursuing a sedentary employment, from parent to child, in the heated rooms of a factory, but are recruited in a circulating current from the healthy and virtuous population of the country. The success which these mills met with of course prompted their extension. In 1821, Mr. Ezra Worther, who had formerly been a partner with Mr. Moody, and who had applied to Mr. Jackson for employment, suggested that the Pawtucket canal, at Chelmsford, would afford a fine location for large manufacturing establishments, and that probably a privilege might be purchased of its proprietors. To Mr. Jackson's mind the hint suggested a much more stupendous project—nothing less than to possess himself of the whole power of the Merrimac river at that place. Aware of the necessity of secrecy of action, to secure this property at any reasonable price, he undertook it single-handed. It was necessary to purchase not only the stock in the canal, but all the farms on both sides of the river, which controlled the water-power, or which might be necessary for the future extension of the business. Such was the beginning of Lowell, since so world-renowned. A new company, the Merrimac, was immediately established under the direction of Kirk Boott, Esq.

The establishment of the Lowell mills took place at a time when the occurrence of war had diverted the capital of New England from commerce, and it eagerly sought new modes of investment. These were presented in the promising prospects of the newly invented machine manufactures. The cotton growth of the south had become large before the war, and that event caused an immense accumulation of stock that sunk the price to the lowest point, and by so doing, offered an abundance of raw material at rates merely nominal compared with what the English manufacturers had been paying. This gave a great advantage to the new enterprise, and Congress aided it by the establishment of protective duties. The *minimum* cotton duty was invented for the purpose. The rate was nominally *ad valorem*, but the price was fixed at a *minimum*, on which the duty was cast—hence the duty was in effect specific. Thus, the abundant raw material, the low price of cotton, and the protection of the government, all combined to give breadth to the newly awakened manufacturing fever. The capital that crowded into it, soon, as a matter of course, overdid the business, and distress followed, which was sought to be relieved by a still higher tariff in 1824. That seemed, however, to add but fuel to the flame; and in 1828, still higher rates were demanded. We may compare these tariffs: cotton goods not dyed were to be valued at twenty-five cents per square yard, and pay twenty-five per cent. duty, or six and a quarter cents per yard; goods printed or dyed were to pay nine cents per square yard; fustians, moleskins, etc., were to pay twenty-five cents per square yard; woollens were charged twenty-five per cent. in 1816, thirty-three and a half per cent. in 1824, and forty-five per cent. in 1828. Under all these circumstances, the manufacture could not fail to grow rapidly, and of course to bring on distress as the result. In 1831, the tariff excitement had reached such a pitch that the most disastrous political results were anticipated. It was then that the committee of the convention collected information of the existing manufactures. They reported the table which we annex. The returns are for the eleven states where manufactures were well developed; some twenty to thirty other mills were also reported, but so imperfectly that the returns were rejected. The table is very valuable—as follows :—

STATEMENT OF THE NUMBER OF COTTON ESTABLISHMENTS IN THE ELEVEN FOLLOWING STATES, AND THEIR PRODUCTS IN 1831.

	Virginia.	Maryland.	Maine.	N. Hampshire.	Massachusetts.	Connecticut.	Rhode Island.	New York.	New Jersey.	Pennsylvania.	Delaware.	Total.	Machine shops.	Bleacheries.	Printeries.
Capital	$290,000	2,144,000	765,000	5,300,000	12,891,000	2,825,000	6,262,340	3,671,500	2,027,644	3,758,500	384,500	40,614,984	2,400,000	900,000	1,000,000
Number of mills......	7	23	8	40	250	94	116	112	51	[illegible]	10	795	..	..	..
Number of spindles...	9,844	47,222	6,500	113,776	339,777	115,528	235,753	157,316	62,979	120,810	24,806	1,246,503	..	..	..
Number of looms.....	91	1,002	164	3,530	8,981	2,609	5,773	3,653	815	6,301	235	33,506	..	..	..
Pounds of yarn sold...	869,000	1,104,000	..		807,366	487,900	..	1,867,790	3,212,184	2,192,865	..	10,642,000	..	..	..
Yards of cloth........	675,000	7,649,000	1,750,000	29,060,500	79,231,000	20,055,500	37,121,681	21,010,920	5,133,776	21,832,467	5,203,746	230,461,990	..	..	..
Pounds of cloth......	168,000	2,224,000	525,000	7,255,060	21,301,062	5,612,000	9,271,481	5,297,713	1,877,418	4,207,192	1,201,500	59,604,926	.	..	..
Males employed	143	824	54	875	2,665	1,399	1,781	1,374	2,151	6,545	697	18,539	3,200	612	950
" Wages per week	$2 73	3 87	5 50	6 25	7 00	4 50	5 25	6 00	6 00	6 00	5 00	..	7 50	6 00	7 00
Females employed. ..	275	1,793	205	4,090	10,678	2,477	3,297	3,652	3,070	8,351	676	38,927	..	126	125
" Wages per week	$1 58	1 91	2 33	2 60	2 25	2 20	2 20	1 90	1 90	2 00	2 00	..	..	2 88	2 52
Children under 12 y'rs	..	..	..	60	..	439	3,472	484	217	..	..	4,691	..	..	432
" Wages per week	..	..	..	2 00	..	1 50	1 50	1 40	1 40	.	..		..	..	1 82
Pounds of cotton used	..	3,008,000	588,500	7,845,000	24,871,981	6,777,209	10,414,578	7,961,670	5,832,204	7,111,174	1,435,000	77,757,816	..	..	..
Pounds of starch.....	8,700	..	15,000	164,000	907,480	187,135	324,908	34,030	..	..	..	1,641,253	..	429,625	..
Bbls. of flour for sizing	352	874	70	1,900	2,351	516	1,334	2,409	975	5,714	750	17,245	..	..	1,300
Cords of wood........	50	6,148	400	7,300	9,476	7,193	1,440	7,038	671	5,000	750	46,519	..	..	30,000
Tons of coal....	200	65	..	1,500	2,621	247	1,410	488	1,007	15,314	768	24,420	..	19,250	2,250
Bushels of charcoal...	1,000	400	..	..	4,635	3,350	..	..	820	..	..	9,205	..	..	
Gallons of oil.........	.	12,875	2,700	40,000	68,428	25,217	61,457	35,923	13,348	29,300	6,000	300,338	.	..	2,800
Value of other articles	2,070	31,045	3,200	103,000	180,677	30,065	77,433	60,335	18,208	74,040	12,000	599,223	1,960,212	276,265	930,585
Total dependants.....	270	4,208	389	8,000	25,211	7,266	17,567	12,951	12,750	25,000	2,500	117,626	9,000	1,403	2,860

REMARKS.—Delaware includes $162,000, and Pennsylvania $500,000 for the capital employing the hand looms. The cotton consumed, 77,757,816 lbs., is 214,882 bales of the average weight of 361 86-100.

Such had been the immense growth of the manufacture in ten years from the time the Lowell mills were started, when but little machine cloth was made; but in 1831, there was made, it appears, 230,461,990 yards, or nearly twenty yards per head of all the people. It is obvious that this large and sudden production of cloth could have found vent only by supplanting the work of families and hand looms, and of course by pressing hard upon the spinners of yarn. The New England mills were mostly carried on as one concern, spinning and manufacturing together. This, however, is not the case with the mills in the middle or the new states. The mills there are mostly employed in spinning only, as were the first New England mills. The yarns are produced for sale to hand looms. The census of 1840 gave the number of mills in the whole country at 1,240, and the number of spindles at 2,284,631, consuming 132,835,856 lbs. of cotton; and the manufacture had continued to spread into the southern and western states. That was still hand weaving, which yet obtains in many parts of the older states of the Union. Thus, while in Pennsylvania the capital invested amounts to about one-seventh of that of Massachusetts, the quantity of cotton consumed is one-fifth; the value of the raw material, not quite one-fourth; number of operatives (male and female), one-fourth; value of products, rather more than one-fourth; the number of pounds of yarn spun and sold as yarn is above thirty times greater in Pennsylvania than in Massachusetts. This, to a certain extent, gives a key to the differences in the modes of manufacture in the two states. There can be no doubt, however, that domestic weaving is gradually giving way, and those manufacturers, especially in Pennsylvania, who formerly did a prosperous business as spinners only, now find that the eastern states supply the piece goods at a rate so little above the cost of the yarn, that it is not worth the while of the farmer to continue this primitive custom of weaving his own cloth. Thus the domestic loom is fast following the spinning wheel of the early settlers, and those manufacturers who until recently have spun yarn only, are gradually introducing the power loom as the only means of sustaining their position in the market. This was illustrated by the Eagle Cotton Mill, Pittsburg, Pennsylvania. Formerly, the proprietors spun yarn only, and did a successful trade; but, by a return which they made, it appears that in six establishments under their direction they had introduced already 540 looms to the 26,000 spindles, and were manufacturing sheeting at the rate of 6,000,000 yards per annum, together with twilled cotton bags, batting, and yarns, and this in order to make the latter pay, by consuming the surplus yarns themselves. In the Penn Cotton Mill, Pittsburg, the more modern system had become the rule of the establishment, and with 7,000 spindles and 207 looms, 2,730,000 yards of shirtings were produced annually, besides 240,000 lbs. weight of colored yarns for cotton warps and cotton rope. At two establishments in Richmond, Virginia, the consumption of the yarn in the manufacture of piece goods was the rule. Georgia, Tennessee, and North Carolina are quoted as those in which the greater progress had been made, while Virginia, South Carolina, and Alabama were the next. In Tennessee, spinning would appear to be the rule and manufacturing the exception; in Georgia and North Carolina, equal attention is paid to both; while in Virginia, South Carolina, and Alabama the manufacture of the piece goods is decidedly more extensively carried on than spinning; only slave labor is largely used, with free whites as overseers and instructors. The males are heads of departments, machinists, dressers, etc., and the females are spinners and weavers. The latter are chiefly adults, though children from twelve to fifteen are employed. The average hours of work here are twelve, but vary a little with the season, very full time being the rule. The James River Mill produces a large weight of work for the extent of its machinery. The goods manufactured are coarse cottons, and average about two and one-half yards to the pound, shirtings twenty-eight inches wide (osnaburgs), summer pantaloons for slaves, and bagging for export to the Brazils for sugar bags, running about three yards to the pound. Bagging of a lighter character for grain, and thirty-six inch osnaburgs, two yards to the pound, are also produced. The Manchester Company manufacture sheetings, shirtings, and yarns, and employ about 325 operatives; the children being of the same average age as at the James River Mill. Mr. Whitehead, of Virginia, in 1853, perfected a patent speeder. Its advantages are a greater speed, a more even roving, and a bobbin of any desirable size, which never becomes spongy in the winding. In Maryland, however, there were twenty-four establishments in 1850, chiefly engaged in the manufacture of piece goods, such as drillings, sheetings, ducks, osnaburgs, and bagging. The yarns produced for domestic purposes bear but a small proportion to those manufactured into cloth, and these are chiefly sold within the state for the home weaving of mixed fabrics of wool and cotton, forming coarse linseys. If the illustrations given show the early progress and position of this manufacture in the United States, so far as daily-recurring improvements and ever-increasing wants have permitted it to remain in its original form, the manufacturing towns of Lowell, Manchester, and Lawrence, strikingly demonstrate the results of the energy and enterprise of the manufacturers of New England. At Lowell, Mass., the cotton manufacture has been developed in a form which has been a theme for many writers on the economy and social bearing of the factory system; and the plans so successfully put into operation here and carried on since 1822 have led to the erection of large establishments, with their attendant boarding-houses, at Manchester, N. H., and more recently at Lawrence, Mass. The falls of the Pawtucket on the Merrimac river and the Pawtucket canal, which had previously been used only for the purpose of navigation and connecting the river above and below the falls by means of locks, presented to the original projectors of Lowell a site for the solution of an important problem, not only in American industry, but to a great extent in that of Europe itself. This was the combination of great natural advantages with a large and well-directed capital, resulting in extensive and systematic operations for the realization of a legitimate profit, while the social position of the operative classes was sedulously cared for, and their moral and intellectual elevation promoted and secured.

The census of 1860 gave figures that show the extent of the manufacture as it existed at that date, in all the states. Those figures are as follows:—

COTTON MANUFACTURES OF THE UNITED STATES PER CENSUS OF 1860.

States.	No. of Establishments.	Capital.	Cost of raw material.	Male hands.	Female hands.	Cost of labor.	Value of products.
Maine	19	$6,018,325	$3,319,335	1,828	4,936	$1,368,888	$6,235,623
New Hampshire	44	12,586,880	7,128,196	3,829	8,901	2,883,804	13,699,994
Vermont	8	271,200	181,030	157	222	78,468	357,450
Massachusetts	217	33,704,674	17,214,592	13,691	24,760	7,798,476	38,004,255
Rhode Island	153	10,052,200	5,799,223	6,353	7,724	2,847,804	12,151,191
Connecticut	129	6,627,000	4,028,406	4,028	4,974	1,743,480	8,911,387
New York	79	5,383,479	3,061,105	3,107	4,552	1,405,292	6,676,878
Pennsylvania	185	9,203,460	7,386,213	6,412	8,582	2,768,340	13,650,114
New Jersey	44	1,320,550	1,165,435	1,010	1,524	468,336	2,217,728
Delaware	11	582,500	570,102	520	589	218,352	941,703
Maryland	20	2,254,500	1,698,413	1,093	1,594	582,780	2,973,877
District of Columbia	1	45,000	47,403	70	25	19,800	74,400
Ohio	8	265,000	374,100	372	468	151,164	723,530
Indiana	2	251,000	229,925	177	190	84,888	344,350
Illinois	3	4,700	11,930	10	1	2,640	18,987
Utah	1	6,000	6,000	4	3	3,420	10,000
Missovri	2	169,000	110,000	85	85	30,600	230,000
Kentucky	6	244,000	214,755	130	116	41,280	315,270
Virginia	16	1,367,543	811,187	694	747	260,856	1,489,971
North Carolina	39	1,272,750	622,363	449	1,315	189,744	1,046,047
South Carolina	17	801,825	431,525	342	549	123,300	713,050
Georgia	33	2,126,103	1,466,375	1,131	1,682	415,332	2,371,207
Florida	1	30,000	23,600	40	25	7,872	40,000
Alabama	14	1,316,000	617,633	543	769	198,408	1,040,147
Louisiana	2	1,000,000	226,600	220	140	49,440	466,500
Texas	1	450,000	64,140	130	..	15,600	80,695
Mississippi	4	230,000	79,800	106	109	36,264	176,328
Arkansas	2	37,000	11,600	14	11	4,428	23,000
Tennessee	30	965,000	384,548	323	576	139,180	698,122
Total	1,091	98,585,269	57,285,534	46,859	75,169	23,940,168	115,681,774
Total in 1850	1,074	76,032,578	37,778,064	35,295	62,661	17,267,112	65,501,687
Increase	17	$22,552,691	$19,507,470	11,364	12,508	$6,672,996	$50,180,087

CHAPTER III.

INVENTIONS—MODE OF MANUFACTURE—PRINTING—AGGREGATE.

While the manufacture has thus spread over the face of the Union, the pioneer mills, or those which are erected in new localities, are generally employed in the spinning of yarn of coarse sorts; the old mills gradually spinning finer yarn, and attaching weaving and printing to their operations. In the whole period, however, of the past forty years, continued improvements have been made in machines and in power. Those mills that came into operation with fresh capital and the newest machines, had always advantages over those which still worked the old machines. The introduction of steam as a motor also favored the introduction of mills into localities that were not provided with water, and many persons contended that steam was cheaper and better even where water power existed. The latter was improved in its turn by the introduction of turbine wheels, which are a steady and sufficient power. The streams of New England were by art made to contribute in a wonderful manner to the work of factories. The works at Holyoke, Mass., are a singular instance of genius and enterprise. In the machines themselves, the greatest improvements have been continually made, in this country, as well as abroad. We have mentioned the American gin of Whitney, which, by enabling cotton to be cleaned, laid the foundation of the whole trade. The card-sticking machine, the steel die of Perkins, ring spindle of Jenks, the improved throstle of M'Cully, the tube-frame, the patent size of Mallerd, of Lowell, are among the most important of a crowd of inventions that have been made by American mechanics, and every few years a new mill starts in some quarter, with all these combined. The ring spindle of Mr. Jenks is very curious, and is producing important results. That gentleman was a pupil of Slater, and has an establishment for the manufacture of cotton machinery near Philadelphia, since 1810. On the starting of the Lowell mills, Mr. Moody invented a number of machines, viz: a loom, a filling frame, a double speeder, a governor, and also what is called the "dead spindle," in distinction to the "live spindle," which was the English invention. The dead spindle is mostly used in Lowell. Mr. Jenks' ring spindle is, however, superseding both, inasmuch as that it produces more and better yarn. The spindle of this improved frame has no fly, but has a small steel ring, called a traveller, about a quarter of an inch in diameter, with a slit for the insertion of the thread, which is wound by the ring travelling around the bobbin, being held in its horizontal plane, during its circuit, by an iron ring loosely embraced by its lower end and fastened upon the traversing rail, being sufficiently large to allow the head of the bobbin, as well as the traveller, to pass through without touching. This plan of spindle may be driven 8,000 revolutions per minute with perfect security when spinning coarse yarn, and when producing the finer numbers, 10,000 revolutions per minute is not an extraordinary speed for it to attain; the yarn produced in either case being superior in strength and character to the yarn produced by the other throstles at a greatly reduced speed.

The manufacture, as at present conducted, is a most beautiful and complicated art. The raw material is divided into long staple, medium staple, and short staple. The staple means simply the length of the fibre, and it is characteristic of the origin of the article. The first or long staple is used for the warps, or the longitudinal threads of a cloth. These threads must be made of long staple; no other kind of cotton will spin into the fine numbers. The medium staple is used for the "weft," or cross threads of tissues. It is softer and silkier than the long staple, and fills up the fabric better. The long staple will not answer for this purpose. The quantity of cotton in the weft of cloth is from two to five times as much as that in the warp. The short staple is used for weft, but it is harsher and more like wool, and after washing or bleaching it makes the cloth meagre and thin. It is mixed with the medium staple in small proportions.

This last and almost, when alone, useless sort is that which comes from India, and the first or long staple is "sea island," raised on our southern coast. The medium staple, or that which is required for the great bulk of the manufactures, is alone found in the United States. It is that kind called "uplands," bowed Georgia, or New Orleans. The quality is a result of climate and soil.

The cotton having reached the mill, it is requisite that all of the same staple, but of different qualities, should be well mixed, to give as uniform a character as possible to the cloth. To attain this, the contents of a bale are spread out upon the floor, and upon it another is scattered, and so on until a huge pile, called a "bing," has been raised; a rake is then used to scrape down from the sides, thus mixing the whole as the cotton is required for the mill. This cotton is matted together and filled with dirt, sometimes by design to increase the weight fraudulently. It must, therefore, first of all be cleaned and the fibres loosened. For this purpose several machines are used. The favorite is a patent Willey, which is composed of two iron axles on a level with each other, each having four stout steel teeth. The teeth of both axles mesh together as they revolve, and also the fixed teeth attached to the inner casing of the box which contains them. These axles revolve 1,600 times in a minute, opening out the fibres and beating out the dirt from the cotton, which is blown through a tube by a revolving fan.

The second machine through which the cotton passes is the spreading machine, the object of which is to perfect the cleaning and loosening of the fibres. The cotton being carefully weighed and spread upon the feeding apron, passes in between a pair of rollers, where it meets the action of blunt knives revolving 1,700 times in a minute. The cotton coming from this machine is flattened into a filmy sheet of uniform thickness, and wound upon a roller. It is of the greatest importance that this feeding should be done evenly, as otherwise the "lap," as it winds upon the roller, will have thin and thick places, which will run through the subsequent manufacture.

The laps that come from the spreader wound on rollers, are now to go through the third process, that of carding. The machine for this purpose we have described. It receives the end of the lap from the roller of the spreader, and by its operation combs out and straightens the cotton into a delicate fleece, which the "doffer" delivers through a funnel, whence it is drawn compressed, elongated, and consolidated by a pair of rollers, that drop it into a tin can. To the observer it appears like a stream of cream running into the tin can. For very fine yarns, this process is repeated with finer cards. The first carding is then called breaking.

The fourth process for the cotton is the drawing. Hitherto the cotton has passed only through male hands; with the drawing it passes into those of females. The slivers, as they are dropped into the tin can from the carding machine, are exceedingly tender and loose, and the fibres are not yet arranged in the position proper for the manufacture of smooth yarn. This is to be perfected by the rollers of the drawing frame; some frames have three pairs of rollers and others four. The distance between the pairs of rollers is such that the longest fibre of cotton will not reach from the centre of one roller to that of another pair. This prevents breaking the fibres, but the rollers must not be too far apart, lest the cotton separate in unequal thicknesses. The "doubling," by which the end of a new sliver is laid on the middle of one running in, equalizes the sliver. The more it is doubled and drawn, the more perfect is the yarn, and this doubling is done sometimes 32,000 times.

The fifth operation is the roving, or first spinning process. The slivers under the action of the drawing frame become so thin and tender they will no longer hold together without a twist, and many machines are used for the purpose of imparting it, under the names of slubbin, fly frame, belt speeder, tube frame, and others. The operation is performed one or more times, according to the fineness of the yarn desired. The cans which receive the slivers from the drawing frames are placed upon revolving wheels, and the sliver passes from these to the fly frame. This came into use in 1817. In this frame the spindles are set vertically in one or two rows at equal distances apart, each passing through a bobbin, which is loosely attached to it, and which has a play equal to its length up and down on the spindle; at the top of the spindle is suspended a fly with two dependent legs, one solid, and the other hollow. The roving enters this by an eye immediately above the top of the spindle, and passing down the hollow leg attaches to the bobbin. The revolving spindle carries the fly with it, spinning and winding the roving at the same time. At this point enters a very nice calculation. The roller on which the roving is wound delivers it with the exact speed of the spindle, but as the size of the bobbin on the latter increases, it going at the same speed would take up the yarn faster than the roller would deliver it, and would strain it too much. This is avoided by a contrivance which varies the speed of the bobbin to meet the circumstances. The rovings having received this twist, are now to be spun into yarn, and this is done either by the throstle or the mule spinner. The difference in the motion and structure of these machines is not great. The former is similar to the bobbin and fly frame. The roving being unwound from the bobbin is elongated between three pairs of rollers, and is then spun and wound upon a bobbin as before. The greatest difference in these machines is in the spindles. The oldest is the live spindle, and the dead spindle is that invented at Lowell, and that which has been most used here. The ring spindle of Jenks is fast superseding both. The thread being spun by any of these means is wound upon bobbins, and these are then set in a frame in such a manner that the threads can be wound off from them on to a large six-sided reel. This, one and a half yards in circumference, makes 560 revolutions, giving the length of a "hank;" many hanks are wound on the reel at the same time, and when these are removed and weighed they give the number of the yarn. The coarsest yarn weighs half a pound to the hank, or 840 yards; common quality gives ten to forty hanks to the pound. The finest seldom exceeds 300 hanks to the pound. Previous to 1840 no yarn finer than 350 was made in England; at the World's Fair there was some exhibited 600, and some muslin for a dress for the queen was made of 460 yarn. This exceeds the "fairy tissues" of the east, mentioned in the fore part of this article. Thus machinery has overtaken eastern hand art. It has been stated that yarn has been spun 900, and one specimen of No. 2,150, or 1,026 miles for a pound of cotton!

The finest yarns are singed by being run through a gas flame; they are then passed over a brush and run through a hole in a piece of brass just large enough to admit the yarn. Any inequality then stops the yarn and is immediately remedied. Upon most of the machines, throstles, and feeders there are clocks, which, wound up once a week, mark the quantity of work that each machine does. From this register the account is transferred to a board which hangs in sight of all the operatives, and from which the monthly wages are ascertained.

The yarn being spun, the filling is now ready for the weaver, but the warp goes to the dressing-room. Here the yarn is warped off from the spools on to the section beams. This is considered hard work, since it requires unremitting attention to reconnect the threads that are constantly breaking. The yarn now upon the beams undergoes "dressing," or the application of the size before mentioned, and the friction of the brushes. The beams containing the dressed yarn go to the weaving-room, which usually is a large mill containing one hundred and fifty girls, and some six hundred looms. From this room the woven fabric goes to the cloth-room, where it is trimmed, measured, folded, and recorded, and either baled for market or sent to the print-works.

The print-works are a most interesting portion of the manufacture. The cloth received from the manufactory is covered with a fine nap, which, if printed, would rise up and give the colored parts a pepper-and-salt look. To get rid of this, the cloth is singed; not as the cook singes a fowl, by a blaze, but by running the cloth over a half-cylinder of copper, heated red hot. The cloth is passed over dry, and repassed; after which it is moistened by wet rollers, to extinguish any shreds which might happen to be on fire. This singeing process always excites the wonder of the beholder, who is not a little astonished that the cloth is not injured. The next process is to bleach the cloth. On the success of this depends all the after-work. A good white is not only the soul of a print, but without it no good and brilliant color can be dyed. The greatest difficulty is to remove every trace of grease and oil, imparted by the spinner and weaver. The cloth is, therefore, put into big tubs, holding five hundred pieces, and steeped in warm water some hours. It is then washed in the dash-wheel, and subjected to the following operations, which convert the oil to soap, and remove with it the coloring matter:—

1. Boiled by steam in a creamy lime.
2. Washed in the dash-wheel.
3. Boiled in alkali by steam.
4. Washed in the dash-wheel.
5. Steeped in bleaching-powder solution some hours.
6. Steeped in oil vitriol and water, about the strength of lemon juice.
7. Washed in the dash-wheel.
8. Squeezed between rollers.
9. Mangled and dried in air, or in warm rooms built for this purpose.

The cloth is now perfectly white, and loses not so much in weight and strength as by the old process of grass bleaching. The bleached cloth is now printed with one or more colors. Four to six colors only could be applied by the printing machine up to 1845; if more were wanted, they were, until recently, introduced by hand, with blocks, after the other colors were finished. By a Boston invention, patented in 1851, twelve colors may now be printed. The improvement consists in the mode of applying pressure to the print rollers. A yielding pressure of several tons is given to each roller. The frame is also so constructed that any one of the rollers may be removed from the machine without disturbing the others. The machine weighs ten tons, and is ten feet high. This huge machine is so nicely adjusted that the cloth, while passing through it at the rate of a *mile per hour*, receives twelve colors each with the utmost precision. Ordinary machines will print 300 pieces, or 12,000 yards, per day, while, by the old hand process, it would have required 192,646 applications of the block. The figure, or design, is engraved on a copper roller, each color having a separate roller. The color which the beholder sees imprinted, as he watches the process, is not the color that is to be, when the print is finished. The color which he sees is, with the exception of brown, or blue, or black occasionally, fugitive. It is merely what is called "sightening"—that is, a color imparted to the paste, or "thickening," which is imprinted by the roller to enable the machine printer to judge of the perfectness of the work. The paste, or *thickening*, contains the mordant—that is, the peculiar substance which, combining chemically with the cloth, enables it to dye a peculiar color, according to the nature of the mordant and dye-wood. The cloth dyes only where the mordant is applied—that is, on the printed figure only. The mordants generally used are alum and copperas, each of which is first changed to *acetate of alumina or iron*—that is, the color-maker takes away the oil of vitriol from the alum and copperas, and substitutes vinegar in its place. Sometimes the *iron liquor*, as it is called, is made by dissolving iron turnings in pyroligneous or wood acid. The preparation of color, and the thickening it with flour, starch, gum, etc., is a distinct branch, carried on in the color shop of the print-works. It may be added, that with madder, iron dyes black and purple, according to its strength; alum dyes red of various shades; and a mixture of the two dyes chocolate. So that out of the same dye-kettle come various colors, according to the mordant, and these colors are all fast.

The cloth having been printed and dried, is "aged," during which a chemical combination takes place between the mordant and the cloth. Ordinarily, this occurs in two or three weeks by a natural affinity of the cotton fibre and mordant, but by certain agents, this chemical change is hastened and perfectly effected in two or three days; yet as this process goes on in conjunction with the others, the visitor sees only the folding up and winding into rolls of the piece of cloth, though all the time this change is going on. The cloth is then passed, by means of rollers, through a boiling hot solution of *phosphate of soda*, to render insoluble any uncombined mordant, and to wet the cloth evenly. It is then washed in the dash-wheel, and after this, to remove the *thickening*, passed for twenty or thirty minutes through bran or meal and water, quite hot, washed, and it is now ready for dyeing. The dye-woods used are madder, bark, or logwood—the last only for mourning prints, or black and white. The dye-wood is put into large wooden vats, with a portion of water, and then the pieces of cloth, sixteen in each vat, are introduced over a winch, moved by water power. Steam is then admitted, the goods turned through and through, round and round, gradually heating the water, till at the end of two hours it rises near to boiling, and the mordanted cloth is perfectly dyed. It is taken out, rinsed, and washed in the dash-wheel. The cloth after this is passed, by means of a winch, either through hot water and bran or through hot soap, for half an hour, washed, and then again put through these operations, again washed, and then rinsed through a hot solution of chloride of soda, washed again, squeezed, and dried in either air or in warm rooms. Sometimes they are mangled with some stiffening, and so are finished. The visitor of print works will see a great number of men busily employed dipping wooden frames, on which are stretched pieces of cloth, printed with a brown figure, into deep vats, filled with a green-blue liquor. The cloth comes out with a *greenish* hue, and immediately grows blue in the air on all parts, except where the brown figure was. That *resists*, or *throws off* the blue vat. Now, the blue vat contains a solution of indigo in lime water. Indigo is one of the most insoluble substances in water;

but by means of copperas and lime, the oxygen of the indigo is abstracted by the iron; it then becomes greenish and is dissolved by the lime-water. Exposed to air, it again absorbs oxygen and becomes blue. It is during this change from green to blue that it becomes chemically united to the cloth. The brown figure *resists*, because it is a preparation of copper, which yields its oxygen to the indigo on the figure while in the vat. The figure becomes covered with blue indigo in the vat; it forms then no affinity with the cloth, and consequently after the copper has been removed by a weak acid, the brown spot or figure remains white, and so is produced the blue ground with white figures. The whole is a most exquisite chemical process from beginning to end, equalled only by the process for China blue, where blue figures are raised on a white ground. This is done by printing on the figure with fine ground indigo thickened with paste, and then by alternate immersions in lime water and copperas liquor, the indigo is dissolved and fixed on the spots where printed, by a play of chemical affinities similar to those described in blue dipping. Black and white, and red or chocolate and white, are made by passing the cloth through red or iron liquor, or their mixture, and after squeezing, while the cloth is open and flat, that is dried in hot flues. Every part of the cloth is thus imbued with mordant. The process is termed "pading." It is then printed with citric acid (lemon juice) thickened with roasted starch. This acid discharges the mordant, and consequently, when dyed as usual, the discharged figures are left white. Logwood is the dye for black, and madder is the dye for reds and chocolates. The designing of patterns is a distinct branch of art. Usually, one or more designers are employed in each establishment.

In the year 1840, there were thirty-six cotton-printing establishments in the United States. These were in New Hampshire, Massachusetts, Rhode Island, New York, New Jersey, Pennsylvania, and Maryland. They printed 100,112,000 yards, at a value of $11,667,512.

The exports of cotton goods from the United States in 1827 were valued at $951,000 for plain white cloths; $45,120 printed and colored; $163,293 for yarn, etc.; making together $1,159,413. In 1857, the exports of white had run to $3,463,230; and of printed to $1,785,685; dark and other manufacture, $866,262; together, $6,115,117. The American cottons are much in demand in China, in consequence of their heavier quality than the English or Chinese goods. The value of cotton goods imported in 1856 was $25,917,999; and the average for the last sixteen years was $16,758,418. The value per head of United States cotton goods consumed was, for 1856, $2.40; and of foreign goods, sixty cents. The imported goods are mostly of the finer description, nearly all from England and Scotland, and mostly into the port of New York, under the credit system of sales.

We may here add the progress of the trade in Great Britain, as it is given in the factory inspector's official report:—

	Horse power.	Spindles.	Looms.	Cotton used. lbs.
1851,	134,217	25,638,114	301,445	757,379,749
1857,	161,435	33,503,580	369,205	1,023,886,528

The following comparative figures will show the decline in the cost of the yarn, as a result of machinery:—

No. 40 yarn.	1812.	1830.	1857.
Hanks per spindle per day.	200	275	275
Cotton per lb.	$0 36	$0 14	$0 12
Labor " "	0 24	0 15	0 10
Cost yarn "	0 60	0 29	0 22

The manufacture progresses in this country according to the wants of the population, and these wants increase in the two-fold ratio of more means and greater numbers. The progress here is also more steady than it is abroad, for the reason that the demands of the people are not curtailed by those periodical famines, which abroad cause every other consideration to yield to that of food. We may sum in the following table the progress of the manufacture since 1809:—

COTTON MANUFACTURE IN THE UNITED STATES.

	No. of Factories.	Spindles.	Hands.	Cotton used. lbs.	Yards cloth made.	Capital.
1809	62	31,000	4,000	3,600,000	..	..
1810	168	90,800	..		..	..
1820	..	250,572	..	9,945,609	..	..
1831	795	1,246,503	57,466	77,757,316	230,461,990	$40,614,984
1840	1,240	2,284,631	72,119	132,835,856	398,507,568	51,102,359
1850	1,074	4,052,000	97,956	276,074,100	828,222,300	76,032,578
1860	1,091	5,235,727	122,028	437,905,036	1,148,252,406	98,585,269

The figures for 1809 are those of Mr. Gallatin, and those of 1810 those of the United States marshal, also those for 1820. Those for 1831 are taken from the report of the committee before alluded to, and the succeeding ones from the decennial censuses. Although the returns for 1860 have not yet been officially published, the figures given have been copied from the revised records, and are believed to be substantially accurate. The above table shows that in 1830 the cotton spun was six and a half pounds per head; in 1840, eight pounds per head; in 1850, ten and a quarter pounds per head; and in 1860, fifteen pounds per head, being in the double ratio of numbers and wealth, and showing that the United States are the largest consumers of cotton goods in the world. The United States now consume nearly as much raw cotton per annum as Great Britain did in 1838–9; that is to say, Great Britain at that date consumed 442,691,877 lbs., and the United States this year 357,185,523 lbs. Thus the manufacture in the United States this year for home consumption equals what Great Britain produced for home consumption and her vast export trade in 1839, or twenty years since. In this progress of manufacture there has been a steady decline in price. In 1815 the price of cotton cloth was forty cents; in 1822, twenty-two cents; and at this time four to ten cents. In those figures we have the secret of the great dissemination of machine goods. The price of a good calico is now twelve yards to a bushel of wheat. Forty years ago, it was one yard for a bushel of wheat. The quality of the goods at the same time has improved in a greater ratio. The handsome prints that now replace the "factory checks" of that day, show as great a change as does the price.

PAPER: ITS MANUFACTURE.

CHAPTER I.

MATERIALS—PROGRESS.

If the question were put, "What single article has been of the greatest service to mankind?" mature reflection would, we think, decide upon paper as that article, since it has been the means by which thought and ideas have been diffused, not only among cotemporaries, but preserved, and, as it were, accumulated in magazines for future expansion and growth. All other inventions, and perhaps the whole growth of civilization, are due to the material of paper. Every branch of knowledge is reached, and every avenue to the wisdom of great minds and the results of genius are explored only by means of paper, and its blessings are diffused through all ranks of society. Even he who, wrapt in his ignorance, despises "book larning," enjoys a part of those benefits of civilization which paper has been the means of imparting to all. Like almost all great blessings, however, it has been developed most rapidly and completely in the United States. Almost all vegetable substances were used for the manufacture of paper by our ancestors, but it was not until the fourteenth century that linen rags became generally the material. The first German paper mill was established at Nuremberg in 1390; some English manuscripts, however, date as far back as 1340, on linen paper. The first English mill mentioned is in 1496, by John Tate, jun., in Hertfordshire. In 1588 a paper mill was started at Dartford. It is to be conceived, however, that in that age, when books and newspapers were little used, and walls were draped with cloth, that paper was not much in demand, and many improvements were not made in the manufacture. In the early part of the eighteenth century, the manufacture was introduced into the colonies. Mr. J. M. Willcox, a paper maker near Philadelphia, stated that in 1725 his grandfather, who had been educated a paper maker, came over and settled where the mill now is, and he erected in 1732 a mill for the manufacture of paper. The kind of paper then made was of the description used by clothiers for press-boards, for the pressing of cloth. There existed at that time an act of parliament against the manufacture of any other kind of paper in the colonies. There were at that time two other mills in the same business, one near Boston and another near Philadelphia. The demand for paper at that time, either for books or newspapers, was small, and not of a character to attract much capital into the business. When the war came on, a demand sprung up, and Mr. Willcox manufactured the paper for the continental money, and at the same time commenced making writing paper for the first time in America.

The Massachusetts Bay assembly, in 1728, passed an act for the encouragement of the paper manufacture. They granted to Daniel Henchman and others the right of making paper, on condition that within the first fifteen months they would make 140 reams of brown paper and sixty reams of printing paper. Of this the board of trade report of 1731 says: "By a paper mill set up three years ago, they make to the value of £200." This, with the mill of Willcox and another near Philadelphia, were the only ones existing at that time; but the trade grew to a considerable extent. Coxe, in his "Views of the United States," says there were in 1794 forty-eight mills in Pennsylvania. In 1810, the value of paper made in the United States was about $2,000,000. The general government, from its origin, did what it could to encourage the manufacture, by making rags free; curiously enough, however, after the fall of Napoleon, a considerable quantity of paper came to this country, and was bought up by the contractors to supply Congress; and for a long time, up to 1825, the paper used by the United States Senate bore the water line, "Napoleon, Empereur et Roi, 1813."

It was about the year 1760 that the invention of wove moulds was made to obviate the roughness of *laid* paper. This led to the manufacture in France of what is called vellum paper. In Holland, soon after, the manufacture was improved by the invention of cylinders with long steel knives to reduce the rags to pulp, thus superseding the old plan, which was by stampers. It was then customary to pile the rags in large stone vats, and let them remain for a month or six weeks to ferment and rot by soaking and stirring in water. By these means the fibres became loosened, and sufficiently soft to be reduced to pulp in the large wooden stampers. The *vats* were now supplanted by *engines*. These are arranged in pairs. That which first receives the rags is called the washer, working the rags coarsely, while a stream of water runs through them. The contents of this vat, when ready, is called *half stuff*, and is let off into the other engine, which is on a lower level, and this beats or grinds the whole into pulp for making paper.

From the date of the Revolution until the year 1820, there was very little improvement in the mode of making paper by machinery. The number of mills increased in proportion to the demand for material for newspapers and book-making. This grew in such a manner, that by the year 1810 the ordinary supplies of material for paper making began to fail, and rags from Europe were imported in greater quantities for that purpose. The principal supplies of rags in the United States came from the economy of families, purchased by ragmen who called—sometimes paying money, and at others exchanging tinware and other commodities. It is only of late years, and that in the large cities, that the European *chiffonniers*, or rag-pickers, have made their appearance. These are now to be seen, male and female, with the early dawn, armed with a bag and a long iron hook, watching the opening and sweeping out of stores, to pick up every shred of rag or paper, and following the gutters the live-long day, thrusting the iron hook into filth of all descriptions to fish out matter for the paper maker. This they rinse in the nearest puddle, and deposit in their bag. Many of them earn a fair living at this unpromising occupation. Nevertheless, the supply is very inadequate, and large importations are resorted to. The quantity of imports is as follows:—

IMPORTATION OF RAGS INTO THE UNITED STATES.

	Rags imported. lbs.	Of which from Italy.	Value.	Per lb. cts.
1846,	9,897,706	8,002,865	$385,020	3.89
1847,	8,154,886	6,529,234	304,177	3.73
1848,	17,014,587	13,803,036	626,136	3.68
1849,	14,941,236	11,009,608	524,437	2.51
1850,	20,696,875	15,861,266	747,157	3.61
1851,	26,094,701	18,512,673	902,876	3.46
1852,	18,288,458	12,220,579	622,876	3.42
1853,	22,766,000	14,171,292	985,465	4.31
1854,	32,615,753	24,240,999	1,007,826	3.69
1855,	40,013,516	23,948,612	1,224,413	3.06
1856,	38,727,017	20,817,204	1,239,168	3.20
1857,	44,582,080	27,317,580	1,448,125	3.27
Total,	293,192,815	196,404,948	$10,016,014	

It may be remarked that the export of linen rags is strictly prohibited from Holland, Belgium, France, Spain, and Portugal. The import from Italy has been nearly 70 per cent. The rags thence derived are mostly linen which has been used for outer garments, and which have become whitened by exposure to sun and air. That circumstance formerly gave them a value which they have lost since the improvements in bleaching all descriptions. The linen rags from the north of Europe are stronger and darker. The quantity of rags used in the United States in 1850 was, according to the value reported in the census, nearly 200,000,000 lbs., and 20,-696,875 lbs. were imported in that year. The importation has, it appears, since more than doubled, and it is now estimated that the quantity used is 400,000,000 lbs.; and as one and a half pounds of rags give one pound of paper, the product would be 270,000,000 lbs. This compares with the English and French returns as follows:—

	Rags consumed. lbs.	Paper made annually. lbs.	Lbs. per head consumed.
United States	400,000,000	270,000,000	10.80
Great Britain	436,800,000	291,200,000	4.55
France	235,200,000	140,083,447	3.89

At one time there were serious apprehensions that the supply of linen rags would fail, and various researches were entered upon by ingenious individuals to find substitutes. A book written in Germany by M. Schäffer, so long ago as 1772, contains sixty specimens of paper made of different materials. This ingenious person made paper from the bark of the willow, beech, aspen, hawthorn, lime, and mulberry; from the down of the asclepias, the catkins of black poplar, and the tendrils of the vine; from the stalks of nettle, mugwort, dyer's weed, thistle, bryony, burdock, clematis, willow-herb, and lily; from cabbage-stalks, fir-cones, moss, potatoes, wood-shavings, and sawdust. Paper has been likewise made from straw, hopbind, licorice root, the stalks of the mallow, and the husks of Indian corn. These experiments are now continued, and an attempt to make paper from reeds has recently been made in Baltimore. The process of bleaching the coarser rags, so as to render them fit for the purposes to which only those of the finest qualities were formerly applied, will, however, render the use of these inferior substances unnecessary for many years. The advance of a people in civilization has not only a tendency to make the supply of rags abundant, but, at the same time, to increase the demand. The use of machinery in manufactures renders clothing cheap; the cheapness of clothing causes its consumption to increase, not only in the proportion of an increasing population, but by the scale of individual expenditure; the stock of rags is therefore increasing in the same ratio that our looms produce more linen and cotton cloth. But then the increase of knowledge runs in a parallel line with this increase of comforts, and the increase of knowledge requires an increase of books.

The use of cotton for clothing has become so general as to have an important influence upon the supply of rags. It has to a considerable extent superseded linen. When cotton cloth has been much worn, it is of little value for pulp, since the paper made from it will hardly bear its own weight. To remedy this, imported rags, which are supposed to be about 80 per cent. linen, are mixed with the domestic cotton rags, giving the paper a strength and firmness it would not otherwise have. The best qualities of writing and printing papers contain 30 to 50 per cent. of linen, which is entirely derived from abroad. The use of cotton clothing is, however, rapidly spreading all over the civilized world, and the effect of this is that the proportion of linen contained in the imported rags decreases from 5 to 10 per cent. every year. An ultimate resource is, however, new raw cotton, which, mixed with the worn rags of the same material, makes a beautiful paper. Some twenty years since, after the great revulsion of 1837, cotton was so cheap that large quantities were manufactured into paper. It is ordinarily too dear for that purpose. Some years since the project was started of importing the mummy wrappers from Egypt, to convert them into paper. Old Mehemet Ali, who was chief manufacturer in his own dominions, stopped the project, by forbidding the export and monopolizing that valuable material for his own mills. A curious thing that, that the clothing which swathed dead Egyptians, three to four thousand years since, should now be the medium of knowledge in this nineteenth century.

The quality of the paper depends greatly upon that of the linen worn in the country where it is made. Where that is coarse and brown, the rags and the paper made from them must be so too. The quality of the rags depends very much upon the state of civilization of the countries which produce them; the lower the state of civilization, the more coarse and filthy the rags. When the rags are received at the mill, they are sorted according to their respective qualities; for if rags of different qualities were ground together at the same engine, the finest and best parts would be ground and carried off before the coarser were sufficiently reduced to make a pulp. In the sorting of rags intended for the manufacture of fine paper, hems and seams are kept apart, and coarse cloth separated from fine. Cloth made of tow should be separated from that made of linen; cloth of hemp from cloth of flax. Even the degree of wear should be attended to, for if rags comparatively new are mixed with those which are much worn, by the time the first are reduced to a good pulp, the others are so completely ground up as to pass through the hair strainers, thus occasioning not only loss of material but loss of beauty in the paper; for the smooth, velvet softness of some papers may be produced by the finer particles thus carried off. The pulp produced from imperfectly sorted rags has a cloudy appearance, in consequence of some parts being less reduced than others, and the paper made from it is also cloudy or thicker in some parts than in others, as is evident on holding a sheet up before the light. When it is necessary to mix different qualities of materials, the rags should be ground separately, and the various pulps mixed together afterward. The rag merchants sort rags into five qualities, known as Nos. 1, 2, 3, 4, and 5. No. 1, or *superfine*, consisting wholly of linen, is used for the finest writing papers. No. 5 is canvas, and may, after bleaching, be used for inferior printing papers. There is also *rag-bagging*, or the canvas sacks in which the rags are packed, also cotton colored rags of all colors, but the blue is usually sorted out for making blue paper. Common papers are made from rag-bagging and cotton rags. An operation sometimes required after unpacking the rags is to put them into a *duster*, which is a cylinder four feet in diameter and five feet long, covered with a wire net, and inclosed in a tight box to confine the dust. A quantity of rags being put into this cylinder, it is made to rotate rapidly on its axis, and thus a great deal of dust is shaken out, which might otherwise vitiate the air of the rag-cutting room. The sorting is done by women and children in a large room. The rags are sorted, according to their fineness, into the *superfine*, the *fine*, the *stitches* of the fine, the *middling*, the *seams* and *stitches* of the middling, and the *coarse*. These divisions are more or less observed at the present day. The very coarse parts are rejected, or laid aside for making white-brown paper.

The paper was formerly made into sheets by means of the *mould* and *deckle*. The *mould* was a square frame or shallow box of mahogany, covered at the top with wire cloth; it is an inch or an inch and a half wider than the sheet of paper intended to be made upon it. The wire cloth of the *mould* varies in fineness with that of the paper and the nature of the stuff; it consists of a number of parallel wires stretched across a frame very near together, and tied fast through holes in the sides; a few other stronger wires are also placed across at right angles to the former; they are a considerable distance apart, and are bound to the small wires at the points of intersection by means of fine wires. In several kinds of writing paper the marks of the wires are evident, from the paper being thinner in the parts where the pulp touches the wires. In what is called *wove* paper, there are no marks of the wires; these are avoided by weaving the wire in a loom into a wire cloth, which is stretched over the frame of a mould, and being turned down over the sides is fastened by fine wire.

The *water-mark* in paper is produced by wires bent into the shape of the required letter or device, and sewed to the surface of the mould; it has the effect of making the paper thinner in those places. The old makers employed water-marks of an eccentric kind. Those of Caxton and other early printers were an ox head and star, a collared dog's head, a crown, a shield, a jug, etc. A fool's cap and bells employed as a water-mark gave the name to foolscap paper; a postman's horn, such as was formerly in use, gave the name to post paper. Connected with the sizing of papers is the blueing, which is said to have originated in the suggestion of a paper maker's wife, who thought that the practice of improving the color of linen while passing through the wash, by means of a blue-bag, might also be advantageously applied to paper. A blue-bag was accordingly suspended in the vat, and the effect proved to be so satisfactory that it led to the introduction of the large and important class of blue writing paper. It was soon found that smalt gave a better color than common stone-blue, and smalt continued to be used for many years; but when artificial ultramarine came to be manufactured at a very low cost, and in a great variety of tints, this beautiful color gradually superseded smalt in the manufacture of writing paper.

From 1820 to 1830, some efforts were made to introduce into the United States machinery from Europe. England and France were before us in its introduction. Several machines were sent out from England; some very imperfect, and the cost too great for our manufacture. The patronage then offered was no inducement to our own machinists to construct so expensive a machine until 1830, about which time Phelps & Spofford of Windham, Connecticut, made one which answered very well. Soon after, the country was supplied at a reasonable cost, and equal in quality to the best English. Not long afterward, Howe & Goddard, of Worcester, Massachusetts, commenced making the Fourdrinier—the shaking endless wire-web machine. The *cylinder* machine, more simple and less costly than the other, is in more general use; but the paper made on it is not equal in quality. Notwithstanding, it does very well for news, and the various purposes which a coarser article will answer for. These are made in various places throughout the United States. The interval from 1830 to 1840 was important for the vast improvements in the manufacture, by the application of this kind of machinery for that purpose; also, by the introduction of the use of chlorine in the form of gas, of chloride of lime, and the alkalies, lime and soda-ash, in bleaching, cleansing, and discharging the colors from calicoes, worn out sails, refuse tarred rope, hemp bagging, and cotton waste, the refuse of the cotton mills. These articles, which heretofore had been considered only applicable for the manufacture of coarse wrapping paper, have, through the application of this bleaching and cleansing process, entered largely into the composition of news and coarse printing papers, and consequently have risen in value 300 per cent. A few mills possess machinery and adopt a process by which they are prepared for the finest printing and letter paper. A beautiful paper is made of cast-off cable rope. Hemp bagging is an excellent material for giving strength, and is in great demand, especially for making the best news paper. The cost of making paper by machinery, compared with that of making it by the old method (by hand), not taking into account the interest on cost and repair of machinery, is about as one to eight. The present low price resulting from improved machinery and the cheap printing by steam power, has placed newspapers and books in the hands of all; and a great increase of production has followed within the last few years. The quantity now made might be nearly ascertained, if the deputy marshals could report the number of *engines* in operation: 300 pounds of paper would be the average daily produce of each engine—taking into consideration the loss of time and power from a deficiency of water in the summer season. There has been a greater proportional increase of mills in the middle and western states within the last ten years, than in the east. Ten years ago, 80 per cent. of the supplies for Philadelphia came from the east of the North River; at present there probably does not come 20 per cent. Formerly, a much greater quantity was sent west of the mountains, and large quantities of rags brought in return. In consequence of the greater number of mills in the west, particularly in Ohio, New Orleans is to some extent getting supplies there. Formerly, they all went from the Atlantic states.

CHAPTER II.

INVENTIONS—MANUFACTURE.

The slow and difficult process of moulding the separate sheets of paper by hand, has to a very great extent been superseded by the introduction and gradual improvement of the very beautiful machinery of Fourdrinier. By means of this machine, a process which, under the old hand system, occupied a couple of weeks, is now performed in a few minutes. Within this brief space of time, and the short distance of thirty or forty feet, a continuous stream of fluid pulp is made into paper, dried, polished, and cut up into separate sheets ready for use. The paper thus produced is moderate in price, and, for a large number of purposes, superior in quality to that which was formerly made by hand. In fact, the machine-made papers can be produced of unlimited dimensions; they are of uniform thickness; they can be fabricated at any season of the year; they do not require to be sorted, trimmed, and hung up in the drying-house—operations which formerly led to so much waste that about one sheet in every five was defective. The paper machine moves at the rate of from twenty-five to forty feet per minute, so that scarcely *two minutes* are occupied in converting liquid pulp into finished paper, a result which, by the old process, occupied about *seven* or *eight days*. If the machine produce ten lineal yards of paper per minute, or six hundred yards per hour, this is equal to a mile of paper in three hours, or four miles per day of twelve hours. The paper is about fifty-four inches wide, and supposing three hundred machines to be at work on an average twelve hours a day, the aggregate length of web would be equal to 1,200 miles, and the area 3,000,000 square yards.

Paper is sent into market in various forms and sizes, according to the use for which it is intended. The following table contains the names and dimensions of various sheets of paper.

	Inches.
Foolscap	14 by 17
Crown	15 " 20
Folio post	16 " 21
Demy	17 " 22
Medium	19 " 24
Royal	20 " 25
Super-royal	22 " 27
Imperial	22 " 32
Medium and half	24 " 28½
Royal and half	25 " 29
Double Medium	24 " 38
Double super-royal	27 " 42
Double imperial	32 " 44

Many of the papers above enumerated are made by hand of the exact size indicated, but if made by the machine, the roll of paper has to be cut to the required dimensions. In order to do this with precision and expedition, various cutting machines have been contrived, in which the paper, as it comes from the manufacturing machine, is cut to any size required. Fine papers are, in many cases, hot-pressed and glazed. In hot-pressing, a number of stout cast iron plates are heated in an oven, and then put into a screw press in alternate layers, with highly glazed paste-boards, between which the paper is placed in open sheets; and the hard-polished surface of the pasteboards, aided by the heat and pressure, imparts that beautiful appearance which belongs to hot-pressed paper. A yet more smooth and elegant surface is produced by the process of glazing. The sheets of paper are placed separately between very smooth, clean, copper plates. These are then passed through rollers, which impart a pressure of twenty to thirty tons. After three or four such pressures the paper acquires a higher surface, and is then called glazed. The general introduction of steel pens has increased the demand for smooth papers, and has led to improvements in finishing them. As an improvement in the manufacture of paper sized by the machines now in use, it is proposed to conduct the web of paper, after it has been either partially or completely dried, through a trough of cold water, then to pass it through a pair of pressing rollers, and afterward to dry it on reels, or over hot cylinders. The paper which has been thus treated will be found to "bear" much better, and admit of erasures being made on its surface, and written over, without the ink running in the way it does when the paper is sized and dried in the usual manner. It has been found that when paper is dried, after sizing, by the drying machines in present use, the paper is very harsh, and until it stands for some time to get weather (as it is technically termed) great difficulty is experienced in glazing the paper. This inconvenience is proposed to be overcome by passing the paper partially round a hollow cylinder, through which a small stream of cold water is made to run. By this means the heat is carried off, and the paper is rendered more tractable, and brought to a proper state for undergoing the glazing operation.

We may describe the modern process of paper making, by detailing the operations as carried on in large mills. The visitor goes up to the second story, into a room some sixty by eighty feet, in which girls are engaged assorting the rags. Here are numerous bales of white rags, foreign and domestic. The imported are linen, the others cotton. In the same room these rags are cut by a machine, driven by power, which fits them for the subsequent processes. They are next sent into a rotary boiler of about two tuns capacity, into which steam is admitted, and the rags boiled. Next they are cast down on a floor in the first story, where they are put into cars, on which they are conveyed to the washing engines. Two engines are employed in washing, called rag engines. These engines play in tubs of an oval form, of large capacity, each containing perhaps 200 lbs. of rags. The impelling power, steam or water, causes the revolution of a roller, set with knives or bars of cast steel inserted in it longitudinally. This roller is suspended on what is called a *lighter*, by which it may be raised or lowered at pleasure upon a plate, consisting of bars of steel, set up edgewise. Passing now between this and the plate, the rags are reduced to fibre. A stream of pure water is then conveyed into the rag engine, and, by means of a cylinder covered with gauze wire, the dirty water is passed off. This cylinder, called a patent washer, is octagonal in shape, some thirty inches in length, revolving in the engine, and having buckets within it, corresponding with the sides of the washer. By this process the rags are washed perfectly clean in from three to six hours.

The bleaching process is performed by the insertion into this engine of a strong solution of the chloride of lime and some acid, to cause a reaction. The pulp is then emptied into large cisterns, covered with the bleach liquor it contains, where it is allowed to remain from twelve to twenty-four hours to bleach. It is then drained, put into the beating engine, and reduced to a pulp, the consistency of milk, which it much resembles. This pulp is emptied into a large cistern, in a vault beneath, and kept in motion by means of an agitator revolving in it. It is then raised by a lifting pump into a small cistern, from which it is drawn off by a cock—which is opened more or less, according to the thickness of the paper intended to be made—on to a strainer, which removes the knots, sand, or hard substances that may damage the paper, and then flows upon a leathern apron, which conducts it to an endless wire cloth, over which the web of paper is formed. This wire cloth is kept constantly vibrating, which both facilitates the escape of water and the felting together of the fibres of the pulp. The wire cloth, with the pulp upon it—the edges being protected by deckle-straps—passes on until it comes to a couple of *wet-press* cylinders, as they are called, the lower of which is of metal, but covered with a jacket of felting or flannel; the upper one is of wood, made hollow, and covered first with mahogany, and then with flannel. These cylinders give the gauze with the pulp upon it a slight pressure, which is repeated upon a second pair of wet-press rolls similar to the first. The paper is then led upon an endless felt or blanket, which travels at exactly the same rate as the wire cloth, while the latter passes under the cylinders, and proceeds to take up a new supply of pulp. The endless felt conveys the paper, still in a very wet state, between cast iron cylinders, where it undergoes a severe pressure, which rids it of much of the remaining water, and then between a second pair of press-rollers, which remove the mark of the felt from the under surface; and finally it is passed over the surface of cylinders heated by steam, and when it has passed over about thirty lineal feet of heated surface, it is wound upon a reel ready for cutting. Forty years ago three men could by hand manufacture 4,000 sheets in a day. The same number now by the aid of machinery will make 60,000.

From the time of the Revolution the quantity of paper imported has been gradually decreasing; and before the revision of the tariff in 1846, had dwindled to perhaps not more than 2 per cent. of the amount consumed, with the exception of wall papers, of which large quantities were imported, and still continue to be, from France. Since 1846, there has been an increase of cheap French letter paper, but the amount is small compared with the whole amount of letter paper consumed, probably not more than 3 per cent. There is also a small quantity of ledger and letter paper brought from England, but as the American is quite equal in quality, the importation is gradually diminishing. Within the last few years great ingenuity has been exercised, both in England and the United States, in trying to make a paper by machinery to resemble the old-fashioned hand-made *laid* paper (yet preferred by many). To the eye it is a pretty good imitation, but lacks the toughness, firmness, and surface of the hand-made. By an experienced judge the difference is easily discovered. Notwithstanding, large quantities have been used under the supposition that they were hand-made. The reduced price of machine paper has forced almost all manufacturers to abandon the old method. There were a few years since only two mills in operation in the United States in which it was made by hand—one in Massachusetts and one in Pennsylvania. There is a limited quantity of peculiar kinds, that can be better made by hand than on a machine, such as band-note, laid letter, deed parchments, and such as are used for documents that are much handled, and require great strength and durability. Within the last few years some improvement has been made in the finish of writing and printing papers, by the introduction of iron and paper calenders for the purpose of giving a smooth surface. The finish of American papers is now equal to any in the world.

The quantity of paper required for the newspaper service of the country is probably 150,000,000 lbs. per annum, which would allow a circulation of 750,000,000 sheets. There would remain 250,000,000 lbs. of paper for the service of the book trade, and the trade and publications of the religious societies.

The use of paper-hangings, which has become so common in the past ten years, superseding hard finish and painted walls for city dwellings, absorbs a large amount of paper. In Philadelphia, which has been the leading place for the manufacture of paper-hangings until more recently, when the business has been carried on in New York and Boston, the consumption of paper for hangings has been yearly 1,500 tons, or 3,000,000 lbs. The paper used for this purpose is heavy, and comes from the mill in rolls 1,200 yards long, and from 20 to 35 inches wide. It costs from 9 to 14 cents per pound. In the preparation of this paper the pattern is first carefully drawn from original designs, and then printed. The outlines of the various tints are made each upon a separate block, made of pear-tree mounted with pine. The color is contained in sieves, and the blocks thus applied to these are laid upon the paper, following each other upon the guide-marks left by the previous impressions. It is stated that a paper-hanging exhibited at the World's Fair, and representing a chase in a forest with birds and animals, was perfected by the application of 12,000 blocks.

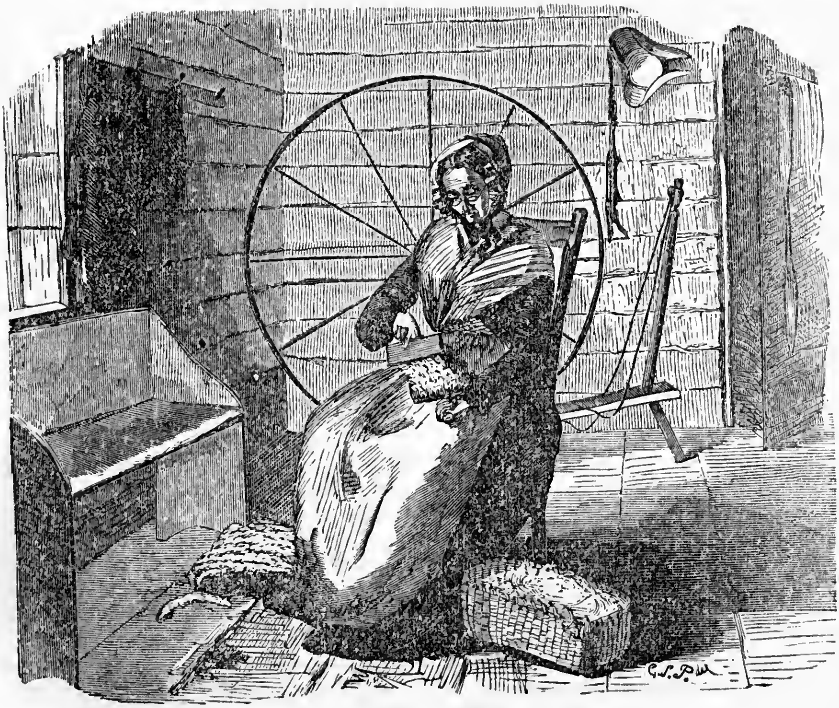
In making what is called flock (shearings of broadcloth) paper, the pattern is printed in size and varnished; the wool then being sifted on the varnished pattern, adheres to it.

The census of 1860 gave the localities of the paper mills and their comparative importance as follows:—

MANUFACTORIES OF THE UNITED STATES.

States and Territories.	No. of Establishments.	Capital.	Cost of raw material.	Male hands.	Female hands.	Cost of labor.	Value of product.
Connecticut	55	$1,860,000	$1,527,672	698	502	$342,996	$2,453,258
Delaware	2	280,000	286,439	66	27	29,292	385,000
Georgia	4	171,000	72,400	52	26	20,904	146,300
Illinois	2	47,103	43,075	29	12	13,080	59,938
Indiana	10	147,500	56,785	64	26	25,548	140,200
Kentucky	1	125,000	68,500	25	35	19.200	122,000
Maine	14	519,100	535,539	223	183	100,834	949,645
Maryland	25	272,800	300,759	155	69	51,228	513,690
Massachusetts	99	3,589,860	3,313,162	1,494	1,845	800,692	6,170,127
Michigan	5	46,500	62,837	53	35	16,248	127,000
New Hampshire	24	425,000	378,596	207	126	95,580	701,209
New Jersey	36	990,000	997,109	461	254	179,940	1,582,703
New York	126	2,039,000	1,394,210	1,411	446	433,028	3,059,776
North Carolina	6	121,850	54,600	54	35	53,916	165,703
Ohio	29	875,500	737,246	512	212	197,448	1,382,241
Pennsylvania	84	1,917,920	1,313,841	690	392	256,656	2,367,268
Iowa	1	12,000	6,600	8	5	3.924	17,400
South Carolina	3	111,000	53,000	38	19	16,044	96,500
Tennessee	2	14,500	10,200	11	13	4,500	28,000
Vermont	12	139,500	152,396	87	55	35,688	227,800
Virginia	9	154,500	130,165	11	38	41,678	270,000
Wisconsin	5	133,000	99,135	56	37	23,988	193,114
California	1	60,000	8,000	14	..	4,800	40,000
Total in U. S.	555	14,052,683	11,602,266	6,519	4,392	2,767,212	21,216,802
Total in 1850	443	5,523,929	5,523,929	3,835	2,950	1,497,792	10,187,177
Increase	112	$6,048,337	$6,048,337	2,684	1,442	$1,269,420	$11,029,625

There were produced in these 555 paper mills, in 1860, 131,508,000 pounds of printing paper, 22,268,000 pounds of writing paper, 33,379 tons of wrapping paper, and 8,150 tons of straw boards. The mills which manufacture tarred boards, that is, those made of oakum, hemp rope and bagging, &c., were not enumerated. During the war, the price of paper rose more than one hundred per cent., and the product has been greatly increased since 1860.



HAND CARDING.

WOOLLEN MANUFACTURES.

CHAPTER I.

WOOLLEN MANUFACTURES — CARDING — WEAVING—FELTING.

The manufacture of woollen, or any other goods, having been prohibited in the colonies under that harsh principle which prompted the Earl of Chatham to exclaim that the "colonists had no right to manufacture so much as a horse-shoe nail," much progress could not have been expected. Nevertheless, progress was made, since the home manufacture of woollen cloth became very general. The people spun and wove their own cloth, and the merchant found little sale for the imported article. The oppressions of the home government were continued, until finally, in 1765, a society was started in New York with great zeal, not only repudiating all foreign goods, but taking measures to encourage the home manufacture of cloth from sheep's wool, and from all other materials. This was very popular; and an agreement was extensively entered into, in order to encourage the growth of wool, to eat no mutton or lamb, and to purchase no meat of any butcher who should kill a sheep or lamb. The economist of the present day will smile at such a mode of encouraging the farmer to keep sheep, viz.: by cutting off his market for the mutton. Nevertheless, it showed zeal. Manufactures are not, however, to be established by resolution. For their development there are necessary, 1st, the supply of skilled labor; 2d, the material for its use; 3d, the capital to employ it; and 4th, the demand for the goods. This latter existed to a considerable extent, on certain conditions, among which was, that it should come within the means of the consumers. There does not appear to have been much scarcity of wool, since home-made goods were generally used. There was an absence, however, of capital, and of that skilled labor which is always the result of extensive experience in the same employment. There came great numbers of artisans from Europe, and it was stated that 30,000 weavers left Ulster in 1774. The war came, peace succeeded, and the new government was formed in 1791; on which occasion, Alexander Hamilton, Secretary of the Treasury, made his famous report on manufactures. He stated, that of woollen goods, hats only had reached maturity, and supplied the demand. At Hartford, a mill for cloths and cassimeres was in operation, and produced excellent wares, under the circumstances; but he remarked, that "it was doubtful if American wool was fit for fine cloths." The quality of wool grown in the country must, since then, have changed very much, since the American wool is used entirely for the fine goods, and the imported wools only are used for carpets and coarse manufactures. The manufacture of cloths did not progress rapidly, since we find that, in 1810, according to the report of the Treasury department, ordered by Congress, the manufacture of wool was still mostly in families. The progress of the manufacture, according to that report, has been as follows:—

	1810.	1820.	1830.	1840.	1850.
Woollen manufacture,	$25,608,788	4,413,068	14,528,166	20,696,999	43,207,545

This value, in 1810, was nearly all in families, and the figures subsequently are the product of regular manufactures as the business progressed. The family manufacture was necessarily of a rude description. The wool, being washed, was carded between two cards held in the hands of the operator, who continued to card until the wool was formed into a long roll, which was then spun upon the single spindle, driven by the wheel that the busy hand of the housewife kept in motion. There are many still living who were employed in sticking the teeth for those cards, and in tending the wheel. The cloth, woven also by hand, was subsequently sent to mill to be fulled, and dyed, and dressed; which was the first regular business branch of the manufacture. The dyeing was rather an imperfect process. The operator did not then understand the art of fixing colors. Daniel Webster somewhere relates his misfortune, when, dressed up in a new suit of home-spun blue, he accompanied his father on the way to a new school, and, being overtaken by a shower, had the color washed from his new coat into his shirt. With the lapse of time dyeing became better understood. Not many years have elapsed, however, since the distinctive mark of American cloth was, that it wore "white on the edges;" in other words, its color was not fast. With the introduction of machinery, and the improved condition of the people, home manufactures necessarily gave way to machine work. Other occupations paid the time of the farmer better, and the use of machines gradually made a market for the raw wool, at a price which, compared with falling prices of the cloth, would give the wool-grower his cloth without labor. This we may illustrate by extreme figures. Suppose, there being no factories, wool is worth 10 cts. per lb., and cloth imported, $2 per yard, a pound of wool will make two yards, or $4; if not as good cloth, at least good enough. The farmer, by turning his wool into cloth, makes a large saving. Soon, however, machine labor sinks cloth to 50 cts. per yard, and raises wool to 60 cts. The farmer can now no longer afford to make his own cloth, but his wool trade has become profitable. Thus, machine goods supplant hand goods. In this line, the inventions have been very remarkable.

In 1797, Asa Whittemore, of Massachusetts, invented a machine for making cards. Instead of sticking them by hand, as before, a strip of leather, by passing between a cylinder and a scraper, becomes of equal thickness. This strip of leather, in passing through the machine, is stuck full of teeth, that are also made from steel wire by the machine at the same time. The ingenuity of this machine was such, that the famous John Randolph, on inspecting it, exclaimed, that "it operated as if it had a soul!" There have been 100 patents since issued for improvements in this machine. The hand cards were then supplanted by the carding machine. This has a drum of about 3 ft. diameter, and as many long, covered with the cards. Smaller cylinders, also covered with cards, are placed so as to revolve against the circumference of the cylinder, and in the contrary direction. There is a feed apron, on which the wool is laid, and, being drawn in between two rollers, is caught by the cards of the revolving drum, and combed out between it and the smaller cylinders. The wool is thus spread on the surface of all, and is finally taken up by the "doffer," or a cylinder in front of the main drum; from this it flows in a broad, thin, gauzy fleece, which passes through a funnel, and in so doing is contracted into a ribbon, or sliver, which is delivered into a can, ready for the "drawing frame." Long wools and short wools are subjected to different treatment in this stage of the manufacture. The long wools are sometimes called combing wools, in consequence.

In the manufacture of worsted, the long staple is used mostly, because a smooth, fine yarn is required, not much liable to full, or shrink, or curl. In order to form such a thread, the first object is to lay or stretch the fibres into lines, as parallel as possible. If it were possible to procure a single fibre of wool of a length sufficient to weave like a fibre of silk, the beauty and finish of the fabric would be as nearly perfect as could be desired. As that, however, is not possible, the object of the manufacturer is to draw out the fibres into parallel lines, in order that they may twist into a thread as fine and smooth as can be obtained. The old mode of doing this was by hand. When the wool has been washed with lye, or soap and water, and dried, it passes into a machine called the "picker," tended by a boy, who lays the wool as evenly as he can upon the feed apron, which carries the wool between rollers, when it is caught by revolving teeth, torn asunder, and scattered in the air. The fibres are thus cleared and straightened to some extent. They were then taken to the comber, who, in a close room, employed combs with long, heated teeth. The workman oiled the wool, and combed it with these heated instruments, until it became suitable, when it was arranged in "slivers." This was a very laborious and unhealthy task, and many machines have been invented to supersede the hand labor. Some of them are very ingenious, and they have advanced the stage of the manufacture in an eminent degree. When the "slivers" are thus prepared, they are carried to the "breaking machine." There the first sliver is placed upon an apron, which carries it between two rollers, that seize and draw it forward, and it passes from them through other sets of rollers, which move three times as fast. As a consequence, the sliver is drawn out to three times its original length. When it has half passed into the first set of rollers, the end of another sliver is laid upon it, passing thence with it, and becoming incorporated with it in the drawing. All the slivers thus become incorporated in one of three times the aggregate length of all the original slivers, and it is coiled in a can. Three of these cans are carried to the "drawing frame," which has five sets of rollers, operating in the same manner as the breaking frame. As fast as the sliver comes through one set of rollers, it coils into a can, and the slivers of three cans are then united, and pass through another set of rollers. These drawings thus take place 1,500 times with some wool, and the process reduces the sliver to one-fourth its original bulk. There are many variations of the detail of drawing by different machines, but the result is the same. After the drawing is finished, a pound of the sliver is taken and measured, in order to test the accuracy of the drawing. This done, the sliver is passed to the "roving" frame, where two slivers are drawn, as before, into a "roving," which has now become so attenuated, that it must have a twist to hold it together. This twist is imparted to it as it is wound upon spindles, of which the frame contains a great many. The bobbins from the roving frame spindles are then carried to the spinning frame. They are placed upon skewers, and the roving proceeds from them between rollers, of which there are three sets: the first pair turns slowly, the middle twice as fast as the first, and the third from twelve to seventeen times as fast as the first pair. The spindles that receive the thread from the rollers must turn very fast to give the required twist to the thread. The hardest thread is tammy warp, and, when this is of size of twenty-four hanks to the pound, the twist is ten turns to an inch. The least twist is given to thread for fine hose, and it is then five to the inch. The threads are then reeled. The bobbins are placed in a row upon wires, before a long horizontal reel, which is exactly a yard in circumference. When this has revolved eighty times, it rings a bell. It is then stopped, and a thread passed round the eighty turns of each thread. The reel then proceeds. Each of these eighty turns is called a ley; seven such are a "hank:" which is, consequently, 560 yards. When this quantity is reeled, the ends of the threads are tied together, and each hank is weighed by a machine, which denotes the number of hanks to a pound, and this is the number of the yarn: thus, No. 24 means that twenty-four hanks of 560 yards each will weigh 1 lb. A hank of cotton measures 840 yards.

Short wool, for the cloth manufacture, resembles cotton in some respects. The wool being oiled and "picked," is passed through the carding machine, whence it proceeds through the drawing process, as with the long staple, until it assumes the form of yarn for the weaver.

In woollen cloths, cassimeres, broad cloths, narrow cloths, etc., all wool is used: that is, both warp and weft are wool, but the wool is combined with many other articles, according to the dearness of each. The cotton warp is used in satinets; and in most descriptions of dress goods there is a combination of wool with silk or cotton. If these articles are very high, more wool is used; and the reverse, if wool is high, and cotton is cheap, more cotton is introduced into the fabric. There are also a great variety of styles and patterns constantly produced, to attract attention.

The weaving process on the improved power-looms has been greatly facilitated of late years, and the labor has been diminished. Thus, formerly, one person was required to tend one loom, at a certain speed; but, by various improvements, one person may now tend four. In large factories, great numbers of looms are placed in one room, and, as the cloth-rolls become full, they are placed upon a little rail-car, which carries them off to the dyeing and finishing department.

The woven cloth is carried to the fulling-mill, to have the oil applied in spinning, and other greasy matters removed, and, by a partial felting, to give the fabric more compactness. The first process is to scour the cloth. This is done by placing it in troughs, so arranged as to contain the liquids—stale urine and hog's dung, then urine alone, and to be followed by fullers' earth and urine. Heavy oaken mallets, or pounders, slide down with force into one end of the trough, and mash, or roll over the cloths. The pounders are lifted by wooden cams, kept in motion by horse-power for many hours. In this process the oil is detached from the wool, the urine is absorbed by the earth, and both washed off by the water. When this is complete, soap is applied liberally, and the pounding continued, to full the cloth. Instead of soap, in some cases steam is applied, and the pounders made of iron. The process of fulling is also effected without pounders, the cloth being pushed, or squeezed, through a long trough. After the fulling, the soap is washed out, and the cloth is ready for teasling. To full a piece of broadcloth requires sixty to sixty-five hours, and 11lbs. of soap are usually applied. In the process, the cloth will shrink in length from fifty-four to forty yards, and from twelve quarters wide to seven quarters.

When cloth is returned from the fulling-mill, it is stretched upon the tenter frame, and left to dry in the open air. As cloth in the fulling-mill shrinks nearly one-half, it must be woven nearly double its intended breadth. Superfine six-quarter broadcloths are therefore woven twelve quarters wide.

The cloth is minutely examined, when dry, in every part, freed from knots and uneven threads, and repaired, by sewing any little rents, or inserting sound yarns in the place of defective ones.

In order to raise up the loose filaments of woollen yarn into a nap upon one of the surfaces of the cloth, it is scratched with the heads of the teasle plant, or with teasling cards made of wire. In large factories the operation is performed in the gig-mill, which is a cylinder covered all over with teasles, and made to revolve rapidly, while the cloth is drawn over it. This operation requires attention, lest the goods become tender. Indeed, every branch of the wool manufacture requires the supervision of a practical man. If a piece of cloth comes from the press damaged, or inferior, he must be able himself to discover where the fault lies, without taking any other man's word for it; if the wool is not properly cleaned and dyed, the dyer must be called to account, not the carder, or the weaver; and if, through the carelessness of the shearer or gigger, the goods are made tender, they must answer for it, not the spinner. Therefore, the manager of a woollen establishment must be a thorough practical manufacturer, conversant with all the branches of his business, and able to assume and maintain the responsibility of each and every one. This individuality of the manufacturer is well divided among the different branches of the manufacture in England, where the business has grown up in the hands of practical men; but in this country, where manufacturing was, as it were, improvised on the formation of the government, it came, necessarily, under the control of corporations, where the supervising power could not be so well exercised as where each branch is produced by an individual on his own responsibility, and to meet the consequences of defect himself. In a corporation, many of the appointments are independent of the general direction, and the resulting defects in fabrics are placed to the account of the wrong party, or not fixed upon any.

The art of dyeing and printing fabrics is one of the most progressive connected with manufacturing. The materials of human clothing are mostly from silk and wool, of animal origin, and cotton and flax, of vegetable origin. These two classes differ in the facility with which they imbibe coloring matter. The animal fibre takes much more brilliant shades than the vegetable, and the color may be applied to either class in the raw state, in the spun yarn, or in the fabric: hence, great diversity in the processes. The coloring matters are themselves of the most various origins—animal, vegetable, and mineral—and their substances, brought together, act upon each other, and produce the most intricate changes. The leading vegetable colors are yellow, brown, and red; blue is derived only from litmus and indigo; black is afforded by nutgalls, sumach, and cashew nut. These are generally obtained by water; but some of the substances require either alcohol or some of the fixed oils. From the animal kingdom come, from the bodies of the cochineal and kermes insects, the brilliant scarlet and crimson dyes. The ancient dye, called Tyrian purple, was long supposed to be lost; but a French chemist has lately discovered it. Hoofs, horns, etc., give Prussian blue. Many brilliant colors are derived from the salts of various metals. The same metal is caused to give various colors. Iron gives that buff known as nankeen; it gives various shades of blue, and is made to yield black, slate color, and other shades. Chrome, and lead salts, give an interesting variety of colors. The materials to be dyed, of whatever nature, are seldom found to have such an affinity for the dyes used that they will retain them. They will soon wash out, unless a remedy is applied. Chemistry discovered this in certain substances that will fix themselves permanently upon the fibre, and then, by uniting chemically with the color, "fix" that permanently also. These applications are called "mordants," from the Latin, *mordeo*, because they were thought to bite into the fibre. It is sometimes the case that, in thus combining with the color, the mordant will modify or alter its tone, and those having this effect, are sometimes called "alterants."

Thus, if a decoction of madder be applied directly to cloth, it gives a dirty red color, that will not remain. If the cloth is first prepared with acetate of alumina, the color will not only become entirely fast, but will assume a fine red hue, which will resist the action of air, light, and water. If, instead of the alumina, oxide of iron is used as a mordant, a purple color will be obtained. In dyeing with cochineal, if crimson is required, alumina is used for a mordant; if oxide of iron is used, the color will be black. It follows, that mixing mordants will multiply shades, and the variations of proportions and strength of solution give a wide field for the production of effects. It sometimes is the case, that two solutions, neither of which will give any color at all to the fabric, will impart a fast color by following each other in the application. Thus, a solution of nitrate of potash gives no color to cloth, and may be washed out; the same is true of bichromate of potash; but if one of these is applied after the cloth has received the other, a fast yellow is obtained. In the process of mandarining, an acid is made to act directly upon the fibre of the wool. In a large factory, the dye stuffs are ground and mixed in an appropriate room. The infusions are made in tubs or vats, some in cold water, and others in boiling water. Some of the dyes are introduced in the shape of a coarse powder, and others in bags, through which the color oozes. The cloth is first prepared by thorough cleansing, in order to remove all extraneous matters that may be attached to the fibre. When this is completed, the mordant is applied by soaking the cloth in appropriate solutions. It is then hung up to dry in long folds, if intended for printing, as in the case of muslin-delaines, a fabric in which the American manufacturer has come to surpass the imported article, and to monopolize the market.

The art of printing goods may be said to have been created in the last fifty years. As practised in the early part of the century, it was comparatively rude. The figures to be impressed upon the cloth were engraved upon a square block of wood, and the color being applied to this, it was impressed upon the cloth, which was then drawn forward, and a new application of the block made. This was the style of printing practised originally by Robert Peel, grandfather of the late prime minister of England, and founder of that family. An improvement was then made by engraving the pattern upon a copper cylinder, and by passing the cloth over this, the work was done with more precision and continuity. This was costly, however; and one such cylinder laboriously engraved, would print only 1,500 pieces of cloth. Perkins, of Newburyport, Massachusetts, then invented the die. This is a small steel roller, on which the figure is engraved, and made exceedingly hard. From this, the figure is conveyed to a soft steel roller by pressure. From this last the design is impressed upon a copper roller by pressure. This last prints the cloth. In this manner, the design on the steel die, once engraved, may be multiplied to any number. The original block-printing would take but one color. Numbers of improvements were made to increase the number of colors that might be printed. This is now done by engraving the dies and rollers with portions of the designs that are to take different colors. The rollers are placed upon the printing machine in such a manner, that the cloth passes up slowly over the large drum of the machine. They each, in succession, impress it with the design and color with which they are fed. Almost any number of colors may thus be printed. The style and quality of ladies' dress goods of wool, have thus made rapid strides in the last few years.

The faculty of felting possessed by the wool, arises from the barbs upon each fibre, like those that are to be seen on each fibre of a feather, locking into each other. The process of rubbing in hot water causes those in the wool to become more closely interlocked, until the whole becomes a compact mass.

The making of hats of wool was a large business in the New England colonies early in the 18th century—so much so, as to draw upon them the interference of the government for the suppression of the business. It continued, however, locally, and was, in 1791, mentioned by the Secretary of the Treasury as one of the most successful. The manufacturing process was mostly the same, although the form of the hat underwent many changes, from the "cocked" to the "stovepipe," and latterly to "Wide Awake," "Kossuth," and other styles. The wool—mostly lambs or short wool—was washed in urine to remove all grease that prevented felting. The wool then, being dried, was "bowed." This was performed by the operative, who laid about 3 oz. of wool upon a board, and then, holding in his left hand a bow with a stiff string, he vibrated the string in such a manner as to strike the wool, and cause it to fly out clear and loose. When quite clear, it was formed by hand into a cone form nearly three times as large as the proposed hat body. To keep the light wool together, it was placed between two cloths. It was then immersed in water, and continually rolled in different directions upon a short round stick held in the hands of the operator. This operation caused the hat to felt or shrink into the proper size and shape. Being then in the sugar-loaf form, it was stretched upon the hat block that gave it its shape, and the manufacture proceeded with, until, napped with fur and trimmed, it was ready for sale. About 30 years since, machines for forming the bodies were introduced, and these soon supplanted the old hand system. The wool was washed with soft soap as a substitute for urine, the lye of the soap being equally efficacious in removing the grease. When dry and clean, the wool was passed through the "picker," made with a cylinder covered with long teeth. As this revolved with great velocity, it took from a pair of rollers the wool, separated it, straightening the fibres, and cleaning it of dust at the same time. This wool was then passed through the breaker, or carding machine, as in preparation for spinning; but as the broad fleece comes off the doffer, instead of being drawn into a ribbon, it is received upon a pair of light wood cones, placed with their bases together. To these a vibratory motion is given at the same time that they revolve. The result is, that the fleece of wool winds over them in contrary directions, until they appear like a large cocoon. When about 3 oz. are wound upon the cones, the boy who tends cuts them apart with shears, and by a rapid movement removes the woolly cap from the cone, which instantly resumes its motion. These caps, so removed, are perfectly formed "bodies," ready to be felted in the usual manner. The regularity and rapidity of the formation enables a "body" to be formed with much less wool than by the hand system. Instead of 3 to 4 ozs. for a hat, a perfect body was now formed of 1 oz. weight. This process of the wool manufacture grew rapidly, until a machine was invented to form hat bodies of fur. The difficulty in that respect had been that the fur could not be carded into a fleece like the wool. A machine was then invented, by which the air was exhausted under a fine wire gauze, and the fur flying was drawn upon this and partly felted into a ribbon, which was wound upon cones for the hat bodies. The next process was to form the cone itself full of holes, and, by exhausting the air, the fur is caused to settle upon it evenly, in weight sufficient for a body. These fur hats caused those of wool to rank second.

The felting qualities of wool have, however, caused it to be used for many other purposes, such as piano-covers, drugget, and for the manufacture of cloth without weaving. This is called beaver cloth, and is difficult to detect, by the eye, from woven cloth. Several manufactories of this description are in operation in Connecticut. The wool being worked and "picked," is carded in a machine which is double the width of the ordinary one, in order to deliver a fleece or web six feet wide instead of three. This "web" is, as it is delivered by the machine, carried out, in a horizontal direction, 21 feet, and so doubled in folds until it gets a proper thickness for felting. Inasmuch as that the process of felting causes a web to contract more in breadth than in length, it becomes necessary, to give the cloth a proper consistency, that the webs should cross. To do this two machines are placed at right angles with each other, and as the web of one is extended, that of the other crosses it. When the proper thickness is thus attained, the whole is rolled upon a beam, and transferred to the felting table. Here a number of cloths are laid together upon an endless apron, the movement of which carries them forward over an iron plate, perforated with holes, through which steam ascends, and thoroughly heats and saturates the cloths, which proceed under a platen, to which steam power imparts a rapid vibratory motion, which felts the cloth. When this is completed, the cloth is dyed of the requisite color, and then subjected to the fulling and teasling process, like a woven cloth. For those heavy coat cloths that are in the style called Petershams, another process is substituted. It consists in passing the cloth under a sort of press, of which the lower side, on which the cloth rests, is stationary, and the upper, being covered with sand, receives a rapid, rotatory, vibratory motion, which rolls up the nap into those little knots that are the distinctive feature of Petersham. The nature of these cloths permits of giving them two colors. Thus a dark and a drab color may be felted together to form one cloth, of which the inside is of a different color from the outside. These cloths are used to some extent by the clothiers, but their durability is said not to be such as to recommend them.

Of all people, the American shows the most remarkable inclination for good carpets. It seems to be impossible for him to walk comfortably through life without a carpet under his feet. Every man who occupies a few square feet of house-room must have the brick or the boards protected from his tread by so much carpeting. Here carpeting appears in a thousand places where, in other parts of the world, it is never seen. The English shopkeeper thinks the bare boards good enough for the reception of his customers, and seldom does the merchant think of adding to the elegance of his counting-room by laying down a square of Brussels. Only those churches devoted to the service of the more aristocratic worshippers, are furnished with the comforts of Kidderminster—the bare wood, or bricks, or stone, being considered more consonant with "the self-denying duties of the sanctuary." Widely different is it with the well-to-do American. He believes in enjoying life; and considering that carpets contribute to life's enjoyment, he does not hesitate to spread every place where he is accustomed to tread with a due quantity of three-ply, or tapestry, or Brussels, or Turkey. Yet, withal, the quantities imported are apparently inadequate to this general demand. The number of yards, of all descriptions, imported, is about 1,500,000 per annum—a quantity that might suffice for 15,000 houses; but in 1850, according to the census, there were 3,362,000 dwellings in the Union. It follows, that by far the largest portion of carpets are furnished by home manufacture. The carpets most in use in this country are known as "rag carpets," as ingrain, three-ply, Venetian, tapestries, Brussels, velvets, Wilton. The Turkey, Axminster, and Persian carpets are used but little, and manufactured not at all. The ingrain carpet is made with two sets of worsted warp, and two sets of woollen weft. It consists of two distinct webs, incorporated into each other by the warp threads passing from one to the other to bring the required colors to the surface. Each web is, however, a cloth of itself, which, if separated by cutting from the other, would present a coarse surface, like baize. Two colors only are used with effect in this kind of carpet. The three-ply is similar, but produced by three webs, making a thicker carpet, with a greater number of colors. The pattern in this does not appear in opposite colors, as in the two-ply. This fabric was long thought not adapted to power looms, but in 1839, Mr. Bigelow, of Lowell, improved the matter, so that weavers, who were then making 8 yards per day by hand, could make 12 yards per day by power. This plan has since been so improved, that power looms are now wholly used, with such economy of labor as greatly to reduce the cost of carpets. The hand weaver could always tighten the weft thread, if he found it too loose to make the selvage regular, and if he saw that the weft thread was too irregular to make the figure a just proportion, he imparted more or less force in beating it up. The judgment and skill of the weaver was thus a great element in the production of the goods. Mr. Bigelow, in his first loom, contrived to take up the woven cloth by an unerring motion, the same amount for every beat of the lathe. His next step was to regulate the tension of the threads, so as to keep the selvage smooth, and the figure regular. In this he succeeded so as to bring the two-ply loom to 27 yards per day, and the three-ply loom to 18 yards. His method of producing figures that will match was patented in 1845. The same machine was found to be applicable to Brussels and tapestry carpets, the weaving of which by power was before thought to be impracticable. They were made at the rate of 4 yards per day by hand. This has been increased to 20 yards per day by the new process. The figures of the carpets are also made so as to match perfectly, and surpass the best carpets made in any other part of the world.

These looms are used in factories built for them in Lowell and Clinton, Massachusetts; Thompsonville and Tariffville, Connecticut; a large factory is in operation in New York, and Philadelphia and other cities have lately established them. The Brussels carpet takes its name from the capital of Belgium, whence it was introduced into England in the last century. It is made upon a ground of linen weft, which is concealed by the worsted threads that interlace and cover it. The threads are generally of five different colors. In weaving, these run the length of the web, and are so managed that all those required by the pattern are brought up together across the line of the carpet. Before they are let down, a wooden instrument called a sword is passed through, to hold up the threads. This is replaced by a wound wire, which being at last removed, leaves a row of loops across the carpet. In a yard there are sometimes 320 successive lifts of the sets of colors required, each of which forms a row of loops. Four colors must always lie beneath the 5th, which appears on the surface, and thus the carpet is thick and heavy. The Wilton carpet differs from the Brussels in that the loops are cut before the wire is removed. A groove runs in the wire to receive the edge of the cutting knife. The soft ends of the cut loops give the carpet its velvet appearance. In Imperial Brussels, the loops of the figures only are cut. Here a new invention was brought into use to make "tapestry and velvet pile." This is a combination of the arts of printing and weaving. The principle is this: if a rose-bud occurs a thousand times in the length of a web, at 4 feet apart, the block printer must apply his block a thousand times to print the bud. By the new process the thread is wound a thousand times round a cylinder 4 feet in circumference, and a turning wheel, charged with color, passes across the coil. The thread unwound is found to be marked in a thousand places exactly where it is wanted. The threads are thus all parti-colored, and singly show no regular figure; but when arranged in the proper order for the weaver's beam, the figures come into view much elongated. Sometimes 18 feet of warp will be gathered into 4 feet of cloth, in order to secure the due proportion of the intended object. By this system the number of colors, that could not exceed 6 or 7 by the old plan, is now increased to 20 or 30, or any number; and instead of a change of blocks for every pattern, the same blocks serve for all patterns.

The wool used for carpets is imported from South America and the East Indies. Of that obtained from South America, the best is the Cordova, which is worth here 22½ and 23 cents per lb., and next in grade to it ranks the Buenos Ayres, worth 13 and 14 cents per lb. The East India wools all rank still lower, and are generally of a dark color. It may be interesting to follow the wool in its passage through the various processes which transform it from its hard, dirty, and oily mass, lying in bales, to the brilliant velvety pile worthy the foot of Flora McFlimsey. The material passes in the usual way, from the wash to the combing machines, which separate the long from the short fibres. The long are passed through rollers, and assume a form entitled a "sliver," which is allowed to fall into a hollow cylinder set for the purpose, while the short fibres disappear in a mysterious-looking box at one side of the room. These slivers are then passed through a drawing frame, twenty or more of them united, and drawn out so as to equalize the thread; eight or ten of these threads are again subjected to the drawing process and reduced to one, which operation is repeated as often as is necessary to produce uniformity. These long fibres, so carefully put through this process, are intended to form the warp of the carpets, while the short fibres are used for the "woof" or "filling." In the spinning-room, both staples of wool come together to be spun on the long, clashing, clattering "spinning jacks," twelve in number, some of them spinning 256 and others 308 threads at once. When it leaves the "jacks" it is in the form of coarse yarn, tightly rolled on large spools, from which it is wound into skeins and is ready for the dye house. By a curious system of folding, of a recent American invention, part of the yarn skeins are, after being scoured (a process applied to all yarns to free them from their natural oil), subjected to a parti-colored dyeing—and thus the same skein, or frame of skeins, may sometimes bear half a dozen different colors. These parti-colored yarns are used for warp. Other bundles of yarn are submerged in rolling, steaming floods of colored liquids of every hue. That portion intended to be used white, is bleached by means of sulphur in houses erected for the purpose on the river bank. From the dyeing-room, the yarn is conveyed to the drying-room, immediately over the engine boilers, and after it has become thoroughly dried, is conveyed to the winding-room, where winding machines, worked by girls, are at work, filling spools and bobbins from the skeins; and no sooner are the spools filled than they are unfilled by the warping machines, five of which are constantly in operation. The threads are here wound upon the large cylinders for the printers, and each filling of this great cylinder makes but a single thread in the warp of a single pattern, so that for a piece having 208 threads in its width, the cylinder must be filled and carefully printed a corresponding number of times. These monster skeins, after being printed, sometimes with 100 or more shades of colors, each laid on in straight lines by a small printing roller, travelling across beneath the large cylinder, are packed at full length in rice chaff, and having been placed in boxes on a little railroad car, are shoved into a boiler, where from 4 to 6 lbs. pressure of steam is applied. When the colors have been thoroughly fixed by the means we have stated, the skeins are dried and passed through what are termed setting machines, when the yarn is ready for the Bigelow loom. These have on the end of each of the little wires used to raise the pile of the Brussels carpet, a small knife, which, while it weaves, cuts the pile and makes it "velvet." The next machines to which the fabric is subjected, are for shaving the velvet, and girls are employed in trimming the under side of the goods and preparing them for the rolling machine. Here the carpets are rolled, marked with the number of the pattern of each roll, number of yards, etc., and thus prepared for removal to the warehouse. The lengths of the pieces usually are: velvets, from 40 to 50 yards; tapestries, 50 to 60 yards; and ingrains, from 100 to 110 yards.

The quantity of carpets made in New York and Massachusetts, according to the respective state censuses of 1855, was as follows:—

	Wool used. lbs.	Carpets made. yards.
New York	3,707,500	1,820,500
Massachusetts	2,880,974	1,988,460
Total two states..	6,588,474	3,808,960

The manufacture of long shawls, for men's use, was pushed to a great extent a few years since, when the fashion was more prevalent than now. The Bay State Mills became famous for that description of goods, the manufacture of which required 3,000,000 lbs. of wool per annum.

The delicate yarn, known as zephyr worsted, is much used on these machines, greatly promoting the manufacture of those articles which it has been the rage to knit of late. The demand for that yarn causes frauds to enter into the sale. Each pound of zephyr is divided into 16 laps, which are sold without weighing, as containing each one ounce of wool. Full weight would be 16 drachms to the ounce lap, or if stored in over dry atmosphere, 15¾ drachms; but the fraud consists in putting up only 15, 14, 12, or 10 drachms in each ounce lap, the number of laps in a pound being the correct number—16. These frauds are difficult to detect, as the dishonest dealer is provided with false weights, which make his goods appear on trial to be correct. The ounce of the apothecary shops contains more grains than the true standard avoirdupois ounce, so that it cannot be tested there. The proper remedy would be to inquire continually of dealers whether their goods are full weight or short weight, to show that public attention is directed to the matter, and to compare articles bought at different stores, by putting them on the opposite scales of a balance, and noticing where goods are sold by true or best weight.

The production of hosiery and fancy knit work has become very important in the last ten or fifteen years. The supply of those articles came previously from England, but within that time the manufacture of these articles has received a great development, particularly in Philadelphia. The fine American wool is well adapted to the manufacture. The business is largely carried on in families and by hand looms. There are large factories devoted to the production of opera hoods, scarfs, comforters, etc. The wool is prepared in the usual way, by carding and spinning, and is bleached, dyed, and printed according to the designs required. In the weaving, some fifteen or twenty different kinds of looms are employed. One has recently been invented for weaving neck-comforts. It weaves four neck-comforts of a double fabric, and each of a different pattern. The Jacquard principle, used in carpets for years, is applied to it, and almost any design may be produced. The machinery is changed to suit the goods—hoods, talmas, opera cloaks, neck-comforts, scarfs, hose of every description. A large establishment in Philadelphia uses 250,000 lbs. of wool per annum in these articles.

CHAPTER II.

CLOTHING TRADE—TOTAL MANUFACTURE —SHODDY.

UNTIL within the last twenty-five years, the ready-made clothing trade was confined almost entirely to the furnishing of sailors' sea fit-outs, or slops. The stores for this purpose were mostly in the neighborhood of shipping offices, and kept to some extent by sailor landlords, whose business philanthropy led them to coax "poor Jack" into their "cribs" on his arrival, and feast him high while his earnings lasted; and as soon as these were nearly gone, ship him on board some vessel, obtain his advance pay, which is, in the navy, three months, or $36, and in the merchant marine, one month, varying from $12 to $20, according to the demand for seamen. If this is not all due the landlord, he supplies slops at enormous rates for the balance, gets Jack dead drunk, and puts him on board at the last moment in that condition. In such a business, ready-made clothing was indispensable, but otherwise there was little market for made-up goods. Most families in the country made their own clothes. But as taste and wealth improved, the difficulty of "cutting out" called into being a special trade, and most villages and towns in the country were visited by professional persons, who boarded round in the families where cutting and fitting, as well for males as females, was in requisition. Another trade also grew up in the cities; it was the dealing in second-hand clothing, mostly by Jews. These industrious persons bought up all the old clothing that could be had, cleaned, repaired, and redressed them, and sold them to those who sought to economize. The cleaning and repairing of these clothes occupied great numbers of poor people. The repairing soon grew into fabricating very cheap cloths bought at auction, "half-burnt," "wet goods," etc., to sell them in connection with the old garments. Visitors from the country found that garments could be bought in this way to better advantage than even to have them made at home, and the boarding-round system began to wane. It was soon found in New York that the great crowd of visitors who passed rapidly through the city, and had little time to wait for measures, or to be inconvenienced with tailors' delays and misfits, would become buyers of a better class of ready-made clothing, and the manufacture began to spread by tailors keeping assortments. The visitors who thus bought at retail were disposed to extend orders for resale at home, and in 1834 and 1835 the wholesale manufacture commenced in New York. One of the first of these, a shrewd judge of cloth and a close reckoner, commenced with little capital, slept under his counter, and kept his personal expenses very small, devoting his whole time to the cheap purchase of cloth, and the most economical way of making it up. This trade grew rapidly to an expenditure of $80,000 per annum for labor, mostly to sewing girls, at ridiculously low prices. This work was done to a considerable extent by girls who, living with their parents, wished to increase their allowance for dress. It is obvious that where the purchase of goods, the cutting, and making are attended to by experienced men, on a large scale, the cost of the goods must be very much less than that at which individuals could get them up, and the competition of the clothiers guarantees that the profits shall not be exorbitant. There were many in the trade when the revulsion of 1837 ruined them. The trade was soon again re-established, and it has not since ceased to grow, not only in New York, but to spread into all the cities of the Union. The census of 1850 gave the clothing business as follows:—

Number	4,278
Capital	$12,509,161
Cost of material	$25,730,258
Males employed	35,151
Females employed	61,500
Cost of labor	$15,032,340
Value produced	$48,311,709

This production in amount ranks third of the occupations of the Union. Since then the increase has been very much greater, and the business is now so extensive, that the "purchases of the clothiers" are a regulating feature in the goods market. These purchases take place many months before the goods are sold. The cloths for winter goods are bought in the previous spring, in order to give time for the making up. In a large clothing establishment, the business proceeds with great method. The cloth, as soon as it comes in, is subjected to a rigid scrutiny, and blemished portions are removed. The piece is then taken to the superintendent, a statement of the number of yards, the cost, and of whom purchased, is then entered in a book kept for the purpose. There is also entered the number and description of the goods to be made, how they are to be trimmed, the name of the cutter, the price of making, etc. The cloth is then transferred to the cutter, with directions as to kind of garment, style of cut, sizes, etc. The garments being cut, are passed to the trimmer, who supplies buttons, thread, lining, etc. The goods then come under the control of the foremen, of whom there are several, and these give them out to be made. The number who do this part of the business is very large, and are mostly females. They take home pantaloons, vests, etc., and when not well known to the foreman, are required to leave a deposit in money for the return of the goods. This is necessary in large cities, since it happens that if there is no deposit, the person may be tempted to pawn or sell the goods; or, if she is honest, she may have a drunken husband, who will seize and pawn the goods. It often happens, however, that poor, deserving women have no money to deposit, and go hungry in face of work that they might do. There are, on the other hand, knavish dealers, who, taking advantage of the position of the depositor, require it, and when the goods are returned, declare the work ill done, and retain the deposit to pay for the alleged spoiling of the cloth. There are also great numbers of men employed in doing the heavy work, and since the introduction of sewing machines, these have been greatly employed. The large immigration into New York has caused a great supply of German and other families, who take in sewing, and these nearly all have a sewing machine. This demand for the machines is supplied by the liberality of the competing patentees. They deliver a machine upon the payment of a small sum, and allow the buyer to pay up a dollar or two a month until the purchase is completed. In this manner the supply of labor in the manufacture of clothing is greatly increased, but the pressure is harder upon those who have no machines. The women may, however, earn from $3 to $5 per week; the former price on coarse work was as low as 25 to 37½ cts. for common silk vests, and as much for pantaloons, of which two pair a day is a large production. For custom-made silk vests, $1 is paid. The finer coats are made by regular tailors, employed in fashionable city shops during the dull season, and these earn $7 to $12 per week. The supply of labor is not, however, confined to the city, but embraces a broad circle of country, to which goods are sent by rail and express to be made up. Many clothing concerns have agencies in the country towns. These keep vehicles to travel round to farmers' and other dwellings where good sewing is done in the winter, with his goods, and bring them back when done. This reverses the old system of boarding round to cut out family goods, since the goods go round to get made up. The energy with which the trade is driven, therefore, produces two competitions, one to get the work done, and the other to get the goods sold.

The cutting is an "art" of itself, and requires a certain talent. It is, in fact, the most important part of the manufacturing, since the style and "set" of the goods depend upon it. The large New York clothing stores employ the best "talent" in this line. The majority of the goods made up in New York and Philadelphia, is for the south and west. The capital required is large, since the goods are to be purchased some four or five months in advance of the season; much cash is paid out in the manufacturing, and finally, sales made at six to eight months. This manufacture includes all styles of boys' clothing as well as men's. The house of Brooks Brothers sell $1,000,000 per annum, and pay out $200,000 for sewing. This is stated at one-hundredth part of the clothing business of New York.

The clothing trade of Boston has also received a great development of late years, and by a combination of circumstances which have had their influence everywhere. In 1840 there were only two houses in the trade in Boston, and the aggregate sales were about $200,000. These have now increased to thirty-five houses, with sales not much short of $15,000,000 per annum. The supply of goods of home manufacture is large in Boston—as well from the manufacturers direct, as through commission houses who advance on them to the manufacturers. The cutting is done in Boston, but the sewing is mostly done in the farmers' families throughout New England, and about 60,000 females in such situations are employed. The numerous railroads that traverse the country, make commodities cheap;

and as sewing machines improve in the quality of the work they do, and in the cheapness with which they can be furnished, hardly a house is without one, and all seek employment for them. In 1857, when the financial pressure caused so many mills to stop, throwing hands out of employment, these sought sewing as a substitute; and their savings enabled them to buy machines. The same event threw large quantities of goods upon the market, through the auction houses, and also through the hands of the commission houses, to whom the manufacturers pledged them for money. Thus, there was a large supply of goods and labor at less than former rates; clothing could be furnished much cheaper, and this circumstance was not advantageous to the old stocks. That circumstance, temporary in itself, gave an impulse to the clothing business, as bringing more within its scope.

The national census returns of 1850 and 1860 gave some details of the manufacture of woollen in each state, at each of those periods. That of 1860 was the most full, and is as follows:—

WOOLLEN MANUFACTURES OF THE UNITED STATES FOR 1860.

	Capital invested.	Pounds of wool used.	Value of all raw material.	Number of hands employed. Male.	Female.	Value of entire products.	Yards of cloth manufactured.
Maine	$932,400	2,414,300	$1,003,366	539	488	$1,717,007	2,509,100
New Hampshire	1,421,300	3,829,404	1,612,578	846	672	2,601,353	5,782,641
Vermont	1,746.300	4,047,010	1,662,650	895	1,178	2,938,626	3,975,882
Massachusetts	8,993,903	33,516,797	12,520,675	7,659	5,310	19,655,787	34,899,348
Rhode Island	3,168,500	6,832,600	4,070,224	2,593	1,636	6,915,205	19,343,660
Connecticut	2,491,000	7,179.819	4,043,124	2,308	1,459	6,840,220	14,301,043
New York	3,115,700	7,453,004	3.424,614	2,504	1,716	5,870,117	7,951,679
Pennsylvania	4,339,310	7,128,529	4,427,138	3,738	2,350	8,191,675	23,405,469
New Jersey	583,400	1,175,800	548,578	532	303	1,085,104	1,754,575
Delaware	117,000	140,000	75,807	76	38	153,035	427.200
Maryland	318,200	1,055,272	267,355	248	133	605,992	1,153,857
Ohio	658,750	1,190,751	476,833	543	185	825,231	1,078,266
Indiana	464,341	940,000	352,362	436	97	649,771	680,355
Michigan	103,950	163,100	69,010	77	49	139,246	172,723
Illinois	207,600	324,300	110,462	128	34	187,613	176,960
Wisconsin	100,600	265,000	85,743	74	31	172,720	285.000
Iowa	82,500	168.700	67,293	96	24	127,640	133,315
Missouri	103,750	191,400	56,745	53	17	143,025	358,000
Kentucky	408,500	1,452,500	510,902	350	87	845,226	2,230,246
Virginia	463,600	1,131,000	389,204	381	113	717,827	1,007,714
North Carolina	223,000	504,500	151,005	113	140	291,000	639.000
South Carolina	50,000	250,000	60,000	37	55	80,000	300,000
Georgia	242,500	1,008.600	260,475	167	216	464,420	1,435,000
Alabama	140,000	264,435	80,790	95	103	191,474	613,410
Texas	60.000	81,900	25,980	36	7	38,796	94,976
Mississippi	75,500	270,597	119,849	202	33	158,507	569,203
Louisiana	75,000	69,150	31,300	40	20	45,200	48,800
Tennessee	6,000	10,000	5,225	8	2	8,100	18,000
California	100,000	400,000	50.000	40	20	150,000	....
Oregon	70,000	150,000	27,000	27	3	85,000	52,500
Total	$30,862,654	83,608,468	$36,586,887	24,841	16,519	$61,895,217	124,897,862

There were produced in these 1,260 woollen mills, the same year, in addition to the cloth specified above, 6,401,206 pounds of woollen yarn, 616,400 shawls, 296,874 pairs of blankets, 18,000 table covers, 155,000 yards of felt (all made in New Jersey), and 600 coverlets (made in Ohio). The annual product in 1850 was valued at $43,542,288, and in 1840 at $20,696,699, so that the production was tripled in 20 years. In the returns from the state censuses of 1855 and 1857, the production of all classes of woollen goods increased considerably. Massachusetts and New Hampshire showed the largest increase. The manufacture appears to confine itself mostly to the middle states; curiously enough to those states which are most exposed to the competition of the imported goods.

We should have stated above, that the manufacture of woollens in the United States increased from $20,000,000 in 1840, to $43,000,000 in 1850, according to the national census. The statistical accounts of the general progress are very meagre. The statistics of woollen goods manufactured in 1855, in the states of New York and Massachusetts, were given as follows:—

MASSACHUSETTS.

Broadcloth	yards	759,627
Cassimeres	"	6,444,585
Satinets	"	6,736,082
Jeans	"	1,948,609
Flannels and blankets	"	10,279,227
Yarn	lbs.	689,957
Carpets	yds.	1,988,460
Wool used	lbs.	21,667,272

NEW YORK.

Cloth	yds.	4,836,834
Yarn	lbs.	506,178
Shawls	no.	188,000
Blankets	prs.	48,000
Knit goods	doz.	15,384
Shoddy	lbs.	348,000
Carpets	yds.	1,820,500
Wool used	lbs.	15 325,283

These figures show that there has been an increase of nearly 12,000,000 pounds of the wool used since 1857 in Masachussetts, and a considerable increase in the quantity of goods produced. In New York, the quantity of wool used has fallen off more than one half in five years. This has been partly owing to the lessened production of shawls, which took so large an amount of wool. The following figures, from a well-informed source, show the number of factories, sets of machines, and quantity of wool required to feed them, in New England and New York, at this moment:—

	Factories.	Sets.	Wool required.
Maine	32	91	lbs. 2,065,000
New Hampshire	56	228	5,670,000
Vermont	56	122	2,375,000
Massachusetts	154	999	31,017,000
Connecticut	93	410	12,155,000
Rhode Island	56	225	5,625,000
New York		468	10,590,000
			lbs. 69,497,000

The production of cloths labors under disadvantage from the sharp competition which the English, Belgians, and French have kept up to obtain the American market. Up to 1840, 19-20ths of the cloths and cassimeres imported into the United States were of English manufacture. At that date they lost ground, but have since recovered. The importations have been as follows:—

IMPORTS OF CLOTHS AND CASSIMERES INTO THE UNITED STATES.

	Germany.	Belgium.	France.	England.	Total.
1840,	16,612	93,135	89,767	4,490,830	$4,690,344
1848,	716,931	396,712	2,466,302	2,777,612	6,357,557
1851,	1,411,282	478,532	1,988,181	3,785,070	7,463,065
1857,	2,574,871	909,331	1,659,470	5,711,938	10,855,605

The tariff of 1841 and 1842 approached, by the biennial reductions, the 20 per cent. horizontal rate contemplated by the compromise tariff, for the last and subsequent years of its operation: that is to say, cloth paid 50 per cent. in 1822, 38 per cent. in 1840 and 1841, and 29 per cent. in 1842 to June 30. By the tariff of 1842 it paid 40 per cent., and by the present tariff 30 per cent. It may be observed, that with the advance of duty from 29 per cent. under the last year of compromise, to 40 per cent. in 1844, the import of cloths in the aggregate increased, but this increase came from the continent, and the maximum importation was in 1845. In the year 1848 the quantities received from France, stimulated by the export bounty of the revolutionary government, increased 50 per cent., and the same influence caused cloths to come from Germany in greater quantities. The Belgians and Germans were here in great numbers, at the Crystal Palace exhibition, seeking to introduce their wares, and with more or less success. The result is, that the aggregate value of foreign cloths consumed in the United States did not increase, although the population increased at least 5,000,000 of people. The superior dye and finish of the German and French cloths have been the main reasons for their supplanting the English in our markets. The English manufacturers have now, by outlay of capital and increased exertions, obtained more or less success in recovering their ground; and against this sharp competition of France, Germany, and England, our manufacturers have hitherto fully maintained their ground, as appears from the fact, that while the increase of population and the wealth of that population has been very large within ten years, and the market for foreign goods has been extended, yet, on the other hand, most of the increased consumption of the country, in the double ratio of greater number and enhanced means, has been supplied from our own production under shield of a 30 per cent. duty. The importation of shawls was very much increased in the same period of time, under similar conditions in reference to the successful competition of Europe against England. But the manufacture of these articles in this country has also immensely increased in the same time. The attention of farmers in the last two years has been powerfully directed to this great staple, and the degree of prosperity which it manifests is well calculated to extend their enterprise not only to the number of sheep, but to the quality—

in respect not merely of breeds, but in keeping clean and packing. The fact has been developed by the most elaborate scientific researches, that the climate and soil of the United States are better adapted to the growth of fine, long stapled wools, suitable for the cloth manufacturer, than any other *manufacturing* country, and the article produced exceeds the Australian wool. Under the appliances of increased capital, and the stimulus which the competition of England with the continent may impart to the quality of the fabric, the United States will probably assume the superiority; but our manufacturers should not neglect the necessary exertion to procure as fine a finish and as durable a dye for their cloths as those of the continent exhibit. The United States wools are rapidly gaining a character which will bring the foreign manufacturers into such competition for their purchase as will permanently sustain their price.

The supply of wool in the United States has never been equal to the demand. In 1840 and 1850 the census gave the quantities raised in the country. If to these we add the quantities imported, we approximate the quantity used as follows :—

	1840.	1850.
United States product..lbs.	35,802,114	52,516,969
Imported..............	15 006,410	18,669,794
Total manufactured..lbs.	50,808,524	71,186,763

These wools, imported into the United States, are mostly of the coarser descriptions used for carpets, etc., and the average value is about 10 to 11 cts. These are qualities which do not compete with the fine wools of American growth; but the growth of manufactures was found to be impeded by the want of greater supply. In consequence, Congress, in 1857, made all wools costing less than 20 cents at the place of growth, free of duty. These had paid 30 per cent., ad valorem, previously. This law had not much effect in increasing the supply, for the reason that the supply is everywhere short. There were quantities of South American wool imported of a fine quality, but so filled with the burr peculiar to that country, as to make them nearly useless. Many machines were invented to remove these burrs, but with partial success. One was of the form of a number of circular saws, 8 to 10 inches in diameter, set close together upon a shaft, which revolved with much velocity. The wool was fed to this cylinder, through two rollers. The saw teeth seized the wool, which, passing between the saws, left the burr on the surface, whence it was removed by the motion of the cylinder against a stationary knife placed longitudinally across it. The general impulse given to manufactures at home and abroad, has caused the demand to outrun the supply of wool. This was the more the case that manufactures spread in those countries that formerly were most depended upon for raw wools. The supply of England has been kept up by the extended exports of Australia and the Cape of Good Hope. Hence, the lower duty did not improve the supply in the United States, and the home supply has to some extent been diminished by the operation of railroads and the growth of large cities. These latter have raised the demand for mutton and lamb, while the easy transportation afforded by rail has induced the farmers to send the animals to market instead of the wool, which was formerly alone practicable. The price of wool accordingly rose, and the manufacturers naturally sought to reduce the cost of the raw material by hunting up a substitute. This is usually found in substituting one of these four chief materials of human clothing —cotton, silk, wool, and flax. The one of these that is relatively dearest is mixed with larger proportions of the others. Hence, the value of the whole becomes in some degree equalized.

Out of these circumstances has grown one of the most curious manufactures that have sprung up of late years. This is the shoddy manufacture. It has recently been imported from England; and there are now in New York state six factories—in Watervliet, Newburg, Troy, and Marlborough. These turn out about 100,000 lbs. of shoddy per annum.

But what is shoddy?

In the somewhat hilly district of Yorkshire, between Huddersfield and Leeds, stand on two prominences the pretty little towns of Dewsbury and Batley Car. The stranger, on alighting from the railway car, is struck with the unusually large warehouses, built of stone, by the railway company. For such small stations, these are mysterious erections. But if he enter the principal warehouse, he will probably find piled up hundreds of bales, containing the cast-off garments of Great Britain and the continent of Europe. Here, in fact, from all parts of the world, are brought the tattered remains of the clothes, some of which have been worn by royalty in the various courts of Europe, as well as by the peers and peasants. The rich broadcloth of the English nobles here commingles with the livery of their servants and the worsted blouses of the French republicans; while American undershirts, pantaloons, and all other worsted or woollen goods, may there be found, all reduced to one common level, and known by one common appellation of "rags."

The walls of the town are placarded with papers announcing public auctions of "Scotch shoddies," "mungoes," "rags," and such like articles of merchandise, and every few days the goods department of the railway is besieged by sturdy-looking Yorkshiremen, who are examining, with great attention, the various bales, some of which are assorted into "whites," "blue stockings," "black stockings," "carpets," "shawls," "stuffs," "shirtings," "linseys," "black cloth," etc. A jovial-looking man, of doubtful temperance principles, at last steps forward and puts the goods up to auction. The prices which these worn-out articles fetch are surprising to the uninitiated. Old stockings will realize from $35 to $50 a ton; while white flannels will sometimes sell for as much as $100 a ton, and even more. The "hards," or black cloth, when clipped free from all seams and threads, are worth from $100 to $150 a ton. There are common mixed sorts of coarse fabric which can be bought as low as from $15 to $25 a ton; while the "rubbish," consisting of seams, linseys, and indescribables, are purchased by the chemists for the manufacture of potash crystals for from $10 to $15 a ton.

It will be seen that *assorting* these old woollens is equally important with the assorting of the different qualities of new wool; and there is the additional consideration of colors to render assorting still more necessary. It is surprising, however, with what rapidity all this is accomplished. There are some houses where old woollen rags are divided into upward of twenty different sorts, ready for the manufacturer. The principal varieties are flannels, of which there are "English whites," "Welsh whites," "Irish whites," and "drabs." Each of these command a different price in the market: the English and Welsh being much whiter than the Irish, and of finer texture, are worth nearly double the price of the Irish. The stockings are the next in value to the flannels, on account of the strength and elasticity of the wool. The peculiar stitch or bend of the worsted in stocking manufacture, and the hot water and washing to which they are submitted during their stocking existence, have the effect of producing a permanent elasticity which no after process destroys, and no new wool can be found to possess. Hence, old stockings are always in great demand, and realize, for good clean colored sorts, as much as $80 a ton in busy seasons. The white worsted stockings are the most valuable of the "softs," and, when supplied in sufficient quantity, will sell for as much as $140 a ton. Carpets, and other colored sorts, are generally, owing to their rapid accumulation, to be had at very low prices.

"Shoddy," so well understood in Yorkshire, is the general term for the wool produced by the grinding, or, more technically, the "pulling" up of all the soft woollens; and all woollens are soft, except the superfine cloths. The usual method of converting woollens into shoddy, is to first carefully assort them, so as to see that not a particle of cotton remains on them, and then to pass them through a rag machine. This has a cylinder 3 ft in diameter and 20 inches long, with steel teeth half an inch apart from each other, and standing out from the cylinder, when new, one inch. This cylinder revolves five hundred times in a minute, and the rags are drawn gradually close to its surface by two fluted iron rollers, the upper one of which is packed with thin stuff or skirting, so as to press the rags the closer to the action of the teeth. The cylinder runs upward past these rollers, and any pieces of rag which are not completely torn into wool, are, by their natural gravity, thrown back upon the rags which are slowly creeping into the machine. The rollers are fed by means of a creeper, or slowly moving, endless cloth, on which a man, and in some instances a woman, lays the rags in proper quantities. One of these machines is commonly driven by a seven-inch band, and requires at least five horse power. Half a ton of rags can be pulled in ten hours by one of these machines. The dust produced subjects the workpeople on first commencing the occupation, to what is there called the "rag fever." But after a time the immediate effects are warded off, and although it no doubt shortens life, the remuneration being considerable—in England, 2s. for every 240 lbs. of rags pulled—there is never any difficulty in obtaining workpeople.

The "mungo" is the wool produced by subjecting the hards, or superfine cloths, to a similar operation as that above described. The machine, however, for the mungo trade, is made with a greater number of teeth, several thousand more in the same sized cylinder, and the cylinder runs about 700 revolutions in a minute. The rags, previous to being pulled in this machine, are passed through a machine called a "shaker." This is made of a coarsely-toothed cylinder, about 2½ ft. in diameter, which revolves about 300 times in a minute, in a coarse wire cylinder. This takes away a large portion of the dust, which is driven out at a large chimney by means of a fan. The mungo pulling is, therefore, a cleaner business than the shoddy making, and, as a general rule, is more profitable. The power required for a mungo machine is that of about seven horses.

Both the better kinds of shoddy and the mungo have for some years been saturated with oil; but recently, milk has been applied to this purpose, and found to answer exceedingly well. The consequence is that milk in that locality, in England, has risen 100 per cent. in price; and even in that district, where cows are kept in large numbers, it was feared there would be a great scarcity of milk for the supply of the towns.

When well saturated with oil or milk, the shoddy or the mungo is sold to the woollen manufacturer. There are scores of men who attend the Huddersfield market every Tuesday to dispose of their mungo. It is as much an article of marketable value there, as cloth is here. It is not unusual for good mungo to realize as much as eight English pence per pound, while the shoddy varies in price from one penny to sixpence per pound, according to quality.

The common kinds of shoddy require, of course, to be subjected to the scouring process, for which large wooden heaters, or "stocks," are employed. The dung of hogs is largely employed in this purifying process, as well as human urine, which is extensively used in the blanket manufacture of Yorkshire.

The white shoddy is capable of being used either for light-colored goods or for the common kinds of blankets, while the dark-colored shoddy is worked into all kinds of coarse cloths, carpets, etc., which are dyed any dark color, so as to hide the various colors of the old fabrics. It is mixed in with new wool in such proportion as its quality will permit, without deteriorating the sale of the material.

The mungo is used in nearly all the Yorkshire superfine cloths, and in some very extensively. It produces a cloth somewhat inferior, of course, to the West of England goods in durability, but, for finish and appearance, when first made up, the inferiority would only be perceived by a good judge of cloth. This substance is largely introduced into all felted fabrics. Blankets, carpets, druggets, table-covers, and Petersham coats, are sometimes entirely made from it, and the trade is rapidly extending.

The effect of shoddy in the cloth of an overcoat, in the wear, is to rub out of the cloth and accumulate between it and the lining. We have seen a gentleman take a handful of this short wool from the corners of his coat.

The grounds on which this shoddy and mungo business can be justified are the cheapening of cloth, and the turning to a useful purpose what would be otherwise almost useless.

The business in Yorkshire is dignified by the title of the "Dewsbury trade;" and to it Dewsbury certainly owes its wealth, and we might almost say its existence. In twenty years it has grown from a village to a town of some 30,000 inhabitants, and some immense fortunes have been made by this extraordinary transformation of old garments into new.

Considerable quantities of white shoddy were sent from England and Scotland to this country, and finally a machinist sent several of his rag machines, and several factories were successively started. The sale of the product is now largely conducted in Cedar street, New York.

The shoddy trade is somewhat fluctuating, being affected very much by the state of the wool market. So great is the competition in the markets, that as soon as a rise takes place in the price of new wool, the small manufacturers, instead of raising their prices, commonly regulate their expenditure by using a larger proportion of the old material, and they are thus enabled to compete, in prices at least, with the larger manufacturers, who can lay in a large stock of new wool when the prices are low.

LEATHER.

CHAPTER I.

TANNING—BOOTS AND SHOES.

On the formation of the federal government, much solicitude was apparent in relation to the growth of the more important branches of manufactures. That the imperial government had so persistently prevented the establishment of any considerable branches, was a great drawback, because it had prevented the development of the necessary experience and skill in manufacture required for large operations. The removal of those prohibitions by the act of independence, attracted attention to the forbidden industries, and they began to flourish. The tanning and manufacture of leather, in all its branches, was one of the first that began to thrive, and naturally, because the slaughter of animals for food furnished a greater or less supply of skins, that required to be wrought up into boots, shoes, harness, etc. Parliamentary committees, early in the eighteenth century, mentioned tanning in the colonies as a branch of individual industry, which supplied most of the local demands for leather and shoe-making, as one of the leading handicrafts.

In 1791, the Secretary of the Treasury, Mr. Hamilton, in his report on manufactures, mentions: "Tanneries are not only carried on as a regular business in numerous parts of the country, but they constitute, in some places, a valuable item of incidental family manufacture." He went on to mention, that encouragement had been asked of the government in two ways, viz.: by prohibiting both the import of the leather and the export of the bark. It was alleged that the leather trade had raised the price of bark from $3 to $4½ per cord. He ascribed the rise, however, rather to the increase of tanneries than to the export, of which, he said, there was no evidence. Glue was then a large item with the tanners, who used up the refuse portions of the skins in that way. From that time to the present, tanners have increased in all the states, in the proportion nearly of the growth of the population. The importation of boots and shoes was always insignificant, comprising high-priced articles from Paris mostly. Thus, the year 1822 was one of the largest import: there were then 14,979 pairs of shoes, mostly kid and morocco, imported, for $9,192; and 207 pairs of boots, for $792, or nearly $4 per pair. In 1858 the importation was only 39,826 pairs of leather boots and shoes, at a value of $87,101; and the export of domestic boots and shoes in this year was 609,988 pairs, or a value of $663,905: showing a large excess of exports over imports.

The manufacture of boots and shoes has, therefore, been in the double ratio of the number of people, and their ability to buy, in proportions as follows:—

LEATHER MANUFACTURE OF THE UNITED STATES IN 1860.

	Establishments.	Capital.	Raw material.	Male.	Female.	Labor.	Product.
Boots and shoes.....	12,486	$23,357,627	$42,728,174	94,512	28,514	$30,938,080	$91,889,298
Gloves.............	126	594,825	537,589	453	976	330,419	1,176,795
Leather belting......	46	588,000	915,271	329	25	134,952	1,481,750
Morocco dressers....	136	2,331,250	3,896,522	2,371	331	924,308	6,291,075
Patent leather	12	1,039,000	1,395,400	865	..	317,460	2,101,250
Saddles and harness..	3,695	6,616,034	6,726,344	12,443	337	4,333,041	14,604.328
Tanners and curriers.	5,040	35,655,370	44,520,737	22,622	57	6,933,740	67,306,452
Total..........	21,541	$70,182,106	$100,720,037	133,595	30,240	$43,912,000	$184,850,948

The total value was thus raised to $184,850,948. The value produced by the tanners and curriers was $67,306,452. Of this leather so produced, the harness-makers and shoe-makers used $49,454.588. The tanneries lie at the foundation of the whole. They use the skins and hides of animals slaughtered in the whole country, and require, in addition, an average of some 5,000,000 of foreign hides, imported mostly from Central and South America, and the British East Indies, to make good the demand. The census of 1840 gave the sides of sole leather tanned at 3,463,611, and of upper leather 3,781,868.

The supply of hides in the country originally was derived mostly, if not altogether, from the slaughter of animals for food. Tanneries were started where bark, mostly hemlock, was most easily accessible, and the tannery became the market for hides and skins for many miles around, as well for the farmers as butchers. In the neighborhood of the large cities, foreign hides became the main resource. Thus, in 1858, the value imported was $9,719,683, as follows: Boston and Salem, $3,290,555; New York, $5,629,027; Philadelphia, $377,635; Baltimore, $422,466. The importers of hides sell to the tanners for cash or short time, and then tanning takes place in localities best suited to the combination of the materials. Boston is the largest leather market in the states; but there is not tanned in Massachusetts half the leather they use. They tan the upper leather; but the sole leather is mostly tanned in New York. The hides imported at Boston and Salem are sold to the New York dealers, by them supplied to the tanners, and then resold to the boot-makers of Massachusetts. One reason of this is, no doubt, that the newly opened counties of New York supply more and cheaper bark than can be had elsewhere. When the Erie railroad was opened through the southern tier of counties, tanneries rapidly increased along its line. The returns of the road for the first five years were as follows:—

	Hides sent west.	Leather sent east.
1846,	lbs. 976,950	781,300
1847,	1,200,520	480,040
1848,	1,111,580	1,078,620
1849,	3,253,883	3,696,592
1850,	10,140,022	8,409,765

So rapid was the effect of having access to new hemlock forests. The number of hides that are produced each year in the country, although a very important item, the census has not furnished in any definite manner. That of 1840 gave the number of sides tanned in 1839 at 3,463,611, which would account for 1,731,805 hides. The number of neat cattle in the country was then 14,971,586, and of horses and mules 4,335,669. The deaths among them would give about 400,000 hides, and the neat cattle would give 3,000,000 hides. The number of horses, cattle and other domestic animals in the United States, in 1866, is estimated by the Agricultural Department as follows:—

Horses	6,691,220
Mules	1,054,337
Cattle	26,935,616
Swine	28,845,003
Sheep	41,253,652

The census gives the quantity of cattle slaughtered at 25 per cent. of the whole. This would give 6,733,904 neat cattle. The horse hides (ten per cent.) would be about 669,000. The census of 1850 gives 6,128,970 hides tanned, and 8,653,865 skins, including 6,000,000 sheep skins. If we compare the census of 1840 with that of 1850, for tanneries, we have results as follows:—

	No.	Capital.	Sides tanned.	Skins.	Value.
1840,	8,229	$15,650,929	3,643,611	3,781,868	$20,919,110
1850,	6,263	18,900,557	12,257,940	8,653,865	32,861,796

The census of 1850 gives 6,128,970 hides tanned, which gives 12,257,940 sides. Under the head of skins, the census of 1840 has upper leather, calf, horse, etc. The census of 1850 includes 6,000,000 sheep-skins. Now, these 12,257,940 sides of sole leather by no means account for all the shoes made in the country. The rapid rate at which shoes and boots are made and worn, far exceeds the increase of cattle and hides; and the census returns do not obtain any thing like the quantities that are made in the large cities, where the numbers of very poor foreign shoe-makers are large. The census of 1855 gave 24,804 boot and shoe-makers in the state of New York, while the United States census of 1850 gave but 10,439 in the state. This difference, to some extent, no doubt, grew out of the large migration, there being among the emigrants very many shoe-makers who work very cheap and well.

The skins of domestic animals, or "green hides," are rated of higher value than the foreign or salted hides; yet these latter will give a great weight of leather, because of the water in the green hides, which, on the other hand, are more easily handled. The largest oxen make the best sole leather. The skins of the bull are thickest about the neck and parts of the belly; but the back is thinner, and are inferior in fineness of grain to oxen or cows. The best are made into the heavy leather, used for the best trunks, shoe-soles, machine-belts, harness, etc. The lighter qualities serve for uppers of common boots and shoes. Kips, or skins of young cattle, make the uppers of fine boots and shoes. Those hides of the best quality only are split or shaved for the thin enamelled leather used for ladies' shoes, and are made into "lace leather," or thongs for belts. In preparing the hides for tanning, the heavy ones are soaked for months in lime-water. The hair, at last, can be removed, with the epidermis, by the two-handed scraping-knife, rubbed over it as the hide is laid flat down on the bench prepared for this purpose. The fleshy substance on the other side is then scraped off, and, like the head, cheeks, and other waste, used for making glue. In large establishments, machines are used for this scraping. The lime that remains in the pores of the hide must be removed by soaking in some solution, like chlorine, that will form a soluble compound with the lime. Sometimes hides are laid in piles, and allowed to begin to putrefy, great care being taken to stop it as soon as the hair starts. By the United States plan, the object is more effectively obtained, with less labor, and no injury to the leather. The hides are suspended in a cool vault, protected, like an ice-house, against the entrance of warm air, and furnished with a covered channel-way, that answers as a drain and as a conduit for cool damp air. Cool spring water is then conducted into the vault, to fall round its sides like spray. The hides are thus kept in a mist, at a temperature of 44 to 46 deg., and, in six to twelve days, are found freed from all superfluous matter. The cold vapor has been absorbed, and its action by melting has distended and removed the epidermis with the roots of the hair. As soon as this is effected, the hides are ready for tanning. This American plan, it will be observed, is far in advance of that of the old systems, still practised in Europe.

Of the hides brought into New York in a year, the disposition was as follows:—

Domestic hides, slaughtered		250,000
Imported		1,902,000
Stock, Jan. 1		375,000
Supply		2,527,000
Taken for sole leather	1,877,000	
" upper "	250,000	
" patent "	100,000	
" by western tanners	100,000	
" neighboring cities	150,000	2,477,000
Stock, Dec. 31		50,000

These figures show the relative disposition of the hides sold in New York.

Leather, tanned, is generally divided into three kinds, namely: hides, kips, and skins. The stoutest leather employed for trunks and soles of boots and shoes, is made from butts or backs. Buff leather was formerly made for defensive armor from the hide of the buffalo, but it is now furnished by the cow-hide, and is used chiefly for soldiers' belts. Bull-hide is thicker than cow-hide, while kip-skin, from young cattle, is lighter than the latter. The name kip is also given to Calcutta, Brazil, and African hides. Calf-skin supplies the great demand for the upper part of boots and shoes; sheep-skins form a thin, cheap leather; lamb-skins are used for gloves; goat and kid-skins form a light leather of fine quality; deer or antelope are usually bi-dressed in oil; horse-hide is prepared for harness work, etc., and this, with seal-skin, is used for making enamelled leather; dog-skin makes a thin, tough, leather, but most of the gloves sold as dog-skin are made of lamb-skin. Hog-skin makes a thin, porous leather, and is used for covering the seats of saddles; ass and mule-skins are for shagreen leather, used mostly for scabbards. There is a large import trade in skins. The great demand for leather for the best gloves is supplied by lamb-skins from Italy, Spain, the south of France, and other parts, where, in consequence of the lamb being killed quite young, the skin is small, fine, and thin, and is used instead of kid; but it is neither so strong nor so glossy. The skins of lambs that die soon after their birth, are sometimes dressed with the wool, and are used for lining gloves and shoes. The best kid-skins are from the south of France; they are also imported from Germany, Switzerland, Italy, and Ireland. It is said that as soon as the kid begins to feed on herbage, the skin suffers in fineness and delicacy, and is no longer suitable for the best gloves. The best morocco leather is made from Swiss goat-skins; another kind is from Mogador and East Indian goat-skins, which are often made into black morocco, known as "black Spanish leather," from the circumstance of the first supplies having been obtained from Spain. The leather from the Cape sheep-skin is nearly equal to morocco. Hippopotamus hides are exported from South Africa, and when tanned with oak bark, they make an extremely thick and compact leather. In Canada, recently, leather has been made from the white whale which visits the St. Lawrence. In February, 1860, some specimens of this leather were shown at the American Institute. There are various sorts of excellent leather made from their skins.

The vegetable substances used in tanning have of late years become almost as numerous as the varieties of hides and skins on which they are employed. The active vegetable principle, tannin, varies somewhat according to the source from which it is derived; but it is always marked by an astringent taste, a bluish-black or dark green precipitate in aqueous solution by admixture with a solution of one of the salts of peroxide of iron; while, with a solution of gelatine, it gives a dirty white or brown precipitate. During a long period the principal tanning material has been oak bark and hemlock bark. That which is stripped in the spring is the most esteemed, for it then contains a larger quantity of tannin than that stripped in autumn, and this more than the bark stripped in winter. The best bark is obtained in a warm spring, from coppice trees about twelve years of age. Oak bark contains from 4 to 22 per cent. of tannin, which is contained in the inner white layers next the alburnum, as in the case of other astringent barks. The tannin of bark is probably not identical with that of galls, as it does not yield pyrogallic acid when subjected to destructive distillation; from four to six pounds of oak bark are required for every pound of leather. After the stripping, the bark is stacked to dry; should the season be rainy, a portion of the tannin may be washed out, and the bark be thus deteriorated. When the tanned leather is taken in hand by the currier, it is softened by being soaked in water. It is next beaten by a mallet upon a hurdle, and then placed over a plank called a beam, which projects slantingly from the floor. The workman leans over this and against the leather, so as to keep it in its place, and with a broad knife shaves off all the irregularities from the flesh side. The knife is held firmly in both hands, and the operator continually examines the skin, and moves it to bring all parts under the knife. After it is shaved, it is thrown into cold water, the flesh side laid next to a stone slab, and the other well rubbed with a tool called a stretching iron. This process forces out a whitish matter (bloom) gathered in the tan pit, and reduces inequalities. Many tools are employed, having the same object. The skin then undergoes "dubbing;" an ointment of cod oil boiled with the skins of sheep, is well rubbed in on both sides, and the leather hung up to dry. It is afterward rubbed with the graining board—an instrument shaped somewhat like a brush, but grooved, and made of hard wood. The leather is then ready for sale; or, after shaving the flesh side with a very sharp knife, it is waxed. A color, composed of oil and lamp-black, is well rubbed in on the flesh side, with a hard brush, until the surface is thoroughly black; upon this is applied a size and tallow with a stiff brush, and when dry, it is rubbed with a broad, smooth lump of glass; this is repeated. This leather is called "waxed," or "black on the flesh," and is used for the uppers of men's boots and shoes. If curried on the other side it is called black on the grain, and is used for ladies' uppers. In preparing such leather, the waxing is performed as follows: a solution of sulphate of iron, called copperas water or iron liquor, is applied to the grain side of the wet skin, when the salt, uniting with the gallic acid of the tan, produces an ink dye; stale urine is then applied to the skin, and when dry, the stuffing is applied. The grain is raised, and when dry, the skin is whitened, bruised, and again grained; after which, a mixture of oil and tallow is applied to the grain side, and it undergoes carefully the treatment with the pommel or graining-board again, and several other processes of rubbing, polishing, and dubbing, or oiling. These duly performed, with due regard to time and circumstances, complete the process.

For many years it was found difficult to cause a bright varnish to adhere to leather without cracking, an effect which is now produced by means of boiled linseed oil mixed with vegetable black and Prussian blue. This composition, of the consistence of a thick paste, is rubbed upon the surface of the leather, and then dried at a temperature of from 150° to 170° Fahr. The process is repeated from three to seven times, and when quite dry, the varnish adheres very firmly, and will bear considerable flexure and tension without cracking. By mixing colored pigments with the varnish, enamelled leather of various colors may be produced.

The process of tanning differs considerably in the mode of treatment with the kind of skin and the result desired. A large number of thin leathers which are intended to be dyed, are tanned in various ways. White leathers are not tanned, but tawed, or treated with alum, salt, and some other matters. Wash leather is dressed with oil, or shamoyed; but whatever may be the subsequent treatment, the preparatory steps somewhat resemble each other—whereby hair, wool, grease, and other matters, are removed, and the skin is reduced to the state of a gelatinous membrane called pelt; the hair is removed from kid and goat-skin, by means of cream of lime; the wool is generally removed by the feltmongers before the skin is passed to the tawers.

Foreign lamb-skins, which are received with the wool on, are washed, scraped on the flesh side, and sweated in a close room, until, in consequence of the putrefactive fermentation, the wool can be easily removed. After this, fatty matters are got rid of by subjecting the skins to hydrostatic pressure; they are next worked at the beam and pared into shape, treated with lime, and next with dogs' or pigeons' dung, if the skins are to be tanned, and with bran and water if they are to be tawed, the object being, in either case, to get rid of the lime. During these operations, the skins are worked a few times at the beam, and are finished by washing in clean water. Morocco leather is prepared by tanning goat-skins with sumach, and dyeing on the grain side. Inferior moroccos are prepared from sheep-skins similarly treated, for which purpose each skin of pelt is sewed up into a bag, the grain side outermost, distended with air, and placed in a mordant of tin or alum. They are next placed in a warm cochineal bath for red, indigo for blue, orchil for purple, and are worked by hand until the dye has properly struck. For certain colors the tanning precedes the dyeing. The tanning or sumaching is carried on in a large tub, containing a weak solution of sumach in warm water; another and stronger solution is contained in an adjoining vessel, a portion of which, together with some sumach leaves, is poured into the bag; some of the weak solution is then added, the bag is distended with air, and the skin thrown into the vat. In this way about 50 skins are treated, and are kept in motion a few hours in the sumach tub, by means of paddles worked by hand, or by machinery. The skins are then taken out and heaped upon a shelf at the side of the tub, the pressure thus produced causing the liquor to escape slowly through the pores of the skin, the bags being shifted about from time to time. The bags are next passed into a second vat, containing a stronger solution, where they remain for nine hours. The bags are now opened and washed; fine red skins being finished in a bath of saffron. All the skins are next struck on a sloping board until they are smooth and flat, and in order to improve their appearance in the currying, a little linseed oil may be rubbed on the grain side; they are then hung up in a loft to dry, when they become horny and are in the crust, as it is called; they next pass through much laborious friction with the pommel, and with a glass ball; while the peculiar ribbed appearance of morocco is given by means of a ball of box-wood, on which is a number of narrow ridges. Sheep-skin morocco is prepared from split skins; the skin-splitting machine resembles in principle that hereafter described, only as the membrane is thinner, certain variations are required. Instead of stretching the skin on a drum, it is passed between two rollers, the lower one of gum-metal, and solid, and the upper made of gum rings; while between the two rollers, and nearly in contact, is the edge of the sharp knife, which is moved by a crank, as hereafter mentioned. When a skin is introduced between the two rollers, it is dragged through against the knife edge and divided, the solid lower roller supporting the membrane, while the upper one, being capable of moving through a small space by means of its rings, adjusts itself to inequalities in the membrane; where this is thin the rings become depressed, and when it is thick they rise up, so that no part escapes the action of the knife. The divided skins are not sewed up into bags, as, from their thinness, they can be sumached quickly.

In preparing white leather by "tawing," the pelt is made as pure as possible; the best kind of leather being prepared from kid-skins, while sheep or lamb-skins make the inferior kinds. They are first fed with alum or salt in a drum or tumbler made like a huge churn; about three pounds of alum and four pounds of salt being used to 120 skins of average size. The alumina of the alum forms some definite compound with the gelatine of the skins, while the salt serves to whiten them. When taken out, the skins are washed in water, then allowed to ferment in bran and water to remove the surplus alum and salt, and to reduce the thickness. They are next dried in a loft, and become tough and brittle, but they are made soft and glossy by means of a dressing of twenty pounds of wheat flour and the yolks of eight dozen eggs. By rotating the skins in drums for some time the dressing is absorbed, and scarcely any thing but water remains. This dressing is usually repeated, and the skins hung up to dry. The beautiful softness and elasticity of leather is now given by manipulation. The skins are first dipped in clean water, worked upon a board, and staked upon a stretcher or softening iron, consisting of a rounded iron plate fixed to the top of an upright beam, by which the skins are extended and smoothed; they are then finished by being passed over a hot iron.

The tanning of leather, more than almost any other manufacture, is a chemical process, the success of which depends almost wholly upon the skill and judgment with which its complicated manipulations are conducted. To attain the requisite skill in the laboratory of the chemist is evidently impossible; it can only be acquired in the tanning itself, by long and careful attention and observation; and perhaps there is no description of manufacture where so much depends upon practical knowledge, and so little upon mere theory, as in the tanning of leather. The tanning of leather consists in effecting a combination between the gelatine, which is the main constituent of raw hides, and tannin, a peculiar substance, found in the bark of several species of trees—the oak and hemlock chiefly. The processes employed are so various, and the modifications occasioned by temperature, strength of the liquor, and quality and condition of the hides, are so numerous and so different, that hardly any branch of business requires for its successful conduct a greater degree of judgment and experience, and in few arts have there been effected greater improvements. Within twenty years the gain of weight in converting hides into leather has increased nearly fifty per cent.; that is, from a quarter to a third more leather can now be obtained from a given quantity of hides than in the old-fashioned way.

The great improvement in weight seems to have been gained by the judicious use of strong liquors, or "ooze," obtained from finely-ground bark, and by skilful tanning. In order to produce heavy weights, the hides should not be reduced too low in the beam-house, and should be tanned quickly with good strong liquors, particularly in the latter stage of the operation. To green hides, particularly, nothing can be more injurious than to suffer them to remain too long in weak "ooze." They become too much reduced, grow soft, flat, and flabby, lose a portion of their gelatine, and refuse to "plump up." On the other hand, however, the effects of an early application of "ooze," that is too strong and too warm, to green hides, is very injurious. It contracts the surface fibres of the skin, tanning at once the external layers, so "dead," as it is termed, as to shut up the pores, and prevent the tanning from penetrating the interior. This renders the leather harsh and brittle.

In softening hides, and preparing them for the process of tanning, a great deal also depends upon the judgment of the person superintending the operation, inasmuch as the diversities in the qualities and characteristics of hides render it impossible to subject them to any thing more than a general mode of treatment. In "sweating," the character of the hides and the temperature are essential, but ever-varying considerations. As a general rule, however, the milder the process of preparing the hides for the bark, the better. Unnecessarily severe or prolonged treatment is inevitably attended with a loss of gelatine, and a consequent loss of weight and strength in the leather. Too high a temperature is particularly to be avoided.

In almost every lot of hides, particularly the Orinocos, however, there are generally some that prove very intractable, resisting all the ordinary modes of softening. For such, a solution of ashes, potash, or even common salt, will be found to be beneficial.

As we have said, no precise rule can be given as to the length of time required for the preliminary process of soaking and "sweating"—so much depending upon the qualities of the hides, and the temperature at which these operations are conducted.

The following table, however, may be found useful in conveying an approximation to a definite idea of the practice in a large tannery:—

	SOAKING.				SWEATING.			
Temperatures.	40°	50°	60°	70°	40°	50°	60°	70°
	Days.	Days.	Days.	Days.	Days.	Days.	Days.	Days.
Buenos Ayres hides........	10 to 12	8 to 12	6 to 8	3 to 6	15 to 20	12 to 16	8 to 12	2 to 3
Carthagena and Laguayra...	8 12	7 9	5 7	2 5	15 20	10 15	6 8	2 3

Salted hides do not require more than about two-thirds the time to soak, but about the same time to sweat. In sweating, the temperature rises as the hides sweat, so that the operation is seldom performed under 50°. It is particularly recommended that, for the tougher hides, the heat should never be greater than 60° or 65°.

After the hides are prepared for tanning, the next process is what is commonly called "handling," which should be performed two or three times a day in a weak ooze, until the grain is colored, new liquor being preferable to old. They are then, after a fortnight, laid away in bark, and changed once in two to four weeks until tanned. Much care and judgment is requisite in proportioning the continually increasing strength of the liquors to the requirements of the leather in the different stages of this process. The liquors should also be kept as cool as possible, within certain limits; but ought never to exceed a temperature of eighty degrees. In fact, a much lower temperature is the maximum point, if the liquor is very strong —too high a heat, with the liquor too strongly charged with the tanning principle, being invariably injurious to the life and color of the leather. From this, it would seem that time is an essential element in the process of tanning, and that we cannot make up for the want of it by increasing the strength of the liquor, or raising the temperature at which the process is conducted, any more than we can fatten an ox or a horse by giving him more than he can eat. It may be questioned whether any patented schemes for the more rapid conversion of hides into leather, will be found, on the whole, to have any practical utility.

We have mentioned the injurious effects resulting from too strong a solution of the active principle of the bark; on the other hand, the use of too weak solutions is to be avoided. Hides that are treated with liquor below the proper strength, become much relaxed in their texture, and lose a portion of their gelatine. The leather necessarily loses in weight and compactness, and is much more porous and pervious to water. The warmer these weak solutions are applied, the greater is this loss of gelatine. To ascertain whether a portion of weak liquor contains any gelatine in solution, it is only necessary to strain a little of it into a glass, and then add a small quantity of a stronger liquor. The excess of tannin in the strong solution, seizing upon the dissolved gelatine in the weak liquor, will combine with it, and be precipitated in flakes of a dark, curdled appearance, to the bottom. In the best tanneries, the greatest strength of liquor used for handling, as indicated by Pike's barometer, is 16°. Of that employed in laying away, the greatest strength varies from 30° to 45°.

After the leather has been thoroughly tanned and rinsed, it will tend very much to improve its color and pliability to stack it up in piles, and allow it to sweat until it becomes a little slippery from a kind of mucus that collects upon the surface. A little oil added at this stage of the process, or just before rolling, is found to be very useful.

Great caution is necessary in the admission of air in drying, when first hung up to dry. No more air than is sufficient to keep the sides from moulding should be allowed. Too much air, or, in other words, if dried too rapidly in a current of air, will injure the color, giving a darker hue, and rendering the leather harsh and brittle. To insure that the thick parts, or butts, shall roll smooth and even with the rest of the piece, it is necessary that the leather should be partially dried before wetting down for rolling, and that, when wet down, it should lie long enough for every side to become equally damp throughout.

In the tanning records of 200,000 sides, an average of the whole time was five months and twenty-seven days. The average weight of the leather was seventeen pounds per side. This, according to the best authorities we have at hand, is considerably below the time employed in England. There, it is no uncommon thing for eight and ten months to be employed in tanning a stock of leather, and some of the heaviest leather, it is said, takes even fourteen and fifteen months.

A new process of tanning leather has been recently introduced, as follows:—

Sole leather hides for *sweat stock* are prepared for the tan liquors in the usual manner. Limed stock for upper and sole leather, for either hemlock or oak tanning, is limed and washed, and bated by the paddle-wheel handlers; after being properly prepared for the tan liquors, it is then handled in a section of vats, with the liquors communicating in the manner long known as press-leaches, except the order of running the liquors is from near the top of one vat to the bottom of the next, and so on through the whole section, thus "pressing" the weak liquor ahead on to the greener stock, giving a *perfect* gradation of strength of liquor on each pack, stronger or weaker according to the length of time it has been in; each vat is fitted with a paddle-wheel handler, patented June 19th, 1847, and Dec. 24th, 1850, which is used for stirring the stock in the liquors, dispensing with the necessity of handling by hand entirely; in this section stock should be kept about two weeks, then taken out and hung over sticks with head and butt down in layaways, patented August 10th, 1858, and not again moved or seen till well tanned; the layaways are all in one section with the communicating trunks, in the same manner as the handlers; when a pack is taken out *tanned*, a pack from the *handlers* is put into its place, and the weakest liquor in the section is allowed to fill the vat; here every part of every side is in contact with the liquor at all times, and the liquors on *every pack* are becoming stronger every day till tanned; the liquors are kept in motion by small paddle-wheels, which operate on the surface of the liquor over the suspended sides, causing the liquors to pass with a gentle current among the sides, bearing them up, so that they do not rest heavy on the sticks.

Two men's labor is sufficient for all the *yard work* for a tannery working *in* and *out* 150 sides per day, including washing the tanned stock and taking it to the loft.

The results of tanning 144,000 hides were as follows:—

		Weight. lbs.	Average. lbs.	Value.
Hides	144,000	3,229,155	22.22	$421,810
Leather, sides,	287,275	5,316,789	18.51	704,044

This gives a considerable increase in the weight of the hides, and the increase in the value of the article is much greater. That covers, of course, commission, labor, interest, profits, etc. The great development given to general business in the last ten years has caused an almost continuous rise in the value of leather and hides. The latter, on being purchased and put in the vats, would thus acquire value from the general rise in the market, in addition to the regular value added by the art of the tanners. There was gradually felt a growing scarcity of hides, and the quantities imported by no means kept pace with the rising value. The quantities and values of hides imported for the few last years were as follows:—

	1850.	1855.	1856.	1857.	1858.
No. hides,	2,572,884	2,434,554	2,360,150	2,651,846	2,493,656
Value,	$5,964,838	4,823,119	5,919,319	7,620,272	8,048,825

This shows that for 79,000 fewer hides, there was paid, in the year 1858, $2,000,000 more money than in 1850, a rate which gives an advance of 37½ per cent. in the value of hides, without inducing a greater supply. Such a fact indicates the growing cost of the raw material for boots and shoes, and also indicates the growing value of the hides of animals throughout the country.

Leather being so costly a substance, great efforts are made to introduce economies in its manufacture and use in every direction. One plan for getting the most possible surface out of a given weight, is to split the thick hides into two thinner sheets. This process, formerly difficult, has of late undergone many improvements. When the hide is sufficiently tanned, it is split sometimes into five thicknesses, from a single one. This is done by various machines, in one of which the knife is 72 inches long, or as long as a hide is wide. A late improvement in Boston makes the knife 80 inches long, and economises 25 per cent. in the stock that before was shaved away. The flesh side of the sheet, with the shanks, are used by the trunk-makers to cover wooden trunks, and blackened on the trunks. Other sheets are subjected to a process called "buffing," which consists in shaving off about half the grain, in order to obtain a softer surface to receive an artificial grain. They are then returned to the tan-yard, and, after being scoured, are retanned in warm liquors. They are then sent to the currier to be prepared for japanning. A new patent has been issued for splitting leather with a circular knife, which is of thin metal, made like a disc, convex side up. This revolves horizontally, with its sharp edge just above a table, over which the leather is stretched, and held down firmly to it by springs. Under the table is a roller, which, by revolving, draws the leather forward against the edge of the revolving knife. The upper side of the leather splits off in curls above the knife, which may be nicely adjusted to make the leather of any thickness.

The general manufacture of boots and shoes had undergone few changes other than those produced by changing fashions and the regular improvements of business, until the introduction of sewing and pegging machines, which have given a great impulse to the production by affecting prices and disturbing localities. The Massachusetts shoe-makers, by their industry, early obtained an ascendancy in the manufacture, and it is one that is easily adopted in an industrious community. The towns in the neighborhood of Boston attracted masons, carpenters, and other workmen, in the winter season, when their own professions were dull, to pursue shoe-making, which was always a resource. The town of Lynn was the most famous; and the facility with which shoes were turned out, led to the legend, that the materials, being stuck to the wall by an awl, were combined in the proper manner by a blow of the lapstone being skilfully aimed at them. There were others who asserted that both boots and shoes grew there spontaneously. Whatever may be the fact, an affluence of these useful articles was always observable there, and thirty years since the sales were mostly in the hands of the New York merchants, to whom most of the New England manufacturers consigned or sold their wares. Gradually this changed. The number of skilled workmen that arrived from abroad became so great, as to fill most of the departments into which the boot trade became divided, as crimping, bottoming, heeling, and finishing; and the pay of the workpeople, by the piece, or the pair, enables each to control his own time, working when they please. These sometimes club their work, and appoint an agent to sell; others, by economy, save their pay, and employ a few men, whose work they direct. These, in the cities, are called "*garret bosses.*" When they succeed in establishing a trade, they conduct the manufactory by a foreman, and open an office in the city, where they sell their wares, and purchase the stock for manufacture. The materials are in this manner better purchased; and as the seller is himself the manufacturer, coming in contact with buyers from all sections, he becomes conversant with the styles adapted to all localities, and the manufactory is by far the better conducted for it. The advantages of this system have made Boston, of late years, the grand centre of such operators, and have drawn thither the jobbers from New York, Philadelphia, Baltimore, Cincinnati, St. Louis, etc., until Boston has become the largest shoe market in the world. The sales of boots and shoes there are $62,000,000 per annum. The number of pairs made in Massachusetts in the year 1860 was as follows:—

Boots	11,578,885
Shoes	32,678,167
Boots and shoes	51,250
Total pairs	44,308,302
Total value	$37,468,355

This was a number sufficient for one and a half pairs for each person, great and small, in the United States; and the number employed in making them was 43,907 males, and 32,652 females: together, 76,559. In 1845, the value, manufactured in Massachusetts, was $14,799,140—an increase of $22,669,215 in the fifteen years; showing the force of concentration of the trade.

The number of cases exported from Boston, in 1859, was as follows:—

	Total year.
Baltimore	62,461
Charleston	17,177
Louisville	21,119
Lexington	2,158
Memphis	3,338
Mobile	2,940
Nashville	18,781
Paducah	1,146
Richmond	1,452
Savannah, Ga.	2,526
St. Louis	55,774
New Orleans	37,686
Philadelphia	56,119
New York	182,207
All others	253,107
Total cases	717,991

This gives a value of over $30,000,000. The class of shoes sent from Boston is not of so fine a character as those which are turned out in Philadelphia. The largest quantity of morocco is made there; and the supply of skins and leather is ample, and of the best quality. The workmen have a reputation for skill, and are paid by the piece.

The work is divided into separate branches. For men's dress boots, the "fitter" is paid 75 cts.; for crimping, 10 cts.; for bottoming, $2 50; heeling, 12 cts. A fast workman earns about $12 per week. The production of boots and shoes in Philadelphia has been placed at $4,141,000, including a quantity made in the state prisons. The introduction of sewing machines has had an important effect upon the manufacture of both boots and shoes, and more recently, the invention of a machine to peg soles promises to make a still greater change in the principal branch of the Lynn manufacture. The machine in question, for which a patent has recently been issued, punches the leather, and inserts the pegs, in an incredibly short time, with the utmost accuracy and efficiency. The sole, when pegged, is perfectly pliable, the pegs forming, apparently, a portion of its substance. The use of these machines is as well adapted to the limited wants of small western towns, as to the grand operations of metropolitan manufacturers, and local wants may, by their action, be so gradually supplied, as to dry up those streams which unite in so extended a demand in Boston.

Let us go into an eastern machine shoe factory. In a small room, partitioned off for the purpose, is a neat and compact steam engine, which carries all the machinery, even to the stitching machines. The remainder of the basement is occupied by machines for cutting, stripping, rolling, and shaping the soles. The stock is then passed to the story above, where the shoes are lasted, and the outer soles are tacked on by hand; by which process they are prepared for pegging. The pegging machines are simple in their construction and mode of operation, but perform the work with great despatch and accuracy, driving the pegs at the rate of fourteen a second. One of the most curious operations of the machine is the manner in which it manufactures the peg for its own use. A strip of wood of the required width, and neatly laid in a coil 100 ft. in length, is put into the machine, and at every revolution it is moved forward, and a peg cut off and driven into the shoe. The rapidity and unerring accuracy with which these machines perform the work, is truly astonishing. After being pegged, the shoes are passed up to the third story, where the bottoms are smoothed, scoured, and brushed, and then sent into the front of the building to be packed, ready for sale and transportation.

Another part of the building is occupied by the women who tend the stitching machines, which are also run by steam: thus saving them from what otherwise must prove a laborious and fatiguing operation.

A dozen hands employed in the manufacture of these pegged shoes will complete about 20 cases per week; and the work being almost entirely accomplished by machinery, gives it a uniformity as to style, shape, and general appearance, which it is impossible to obtain by hand. The pegging machine has been invented but a few years. The work, even now, is said to be fully equal to that performed by hand, and must, therefore, we think, certainly supersede it when the machinery is brought to a higher state of perfection, which, in the nature of things (it being impossible to stay the progress of inventive Yankee genius), must be continually taking place.

The style of making boots and shoes changes in some degree, and is leading manufacturers to introduce improvements, like that of a steel shank, so called, which is a steel spring fixed firmly in the heel, and extending under the hollow of the foot between the soles, to give elasticity to the step. The grades of city work vary with the quality of the material and the labor bestowed. The patent leather custom-made boots command $10 per pair; and the high Russia leather Wellington boots $12; and so down to $10, $8, and $5 for calf-skin; with lower rates for split leather, and ordinary material. The scarcity of material, and the high prices of stock, have driven the poorer class of shoe-makers to the use of old tops, or upper leathers, for both boots and shoes. These are not only refooted for the use of the wearer, but are cut down to make new shoes and boots of a smaller size. Many take much pains to buy up old articles of that description, and reproduce them at rates far below what they could be afforded by regular shoe-makers from new stocks. Much art is used also in economising the soles of cheap goods. A thin under-sole is used; between which and the in-sole, pasteboard, old slips of leather, and other cheap substances, are inserted, to give an appearance of substance. These cheap varieties of shoes supply the wants of those whose means are small, with a semblance of shoeing.

The phrase, "paper soles," is not unfrequently used to designate the extremely thin substance attached to the casings of the dainty little feet of our fair sex, but still that substance is leather. Recently, however, a pair of veritable paper soles were put upon a customer, and worn, though for a very limited time. The victim in the case was a strapping negro fellow, who, allured by the seductive invitation to "walk in and see the cheap clodings," entered a Jew's museum, and purchased a pair of laced boots for $1 50. They fitted well, and wore well for a few hours, but great was his astonishment when his trotters parted company with his boots, and he was once again barefooted. On examining more closely his purchase, he found that the soles were composed of thick paper board, colored to resemble leather, and pegged to the uppers. The sympathising justice heard his complaint, but could grant no relief.

The New York state census of 1855 gave the following summary of the production of leather, and the manufactures therefrom:—

	Establishments.	Hands.	Capital.	Raw material.	Value produced.	Quantity.
Tanners.....	863	5,525	$3,367,013	9,670,386	$15,642,383	4,244,615 hides.
Boots & shoes	1,463	10,372	1,061,940	2,628,524	6,063,951	1,478,017 pairs.
Harness, &c.	594	1,613	481,571	816,804	1,580,492	13,663 sets. 37,807 trunks.
Pocket-books	12	581	91,430	128,040	369,000	21,600 gross.
Hose, &c.	2	19	1,000	60,000	77,000	
Patent leather	5	67	59,000	113,000	226,500	73,250 skins.
Morocco.....	30	509	223,300	1,301,612	2,899,829	838,795 skins.

The production of leather by tanners exceeds by much the value used by those who work up leather. A great deal of the leather made in this state goes, however, as we have seen, to New England to be used.

The manufacture of gloves has not extended itself in this country so much as some other industries, with the exception of buckskin gloves, which are peculiarly American, combining utility with dress. The use of gloves is becoming far more general in cities than formerly. In early times, the practice of presenting a pair of gloves at funerals to the attending clergy, and others, was carried to such an extent in Massachusetts, that the legislature forbade the practice, under a penalty of £20. In cold regions, gloves are of the warmest wool, or skins, with the fur side out. Buckskin lined with soft wool is often used: the texture changes with the climate to the softest kid and silk. India-rubber gloves are used for many purposes, such as saving the hands of females in many kinds of domestic labor. Some years since, the French government undertook to clear the sewers of Paris from the multitude of rats that infested them, and which had become a formidable nuisance. These rats were of large and divers breeds. It was stated that a contract was entered into with a Parisian glover to purchase the skins for the glove manufacture at a certain price, on the condition that they should not exceed 1,000,000. It resulted that many millions were procured; and the Parisian house having declined, a London glover took the "lot." It is not certain, however, that the skins are of practical value.

The French excel in the manufacture of kid gloves, and Parisian gloves are still without a rival. The difference is seen in the cutting of the skin to the best advantage. This is performed with scissors, after stretching and rubbing the skin upon a marble slab with a blunt knife.

A skin is first cut longitudinally through the middle, by which it is divided into two equal and similar parts; and the single strip, for the palm and back, is next cut off from one end of the half skin. The pieces for the thumb, the gussets for the fingers, and other small pieces to be inserted, must all be worked out either from the same skin, or from others precisely similar. In this work, it is said, "a Frenchman will generally manage to get one or two pairs of gloves more than an Englishman can from the same skins, and these not inferior or scanty, but as well and handsomely shaped as the rest. This clever and adroit manipulation of the leather is an object of great importance in France, where not less than 375,000 dozen of skins of all kinds are cut up into gloves every year." The nearly square piece cut off is folded over upon itself, giving a little more width for the side designed for the back of the hand; and upon this oblong, double strip, the workman, measuring with his eye and finger, marks out the length for the clefts between the fingers, which he proceeds to cut and shape. Making the hole for the thumb is a matter requiring the greatest skill, for a very slight deviation from the exact shape would cause a bad fit when the parts are sewed together, resulting in unequal strain and speedy fracture when the glove is worn. By late improvements, introduced by M. Jouvin, the thumb-piece, like the fingers, is of the same piece with the rest of the glove, requiring no seam for its attachment. The cutting also is performed in great part by punches of appropriate patterns, and some of these are provided with a toothed apparatus somewhat resembling a comb, which pricks the points for the stitches. The seams are sewed with perfect regularity by placing the edges to be united in the jaws of a vice, which terminates in fine brass teeth, like those of a comb, but only one-twelfth of an inch long. Between these the needle is passed in successive stitches. When the sewing is completed the gloves are stretched, then placed in linen cloth, slightly damp, and beaten, by which they are rendered softer and more flexible. The last operation is pressing. The chief branch of the manufacture carried on in the United States is that of buckskin gloves; and the most important seat of this business is at Gloversville, Fulton county, N. Y.

It follows, from what has been said, that the United States are large consumers of leather; and when we consider that we are largely a grazing and cattle-growing nation, manufacturing from our native hides a greater quantity of leather than any other nation of equal population, in addition to large imports, it would seem to indicate an extravagant, if not a wasteful use of leather.

We are informed by Adam Smith, who has delineated every point and line of every branch of political economy, and who has, apparently, collected and compressed into three volumes more of the critical history of the individual, as well as the general economy of human society, than any one author, and with less of error and mistake than most authors, that it is characteristic with savage nations to export their raw hides, and neither to manufacture nor use much leather; while civilized nations import largely of raw hides, and manufacture and consume large quantities of leather. It is a fair corollary, then, that our excessive consumption of leather indicates our superior degree of civilization; and such is undoubtedly the truth. The high grade of civilization of the people of the United States is abundantly evident, and universally acknowledged.

FIRE-ARMS.

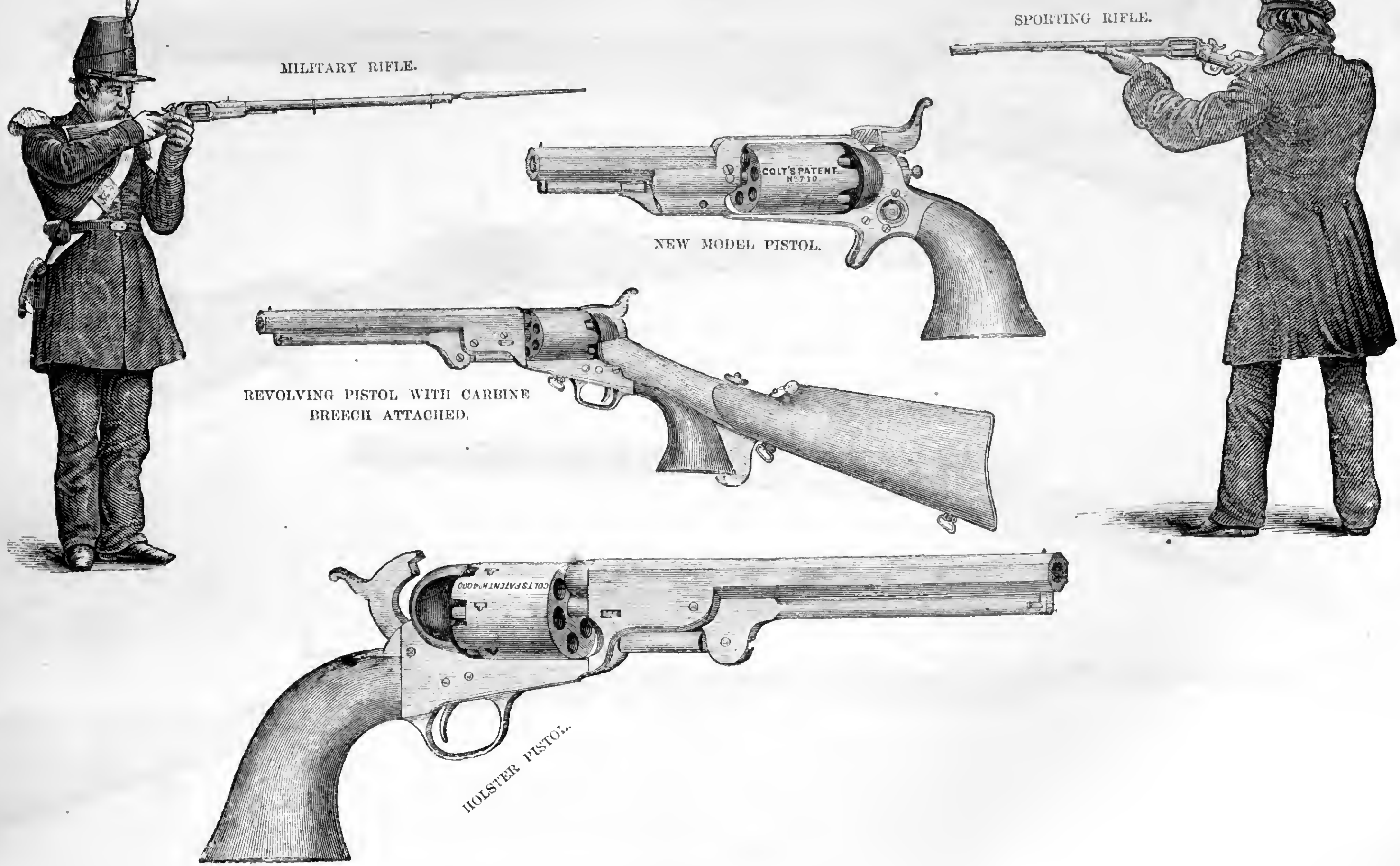
CHAPTER I.

COLT'S REVOLVERS — SHARP'S RIFLES — DAHLGREN'S GUNS.

The improvements in fire-arms are making such rapid progress among civilized nations, that we may indulge the hope that they will soon cease to be wanted at all; since, as extremes meet, they may become so effectual in their operation, and war reduced to such a science, that an attempt to fight will only be entire mutual destruction, like that most effectual combat between the two Kilkenny cats. The last war in Europe, by which France, in three months, liberated Italy from Austrian grasp, is an example of the power that may now be exerted in a short space of time, and the newly invented rifled cannon had a powerful agency in bringing matters to a close. After the invention of gunpowder in the fourteenth century, the art of gunnery made great progress, and the musket came to be the most important weapon. The Roman legions used the short stabbing sword as their favorite weapon. In the age of chivalry, the lance of the horseman was the queen of weapons, and continued so up to the battle of Pavia, in 1525, when chivalry made its last charge, and went down with the white *panache* of the gallant Francis I. From that time the arquebuse, then a matchlock, improved into a firelock, displaced the English bow, acquired the bayonet, and became, in its turn, the "queen of weapons." When the musket, or "Brown Bess," was furnished with percussion caps instead of flints, and the sword bayonet was added, there seemed to be little to hope for in the way of improvement. Since the "wars of the Roses" in England, nine-tenths of all the battles of the world have been decided by projectiles, artillery, and musketry, without crossing a bayonet or drawing a sword. The cavalry, as an arm, has continually lost ground, except in the rout of a defeat, when it follows up a flying enemy. It never could break a square, even when armed only with pikes, and recent events have shown that it cannot reach infantry in line.

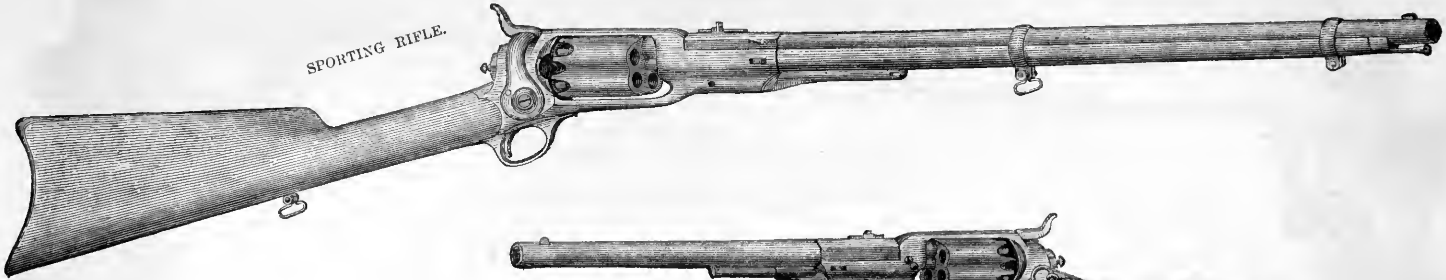
A remarkable change has come over "Brown Bess" of late, and it seems now to have seen its best days. The rifle, or a screwed barrel, was among the first forms of the manufacture of small arms in the sixteenth century; but the musket was preferred, on account of its more speedy loading. The rifle was, however, the favorite with the American colonists, and its execution in their hands during the Revolution brought it into general notice. The adding of the percussion cap was a great improvement to it. Recently it has become so improved as to supplant not only the old musket, but artillery also, since the events of the last few years have shown that it is easy to silence cannon by shooting down the gunners at their pieces, beyond the reach of grape. In the text-book of the St. Cyr Military School of France, it is directed that the fire of artillery should cease when the enemy is distant twelve hundred yards. At Waterloo, the opposing armies being twelve hundred yards distant, were out of reach of all but solid shot from field guns, as they were then served. It is now stated that the Minié rifle is effective at a mile distant, and at two thousand yards troops can easily shoot each other. It follows, from these simple facts, that artillery must improve or become ineffective. The improvements in the rifle were mostly in the ball. The French pin rifle had a small steel "pin" in the bottom of the chamber. The powder filled in around this pin, and the ball, of a conical shape, hollow at the base like a thimble, had a small metal plate, which, on being rammed home, struck against the pin, and spread the ball so as to slug the piece. The Minié rifle was nearly the same, without the pin, because it was found that the explosion would of itself spread the ball. The performances of this weapon are somewhat marvellous, since it is

COLT'S


MILITARY RIFLE.
SPORTING RIFLE.
NEW MODEL PISTOL.
REVOLVING PISTOL WITH CARBINE BREECH ATTACHED.
HOLSTER PISTOL.

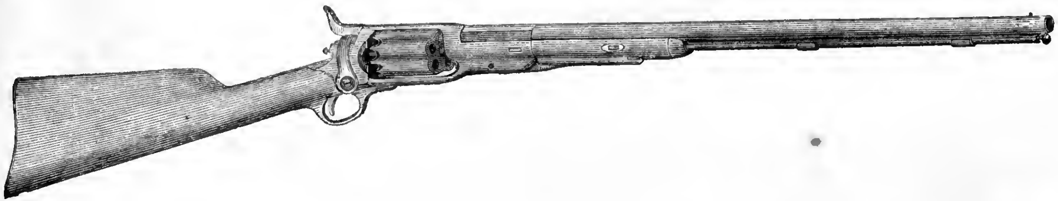
COLT'S

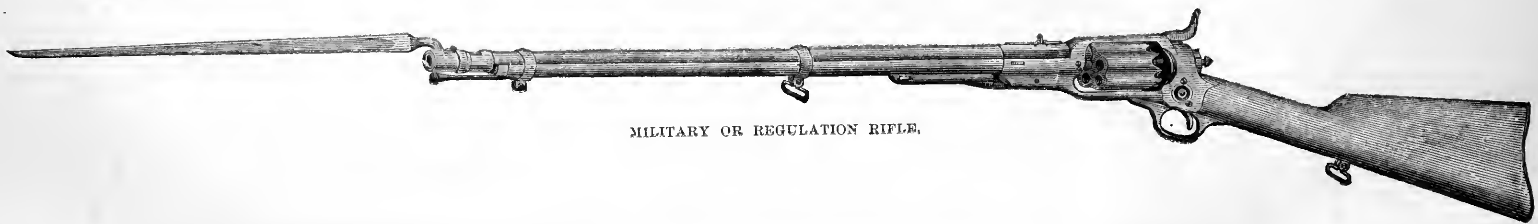
SPORTING RIFLE.



MILITARY CARBINE.

REVOLVING SHOT GUN.





MILITARY OR REGULATION RIFLE.

said that it is effective at a distance of over a mile.

The most important improvement in small arms has, however, been in repeating weapons, of which the revolvers of Mr. Samuel Colt are the type. Mr. Colt was a seaman in his youth, and while on a voyage to Calcutta devised the revolver. He made the model in wood, in 1829, while at sea. Improving upon this, he took out his first patent for fire-arms in 1835. This was for the rotating chambered breech. This of itself was no new invention, since many of the old arms preserved in the tower of London have the same style of manufacture. It is obvious, however, that what is possible in this respect with percussion caps, was not so with the old flint-lock. Mr. Colt had the advantage of the cap, and his invention caused the chambers to revolve by the act of cocking. In 1851, he read an essay upon the subject before the Institution of Engineers in London. Patents were issued in France, England, and the United States; and in 1835 an armory was established at Paterson, N. J., but afterward abandoned. The first important use made of this new arm was in 1837, by the United States troops under Lieut. Col. (now Gen.) Harney. The Indians were acquainted with a "one-fire" piece, but when they saw the troopers fire six times without loading, they thought it time to give in. There was not much demand for the arm until the Mexican war of 1846–47, when a supply was required for Taylor's army. The government ordered 1,000, and there was not a model to be found. This order was filled at Whitneyville, near New Haven. Other orders followed, and the works were transferred to Hartford. Mr. Colt manufactured on his own account. The California fever set in, and was followed by the Australian excitement. The demand for arms thus occasioned, induced Colonel Colt to erect an armory unequalled in the world. It occupies what was a flooded meadow of two hundred and fifty acres. This is diked in for two miles, and the most extensive buildings have been erected, at a cost of $1,000,000, to supply 1,000 fire-arms per day. In 1858, 60,000 were turned out. All the accessories of these arms—balls, cartridges, bullet-moulds, powder-flasks, etc.—are manufactured at this place. There are also extensive works for the manufacture of the machinery by which fire-arms are made. It is to be remarked that at these works the machinery for the British government armory at Enfield has been made; and also all those for the Russian government at Tula. The arms of Colt attracted great attention at the World's Fair of London. "In whatever aspect the different observers viewed the American repeaters," says an account of the impression they made at the Crystal Palace, "all agreed that perfection had been reached in the art of destruction. None were more astonished than the English, to find themselves so far surpassed in an art which they had studied and practiced for centuries, by a nation whose existence was within the memory of man, and whose greatest triumphs had been in the paths of peaceful industry. The Duke of Wellington was found often in the American department, pointing out the great advantage of these repeaters to other officers and his friends; and the different scientific as well as popular journals of the country united in one common tribute of praise to the ingenuity and genius of Colonel Colt. The Institute of Civil Engineers, one of the most highly scientific and practical boards of its kind in the world, invited Colonel Colt to read a paper before its members upon the subject of these arms, and two of its meetings were occupied in hearing him, and in discussing the merits of his invention." He was the first American inventor who was ever thus complimented by this celebrated institute, and he received at its hands, for his highly able and interesting paper, the award of a gold medal and a life-membership. In addition to his presence before the institute, Colonel Colt, in high compliment to his experience and skill, appeared also, upon special invitation, before a select committee on small arms of the British Parliament, and there gave testimony which was gladly received, and deemed of superior practical value. His own statements were amply corroborated at the time, before the same committee, by British officers, and others, who had visited his armory in America; and especially by J. Nasmyth, the inventor of the celebrated steam hammer, who, in reply to the inquiry, what effect his visit to Colt's manufactory had upon his mind, answered: "It produced a very impressive effect, such as I shall never forget. The first impression was to humble me very considerably. I was in a manner introduced to such a skilful extension of what I knew to be correct principles, but extended in so masterly and wholesome a manner, as made me feel that we were very far behind in carrying out what we knew to be good principles. What struck me at Colonel Colt's was, that the acquaintance with correct principles had been carried out in a bold, ingenious way, and they had been pushed to their full extent; and the result was the attainment of perfection and economy, such as I had never met with before." All tests and examinations to which the repeating arms were subjected in England, were highly in their favor. Emphatically they spoke for themselves. The enormous power—nay, the invincibility of British troops armed with them, was demonstrated. "The revolver manufactured by Colonel Colt," said the *Dover Telegraph*, a public journal, expressing the best and almost universal opinion of England upon the arm, "is a weapon that cannot be improved upon. It will, we unhesitatingly predict, prove a panacea for the ills we have so unhappily encountered in the southern hemisphere. The Caffre hordes will bitterly rue the day on which the first terrific discharge is poured upon their sable masses." And so a panacea the revolver did prove, both with the Caffre hordes, and with the Muscovite also, upon the bloody plains of the Crimea. Over 40,000 of these pistols are now in use in the British navy; and Garibaldi has been ably sustained by a corps commanded by Colonel Peard, and armed with Colt's revolving rifles.

The most important progress in the manufacture of these arms, is that each separate part of a pistol or carbine is made after one pattern by machinery, and with such entire accuracy, that a number of the weapons may be taken to pieces, and any part of one will fit any of the others. Each separate part is made perfect of itself, and separate boxes contain these parts. The weapons are put together rapidly when wanted. There has been a gradual improvement in them, from suggestions derived from their use in Mexico, the Crimea, and Italy. It is now a world-renowned weapon.

The great success of Colt has, of course, brought forth imitations, and repeating arms of many descriptions have been patented. Very many are infringements on Colt. There are Allen's, Derringer's, the Volcano, and other pistols, and Pettinger's patent, which is a revolving chamber, but also a patent lock of some reputation.

The invention of breech-loading weapons has also been very successful. The type of this class is Sharp's rifle, which was invented about the year 1852, by Mr. C. Sharp, of Philadelphia. The cartridge in this weapon is put in at the breech, and the "twist" removed by the act of closing the breech. The piece is also self-priming. The caps, instead of being single, in the shape of small thimbles, as usual, are made flat, and arranged together like the coil of a watch-spring; at each cock of the piece this uncoils and thrusts a cap, or one section of the coil, over the nipple. The danger of this is that they all explode at once if not well made. After the most careful examination of the construction of this arm by competent men, it was found, in comparison with others, to stand the tests of a first-class weapon, being safe and certain in firing, easily and rapidly loaded, simple in its construction, and constantly kept clean by its own operation. For sporting purposes, this rifle soon became a favorite weapon. The ordnance department at Washington expressed their admiration of the improvement; and subsequently the British government ordered 6,000 of these rifles, for the use of their army in India. More recently, Mr. Sharp applied the principle which distinguishes his rifles to the construction of a new pistol or carbine, especially designed for the use of mounted dragoons. The advantages claimed by the patentee for the new pistol are numerous; among others, that it is more compact, lighter, has a more extensive range, and fires with greater accuracy than any pistol now in use. It is single-barrelled, but owing to the ease with which it can be loaded, it is capable of being fired twice as often as any revolver in a given period of time. The pistol weighs about two and a half pounds; the barrels are six and eight inches long, and throw a half-ounce ball effectively one-fourth of a mile. It primes itself for twenty rounds. It was recently tested, in competition with various other fire-arms, at West Point, by a board of officers appointed by the United States ordnance bureau, and struck a target six feet square, at a distance of 600 yards, twenty out of thirty shots. The same pistol was fired seventy times in seven minutes, priming it three times, every ball striking a target three feet square, at a distance of forty-five feet, with a force sufficient to penetrate eight inches of pine board. Certificates from officers in the army testify to the high estimation in which it is held by the troops that have tried it. The firm of C. Sharp & Co. erected (for the manufacture of his fire-arms) a very extensive establishment at the west end of the wire bridge, near Fairmount. The building is of brick, 140 feet long by forty feet broad, and is surmounted by a cupola, from which an admirable view of the city and surrounding country can be obtained. The machinery is of the most beautiful and accurate description: the entire cost for the buildings and machinery being about $130,000. The basement is used for the forging of the iron material of the pistol. In the rear of the first story is placed a high-pressure stationary engine of seventy-five horse power, which forms the motive power of the establishment. The second story is used for the boring of rifle barrels, which are drilled from solid cylinders of cast steel. The third story is the tool manufactory, where the cutting, milling, and finishing apparatus is constructed. The fourth story is the finishing shop, where the rude materials are adjusted, and from which the article issues complete. The manufacture of the rifles is carried on in Connecticut.

Among new inventions of breech-loading pistols is that of Stafford, of New Haven. The conical ball, as in the case of all breech-loading arms, is fixed ready for use in a copper cartridge, which is dropped from the left hand into the barrel when the pistol is held by the right hand. The barrel being attached to the stock by a hinge, is opened to receive the ball. Then, on throwing the barrel into line with the breech, by an upward jerk of the right hand, it is ready for use. There is a spring catch in front of the hammer of the lock which catches the barrel and holds it in position until the pistol is discharged. When the thumb is brought down on the catch, the barrel is disengaged, and, by a jerk, is thrown into position for reloading—the whole operation of loading and firing being accomplished in a small fraction of the time required to describe it. This must be so, for an expert can fire sixteen shots a minute with this pistol. The arrangement of sights is also complete, so that any object can be exactly covered by a marksman with precision, and the penetration and force with which the ball is projected can hardly be realized by those who have not experimented with it.

In the present year (1860) a patent issued for a breech-loading cannon, which has also been patented in France and England. By this a ball cartridge is dropped into the gun by an opening in the breech, a pin moves forward, pushing the cartridge, closing the hole by which it entered, and discharging the piece by percussion powder.

The rifle factory of Mr. Eli Whitney, situated at the foot of East Rock, on the Hartford and New Haven turnpike, was founded by the father of the present proprietor, in the year 1798, and was long used by him in the manufacture of arms for the United States government. This gentleman, distinguished for his talents as a mechanic, for his sound judgment, and for his persevering industry, applied to this branch of business the same skill and ingenuity, the first fruits of which had been already displayed in the invention of that instrument so important to the agricultural interests of the south—the cotton gin. The result was the production of an article superior to that obtained from England, not only in itself, but also in the manner in which it was made. The method of manufacturing muskets then devised by Mr. Whitney, and also many of the different kinds of tools invented and used by him, have been since adopted in the national armories. The establishment has, we believe, been exclusively devoted to this business from the time of its foundation until a few years since, when an alteration was effected, and the manufacture of rifles substituted. The metal is wrought into the most eccentric shapes, without any further intervention of human hands than is requisite for superintending the machine. Owing to this skilful arrangement of machinery, only thirty-five men are required to carry on the works, turning out nearly 3,000 rifles a year, worth about $13 apiece. In the manufacture of these about 50,000 pounds of iron, 6,000 pounds of copper, and from 4,000 to 5,000 pounds of steel are annually consumed. The steel is worked up into ramrods, springs, and portions of the lock. The iron costs about $140 per ton, and is obtained from Salisbury, Connecticut—that procured there being found of a superior quality to either the English or Pennsylvania iron. The stocks are made of black walnut, which is brought from Pennsylvania. The rifles, when finished, weigh ten and a half pounds each. A striking advantage gained by the extended use of machinery in making the different parts of the rifle is the perfect uniformity of the work. So accurately and in so many different ways is every part, even the most minute, gauged, that in putting together the whole, no delay is occasioned from trifling inaccuracies in fitting. Each screw, spring, sight, top-board, or any other piece whatever, is so nicely wrought that it may be applied to and will fit any one of the 3,000 rifles made in the course of the year as exactly as it does the one of which it finally forms a part. The rifles are made on contract for the government, and are not offered for sale.

The manufacture of guns is extensively carried on in England, and the value ranges from \$1.50 to \$175 each. A vast quantity of the cheap arms has always been manufactured for the American trade, particularly for the Indians. The common guns are made of flat strips of iron, called a kelp, three feet long, four inches wide. This is rolled into a cylinder by hand, and the edges welded. Sometimes the strip is thick, and one foot long, being drawn out as it is welded. The quality of the gun depends upon the toughness and elasticity of the iron. A superior gun was made of the metal used for horse-shoe nails, and the old nails or stubs were reserved for this purpose, and formed a large item of import into England from the continent. Latterly they have been supplanted by iron made for the purpose. Steel bars in combination with iron ones, called laminated steel, are now thought to be the best. There is much fraud in this manufacture, and thousands of guns of common Damascus iron are imported into the United States as laminated steel.

The manufacture of guns is carried to great perfection at the United States armories at Springfield, Massachusetts, and Harper's Ferry, Virginia. The guns are there made of flat bars of iron 14 inches long, 5 3-8 inches wide, and 9-16 inch thick. The edges are bevelled, so that when turned over into a cylinder they will make a perfect joint. The bars are first put into a reverberatory furnace, and when at a white heat are passed through curving rolls, of which there are five, to bend the bar gradually in order that it may not split. The curving of 450 is a day's work. Before it is curved it is called a plate; after, a cylinder; when welded it is a tube, and a barrel when it receives its shape in the taper groove. The welding being completed, the foreman takes the barrel to the straightening machine. This revolves sixty times in a minute. The machines will weld seventy-five barrels per day. At every stop the tests of gauge and inspection are rigidly enforced. The barrels are proved twice, with 360 and 240 grains of powder, and a ball double the weight of the service ball.

The stocks are of black walnut, and are delivered by contract in the rough. They are turned into perfect finish in half an hour, passing through sixteen machines of the principle of Blanchard's lathes. The "furniture" or metallic mountings for receiving the barrel and stocks, are most of them stamped out of plates.

The locks are highly ingenious, and brought to great perfection. They are too complicated for description. In the year 1859 the government produced 20,000 muskets in both armories. The United States rifle musket is composed of eighty-four different pieces, twenty-six of which are of cast steel, two of wood, and the remainder iron. There are 524 distinct operations performed on each musket and appendages. Each operation has a fixed price.

The improvements in small arms have been more successful than those in cannon, although the subject has for a long time occupied the serious attention of governments and scientific men. The military maxim, that "he who would live long must enlist in the artillery," seems likely to lose its point. That arm was always effective out of musket range, but now, as we have seen, its fire falls short a long way inside of rifle practice. In recent years, there have been attempts to form guns of wrought iron, commonly of hoops encasing bars of the same metal. This construction was adopted for the first cannon, and was returned to in the formation of the Stockton gun, which weighed 7 tons 17½ cwt., the explosion of which killed some members of the cabinet in 1845. It was a gun of the same nature, the explosion of which killed James II. of Scotland, in 1460. The efforts that have been made in this direction abroad have produced many new guns. Among these the Lancaster, which was to have had such effect in the Crimea. The gun has a twist, and the oblong ball moves endwise through this twist, giving the gun an immense range, but it was very uncertain of aim, and each discharge cost one hundred dollars. Many of these burst with great damage. This was supposed to be owing to the wedging of the shot in the twist. The new rifled guns of Armstrong, English, and those of the French invention, have not yet been sufficiently proved, although it was said that the latter were of great influence in deciding the Italian campaign. The greatest decided improvement in guns, however, is an American one, by Captain Dahlgren, of the United States navy. That gentleman entered the navy in 1826, as a midshipman, and was made commander in 1855. Since 1847 he has been employed in ordnance duty, conducting experiments that have had great results. Among these is the adoption for boats of bronze howitzers, 12 lbs. and 24 lbs. calibre, to throw shells, shrapnell, and canister; they are also available on land. The Dahlgren gun is considered the most perfect form yet constructed, and the new steam frigates are armed with them. The length of a 10-inch Dahlgren is 107 inches, and the range 1,776 yards. The improvement in the United States in the manufacture of guns is still making progress.

The best metal yet used for guns is cast iron. That metal was, however, formerly not so well made as at present. It was not so uniform in character, and its strength was estimated at 20,000 lbs. the square inch, while bronze burst at 33,000 lbs., and was thought to be more relied upon for uniformity. This opinion has been modified by experiments, made by Major Wade, of the United States army, at Chicopee, in Massachusetts, in 1850. It there appeared that samples from different parts of the same gun showed a difference of from 23,108 to 54,531, showing a tendency of the metal to cool in masses into separate alloys. Bronze was, however, less hard than iron, and its great cost caused it to be confined to field pieces, while for every thing above iron is used.

The casting of guns was originally hollow, but from unequal contraction in cooling, caused by different temperature within and without, the plan was abandoned, and the gun being cast solid was bored out cold. In the United States, experiments have been successfully made to improve the qualities of iron for gun purposes. The object is to produce a metal of a perfectly uniform texture, hardened with the piece to prevent the battering action of the ball. The principle of strengthening iron by remelting was developed in experiments carried on by Major Wade, of the United States army. Since 1841 an officer is required to be present at the foundries while cannon are making, to examine and test the metal before it is used, as well as the first gun made, before another is cast from it. This inspection has been highly useful. The transverse strength of some iron was found to be doubled by four meltings and castings. From experiments made at South Boston in 1844, it was found that the cohesive power of iron is augmented by exposing the melted iron to intense heat. This is increased by the time of exposure, up to a limit beyond which the strength retrogrades. All the experiments resulted in increasing the average strength of iron from 23,638 lbs. to 37,774 lbs. the square inch. The strongest piece of iron ever cast was a sample of Greenwood (Orange county, N. Y.) ore. It was brought to the degree of density which is combined with the greatest strength. In the sample the density was 7.304, and the tenacity 45,970 lbs. per square inch. This material will be probably the favorite for gun manufacture.

The process of casting bronze guns is complicated. The pattern of the piece is prepared by taking a tapering rod much longer than the gun, and enclosing it entirely in the coils of a soft rope. When this has approached the form of the intended gun body (not including the breech), it is laid over with plaster-of-Paris. It is then caused to revolve against a profile board, and by so doing receives its shape. The models of the trunnions, or arms on which the gun rests on its carriage, are then attached to it, and the whole dried. It is then washed with ashes to prevent adhesion, when it is covered with putty loam dried hard. This is the first layer of the mould, and other layers are added, until the whole is 2¾ inches thick. This mould is then encased in iron bands, over which a further thickness of 5 inches of mould is laid. Over this come more hoops and mould. The rod, with its covering of rope and plaster, is then taken out, leaving the putty mould entire. The breech mould is made separate in the same manner, and that for the "head" also. When thoroughly dried, the three sections are set up in the pit with several others, and the spaces around are rammed in with earth firmly. In order that the metal when running in may settle as equally as possible, it is introduced at the bottom. It thus rises in the gun, and into the head three feet above the gun. The object of this head is to allow the metal most likely to be imperfect to rise to the top. Hence, when the gun is cool, this head is cut off. The gun is then solid, and, being placed upon a frame, is bored out. In this case the borer does not revolve, but the gun itself. A steel cutter, fixed to the end of a bar, penetrates into the gun as it is made to revolve against it, being pressed up to it as the work progresses. The boring being finished, the gun is turned, and the touch-hole drilled with a bit and stock.

In casting iron guns the process varies slightly. The mould being prepared, is enclosed in a huge case of cast iron, called a gun box, made in sections. The lower section contains the mould of the breech, and is entire. Between the mould and the sides of the case, sand tempered with clay is rammed. The flat surface on which the next section is to rest, is covered with fine charcoal and clay water to prevent adhesion. The second section is of two pieces divided lengthwise, and has affixed to it the trunnions. The mould is kept in a perfectly vertical position by being adjusted by a plumb line. Sometimes the space round the box is left empty, and covered over to retain the hot air and prevent cooling too rapidly. When the mould is ready, the iron, which has been prepared by many remeltings, flows from several furnaces, through channels in the sand, into a reservoir, from which runners or channels lead over the tops of the moulds, which are slowly and steadily filled, without the introduction of air to disturb the quiet settling of the metal.

The guns being cast, the difficulty is in cooling them to preserve the uniformity, and fires are sometimes kept burning round the case for several days after casting. At this point, an important improvement was introduced by Lieutenant Rodman. The original mode of casting guns hollow was abandoned for boring in 1729. On the plan of Rodman, guns are now cast hollow. A water-tight tube of cast iron is placed in the centre of the mould. In the centre of this tube is a smaller one, and through this a current of cold water enters, and, rising in the larger tube, flows off. Thus the interior is cooled, while the exterior is prevented, by heated air, from cooling too fast. The metal is thus protected from unequal contraction. In proof of this experiment, guns were cast in pairs. These were 8-inch bores, of the same iron in every respect, one solid and one hollow. The solid gun burst at the seventy-third discharge. The hollow one stood fifteen hundred, and did not fail. A pair of 10-inch guns, treated in the same manner, resulted in the bursting of the solid gun at the twentieth fire, and the hollow one at the two hundred and forty-ninth.

Another curious fact was substantiated, viz., that the strength of the gun increased by time. 8-inch solid cast guns, proved in 30 days, stood 72 charges; one proved in 34 days stood 84; one in 100 days stood 731 charges; one that lay six years stood 2,582 charges. The explanation of Major Wade was, that the particles of iron strained in cooling by unequal contraction, readjust themselves in time, and reach their greatest tenacity.

When the iron gun, whether cast solid or hollow, has been dressed and drilled, it is ready to be proved, which is done in this country by testing the strength of a cylinder of the iron an inch in diameter and two inches long, cut out of the cannon, formerly from one of the trunnions, but now from the barrel near the muzzle. The specific gravity and other properties of the sample are carefully noted, and these, together with the trials to which it is subjected, and the hardness of the metal determined by a very exact method, give correct indications of the strength of the gun, without the necessity of submitting it to extreme proof by firing with constantly increasing charges until the piece is destroyed. Indeed, to such perfection have these proofs been brought, that guns have been selected as of inferior quality from among a large lot, which, on reference to the books of the foundry, were found to have been the only ones of the lot made of hot blast iron. According to the indications furnished by the tests, several guns are usually taken from each large lot of them, to be submitted to extreme proof—the selection being generally of those that appear to be the poorest, best, and intermediate qualities. These are fired commonly with charges of powder equal to one-fourth the weight of the ball, with one shot and one junk wad over it. The firing is continued, unless the piece previously bursts, to 500 rounds. Then one ball more is added with every discharge, till the bore is filled. The powder is afterward doubled in quantity, and the bore filled with shot at each discharge. When it bursts, pieces are selected for further examination from the breech, near the trunnions and the chase. Guns are also tested by hydrostatic pressure, water being forced into the bore with increasing pressure, till it sometimes bursts the piece, or brings to light its hidden defects by opening the small fissures that were concealed in the metal. It is not uncommon for it to appear upon the exterior of pieces, of which the thickness of the metal is four inches, exuding through as a thin froth, which collects upon the outside, and forms drops and little streams. By this method, the exact pressure applied is known, and may be gradually increased to any desired degree. Sample bars are also cast together with the cannon, which furnish some indication of the strength of the metal. The different rates of cooling of the large and small mass, however, render their qualities somewhat dissimilar.

The next hostile operations upon the ocean will have to encounter countless changes that have been made since the last war. Steam will develop its yet untried powers in warfare. The new armor to make ships ball-proof, the range of small arms, and, not the least of the new agents, the effect of the shell guns of Dahlgren, are to be tested. The difficulty of getting to close quarters is by them much increased. The picking off of officers and men by the use of the new rifles must have the same tendency. In naval gunnery, as on land, the small arms formerly came into play only within the range of the batteries. At present, the small arms are first effective, and the Dahlgren only recovers a portion of the ground lost by cannon as a consequence of the increased range of rifles.

In 1848 also commenced in our navy, under the direction of Dahlgren, the adaptation of graduated scales to naval guns. These bear the ranges in yards, and elevations in degrees and fractions. Tables containing the angles of elevation answering to different distances, are furnished in the "Ordnance Manual." The scales are made of brass, and fitted to the breech of the gun. These insure accuracy of aim.

An interesting series of experiments has been conducted, under government orders, by Major Mordecai at Washington, in relation to the initial velocity of shot. By initial velocity is understood the velocity of the shot in the gun after discharge. This is considered the most important point, and infinite pains and expense have been incurred in deciding it. The experiments made by Major Mordecai were in this view. The machines used for this purpose are a block filled with sand suspended on iron straps, at fifty-five feet distance from the gun, which is also suspended. At the discharge the gun recoils, and its rate of recoil is measured, while the shot buries itself in the sand contained in the block, imparting a motion, which is also measured. The weight of the block is 9,358 lbs., and of the gun pendulum 10,500 lbs. The result of a great variety of experiments was, that the velocity measured by the block was nearly the same as that measured by the gun.

The deductions from the experiments were some very valuable conclusions concerning the charges for cannon and small arms, and the form of the cartridge for heavy guns. In relation to wad, it was decided that the use of hay or punk is injurious to correct aim. When a wad is required to hold the ball, it should be light. In small arms, on the other hand, wad is required to develop the force of the charge; unless, as in the case of the rifle, the ball has no windage.

Another description of gun has been made up and experimented upon at Old Point Comfort. This tremendous piece of ordnance, by far the largest ever cast in this or any other country, is designed for use in our coast defences, as an offset to the late important improvement in the construction of vessels-of-war. It is intended to cripple, certainly and hopelessly, at a single shot, any hostile ship or steamer, no matter how large or strongly built, that may venture within a mile of its enormous muzzle.

The Floyd gun was cast but a short time since, at the Fort Pitt foundry, near Pittsburg, Pennsylvania, under the supervision of Captain Rodman, of the ordnance department. It weighs, independently of the carriage, 49,099 lbs., and its cost is something over $10,000. The bore is sixteen inches in diameter, and fifteen feet in depth. The gun is worked by six men, and the time consumed by loading and firing is just one minute and a half. It will throw either shot or shell; and these are spherical in form and of appalling magnitude—the solid shot weighing 450 lbs. The 15-inch shell weighs about 384 lbs., and carries beside 15 lbs. of powder. The charge of powder used in firing this monster cannon was at first only 20 lbs., but this has been gradually increased to ascertain the maximum of powder; and in the last discharge no less than 45 lbs. were used.

The piece is not intended to be fired at a longer range than about two thousand yards, but at this distance its execution is terrific, completely shattering the most massive targets, whether constructed of stone, timber, earth, or iron.

Not the least singular feature of the big gun is the powder used in discharging it. The grains are hard, smooth lumps of irregular shape, varying in size from half an inch to an inch in diameter.

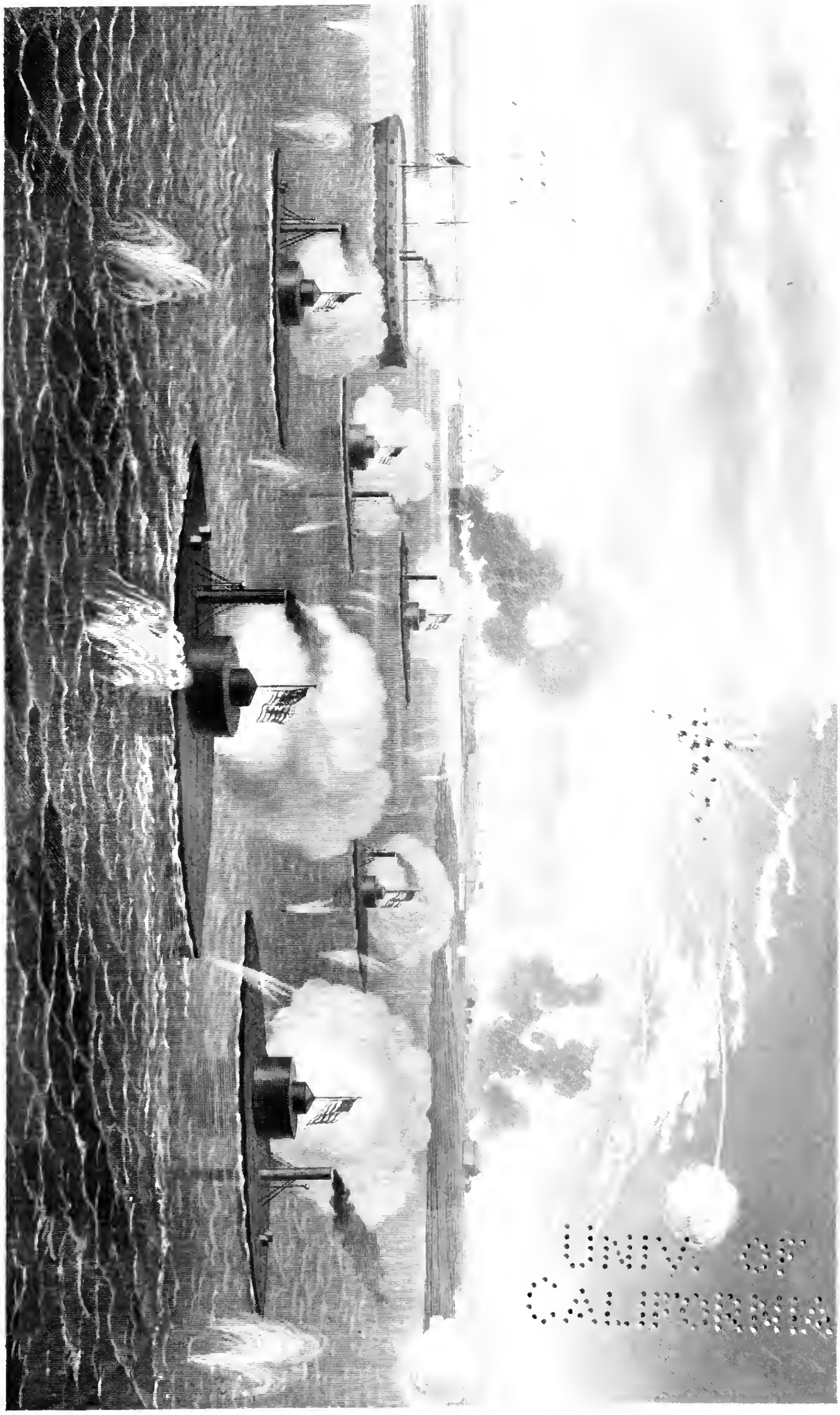
This powder is made on the principle of what is known amongst boys as a "spit devil," that is, it is so mixed as not to explode all at once, like the fine-grain powder, the *inertia* of the bolt being so great that an instantaneous explosion of the whole charge would burst the gun; but the ignition of the charge being gradual at first, the ball is started without any great strain on the piece, and (it is contended by the friends of great guns) is always successfully launched on its mission of destruction.

There was convened in August, at the fort, a board of engineers, commissioned by the government, to examine into the expediency of introducing the Floyd gun as a regular arm of the United States service.

The large guns, as now used, are mostly designed to overcome the resistance offered by the iron covering of the new war steamers, the use of which has become so general in the civil war. The necessity of some material of greater resistance to projectile force became early apparent, when gunnery became so much improved that ordinary wooden ships were no longer capable of withstanding an assault. The question of iron plates for ships was discovered as early as 1811, by Stevens, of New Jersey. In 1840, experiments were made in England upon the resistance of iron in view of arming vessels. In 1852, the United States ordered experiments upon iron batteries, but without favorable results at that time. In 1854, the French Emperor ordered a series of experiments to be made in relation to iron plates; and in 1860 the iron-clad ship La Gloire was built. In 1861, the Warrior was constructed in England. Neither of these vessels appear to be a success, however; both are overloaded, and both roll heavily in a heavy sea.

In 1841, Mr. Theodore R. Timby, of York, constructed a model of a revolving iron tower for harbor defense. In 1854, Captain Ericsson made a model of an iron tower on an armored vessel. The application of the tower to vessels he claimed was first made by him. On this plan was built the Monitor, which encountered the Confederate iron-clad Merrimac, in Hampton Roads. The latter was a wooden ship cut down, and armed with railroad iron, placed at angles, and proved to be very effective and invulnerable to shot. The Monitor was so successful that the government ordered 10 more at once. These were 844 tons, each having one turret and two guns of 11 and 15 inch calibre. Subsequently, seven Monitors, of 1,034 tons each, were ordered, having one turret and two 15-inch guns each. The third class Monitors carry two turrets and four guns each. There were built several other descriptions: of these the Ironsides, tonnage 2,486, weight of armor 750 tons; she carries two 200lb. Parrott rifles, four 24lb, and sixteen 11 inch guns. The Dunderberg is of 7,000 tons measurement, armor weight 1,200 tons. On the Western rivers were many others of various construction; of these, the Essex has over all a continuous layer of India-rubber, one inch thick, and the iron plating is bolted over that. The rubber is supposed to give some elasticity to the plates when struck. The hull is divided into 40 compartments, and there are false sides, designed to break the blow of an assaulting ram. Altogether the number of iron-clad steamers at the close of 1862 was 53, carrying 266 guns. There were also 13 gunboats and rams, carrying 67 guns. The events of the war demonstrating the utility and behavior of gunboats under fire, has developed alike their good and bad qualities to some extent, but by no means definitely.

In the attack on Charleston, the Ironsides, with eight Monitors, carrying 32 guns, were engaged. During three-quarters of an hour she sustained the converging fire of four forts, carrying 300 guns of 8 and 11 inch calibre and 6 inch rifled shot. The number of shot fired was 3,500, distance 1,300 yards, at close quarters, 300 and 600 yards. The Passaic received 58 shots, and was disabled in the turret, which was rendered incapable of turning. The Keokuk was sunk and the enemy captured her guns. The whole number wounded, in all, was 13, of which four were wounded on the Nahant, by the shifting of bolt-heads not properly guarded inside. The experiment was very satisfactory as to resistance.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CUTLERY.

UNITED STATES INDUSTRY—AXES.

The manufacture of cutlery in the United States is of recent origin comparatively. But a few years since, the whole supply came through the hands of the importer from Europe; but the production of edge-tools and cutlery was no sooner started, than it took a rapid growth; and a foreigner, remarking upon branches of American industry, says: "The manufacturers of cutlery have far surpassed those of the old world in the production of tools, and that not merely in the excellence of the metal used, but especially in the practical utility of the patterns, and in the remarkable degree of finish in their work." This is a just remark. The "high finish" of American work is applied only, however, where it has utility; not where it is a useless expense. This may be illustrated in watches and clocks. The English have highly polished works, that add much to the expense, but nothing to the service. In the American article this expense is saved. A peculiarity of American work is the readiness with which improvements are perceived by the intelligent worker, and immediately adopted and applied. This intelligence comes, in some degree, from the entire freedom of industry, and the absence of all trade "guilds," unions, or restrictions. The American who travels in Europe is struck with the, to him, ludicrous mystery with which every species of handicraft is surrounded. It would seem as if the proprietor of every petty workshop or factory was exclusively possessed of the philosopher's stone, which would be robbed from him by the prying gaze of every transient visitor. The apprentices are only taught the routine of centuries, and only so much as is necessary to fulfil the part of the labor required of them. The manufacture itself, whatever it may be, is divided into branches, each of which is in charge of persons who preserve their supposed secret from the other branches. Under these circumstances, the apprentice succeeds with difficulty in becoming a master of his trade. When out of his time, he must travel for three years; and when he returns to his native town, he must have money and interest to be made a citizen, and then admitted as a member of the guild, or trades' union, before he can pursue, except as a journeyman, the trade he has learned. How different is all this in the United States! The boy enters a factory, or a workshop, and is taught his especial work, and has within his reach every branch of information, scientific and practical, connected with the whole of it. His fellow-workmen are experienced in all the branches, and with the best modes in use in all countries. His employer is wedded to no system or rule, but is ever on the alert for improvement; always ready to suggest and hear suggestions, and to adopt feasible ones. It is no wonder that, in such an atmosphere, the arts should flourish, and that an observant foreigner should exclaim, as above, that hardly twenty years of experience in the new world should have surpassed the centuries of progress in the old world. This branch of industry thrives mostly in individual workshops; it has not come much within the sphere of corporate influences. There is a general and very perceptible adoption of American patterns, not only in Europe, but in England, as being more practical; and it is stated, that in American factories already, there is more English steel used than in England itself. The American worker does not believe in using poor tools, when good ones are to be had.

Steel is the material used, by reason of its hardness, for the cutting edges of tools and cutlery. The backs are made of iron, as a cheaper material. So also are the handles, or "tangs," to which the steel is welded. The steel is blistered, as, or after, it is drawn down, by tilt-hammers, into shear-steel. This is used for table-knives, scythes, etc. When a fine finish is required, or great hardness, the blistered steel is melted into cast steel, and the ingots are forged into bars. Simple articles, such as chisels, are made by hammering a bit of cast steel into the required shape. This being intended only for the edge, is made very thin, and upon it is welded a flat slip of iron, which has been forged into the shape of the chisel, with a shoulder formed by driving it into a hole in the anvil. One side of the chisel is, therefore, iron, intended to be ground away, and the other steel. Scissors are made of various materials. Common ones are shear steel, with the blades hardened. Tailors' shears have the blades only steel; the remainder is iron. Formerly, only the edge was steel. Some scissors are made of good cast iron, called run, or virgin steel. Of these, many are sold for 7 cents a dozen. There are some, on the other hand, made with bows and shanks of gold, and sell for $50 a pair. When made wholly of steel, the blade is hammered out at the end of a small bar. It is then cut off, with enough to form the shank and bow. A hole is then punched; the instruments shaped, united by a screw, ground, filed, and burnished. The blades are slightly bowed, in such a manner that they touch each other only at the point of cutting, and this point moves as the blades close in the act of cutting, from the pivot to the point. This operation is seen by holding a pair of scissors, edgeways, to the light. This action gives smoothness to the cut.

The manufacture of table cutlery is of recent introduction into the United States; and it has made progress, by reason of the American invention of a machine to form the blades, which invention has been adopted in Europe. In the old process, the blade of a table or other large knife is hammered out on an anvil at the end of a bar of steel, and cut off. It is then welded on to the bar of wrought iron, about half an inch square, and enough of this is cut off to form the bolster, or shoulder, and the tang. The blade is then heated and hammered, or, as it is called, smithed, which serves to condense the metal, and enable it to acquire a higher finish. The mark of the maker is then stamped upon it, and it is hardened by heating to redness, and plunging it into cold water. It is tempered to a blue color, and is then ready for grinding. The small blades of pen-knives are hammered, entire, out of the best cast steel. A temporary tang is drawn out, to secure the blade while it is ground. A number of blades are heated together for tempering, by being placed over the fire, upon a flat plate, their backs downward. When at the proper degree of redness, so as to take a brown or purple color, they are dipped in water up to the shoulder. For razors, the best cast steel is selected; and when the blade is shaped upon the anvil, from a bar as thick as the back of the razor, and half an inch wide, it is well smithed, to condense the metal. Only the best metal will bear the working down of one part of the blade to the requisite thinness, while the back is left thick. The shape is further improved by grinding on a dry, coarse stone. The tempering is performed after the blade is drilled for the pin of the joint, and stamped. It is then ground and polished.

The grinding and polishing of cutlery is conducted mostly by wheels constructed for the purpose. There is a trough, with a stone for grinding, and a polisher, driven by a pulley. The stones vary in diameter from 4 inches to 2 feet, according to the articles to be ground. The convex surface of the small wheels gives the concavity on the blade of the razor, and the other wheels suit the various sizes and shapes of the articles polished. Some are used dry, and others are kept wet, in order that the heat engendered by dry grinding may not injure the temper of the articles ground. The dry grinding is more expeditious; but, unless the troughs are furnished with a ventilating fan and flue for carrying off the fine metallic particles and dust from the stones, the health of the worker suffers. This flue is constructed of tin, in the shape of a sort of cap, that comes over the back of the stone; the other end of the flue is in an adjoining room, and has the air partly exhausted from it by a fan in rapid motion. This creates a strong current, which, when the stone is in operation, carries the dust and filings from it into the flue. When the grinding is completed, lapping succeeds. This is done on a thin wooden wheel, faced with a tire of metal made of five parts lead to one of tin, and cast upon the edge of the wheel. It is then turned true, and indented, so as to hold a dressing of oiled emery of different degrees of fineness. The steel blades receive various degrees of polish, by drawing them from end to end across the revolving lap, which is fed with emery of various sizes.

The handles of cutlery are made of a variety of substances: ivory, horn, mother-of-pearl, tortoise-shell, cocoa-nut, maple-wood, etc. Ivory is mostly used for table-knives. A solid piece is cut out, of the right size, and a hole for the tang bored at one end. This is sometimes carried through, so that the tang may be visible. When it does not go through, the tang is secured by cement. By a late contrivance, a little spring-catch is fastened to the tang, which falls into a notch made in the cavity of the handle, and prevents it from being withdrawn. Balance handles are made by introducing lead into the handle, to counterbalance the weight of the blade. The handles of pen-knives are complicated. The springs must be nicely adjusted, requiring a peculiar temper. The slips for the handles require great care in the fitting. It is stated that a three-bladed knife passes through the finisher's hands one hundred times.

The manufacture of butcher and shoe knives is large in the state of New York. The state census of 1855 gave it at 35,000 per annum; and these have a wide reputation.

The manufacture of forks is said to be one of the most unhealthy of the mechanical arts. It has been estimated that the destruction of life in it is greater than in any other pursuit, by reason of the fine dust evolved in the process of grinding, and which fills the atmosphere of the rooms, and invades the lungs of the operators. This takes place in the finishing. The forks are hammered out of square steel rods, 3-8ths of an inch thick. The tang and shank are roughly shaped at the end of the steel rod, and are then cut off, with about an inch of the square steel besides. This is drawn out flat for the prongs; and the tang and shank are then shaped by the die. The other end, heated to a white heat, is laid in a steel die upon an anvil, when another die, attached to the under face of a heavy block of metal, is allowed to fall upon it from a height of 7 to 8 ft. The prongs are thus shaped, and all, but a thin film of steel, removed from between them. This is cleared out by an instrument called a fly press. A number of forks are collected together, and annealed by heating and allowing them to cool slowly. They are now sufficiently soft to be easily shaped by the file, and by bending. They are then heated to redness, and suddenly cooled, by which the hardness is restored. The process of hardening renders all steel brittle; and it is intended to remove this, by tempering. The higher the heat when the metal is hardened, the softer and stronger will be the steel. A lower degree of heat gives more hardness, and also more brittleness. The temper is indicated in the color, and the temperature which produces that color follows a regular scale. Thus, 430 degrees of heat give a very pale straw color, suitable for the temper of lancets. Higher degrees of heat give darker shades of yellow, suitable for razors, pen-knives, and chisels; until, at 500 degrees, the color is brown-yellow, adapted to axes and plane-irons. Twenty degrees higher, the yellow has a purple tinge, seen in table knives. Thirty degrees more, and the dark color of a watch-spring is obtained. Again twenty degrees, and the dark blue of saws is visible. At 630 degrees, the color has a tinge of green, and the steel is too soft for instruments. This color is supposed to be produced by the action of the oxygen of the air upon the carbon of the steel, and protects the metal from rust in some degree.

One of the most necessary tools for a new and agricultural country is the axe. The remains of all lost races generally disclose, in some rude form, that useful instrument; and the modern nations of Europe present it in an improved metallic form. The Spanish axe, which has no head, is made by hammering out the bar, and turning it into a loop, to make the eye. The manufacture of the axe has, however, like its use, been carried to its highest perfection in the United States. An American axe has a fame coextensive with that of an American backwoodsman, who alone, of all the nations that visit this continent, is fitted to struggle with the mighty forests with which the country was covered. While the American pioneer, axe in hand, boldly buries himself in the forest to clear and subdue it, the European keeps rather to the plains, as more easily managed. The experience in the use of the axe, and the various uses to which it is applied, have combined to produce great varieties, all of which have undergone continual improvements. Formerly, the operator depended upon the rude forges and limited skill of blacksmiths to supply axes. With the improvements that suggested themselves, special factories sprung up, and the largest factory of the kind in the world is in New England. There, 1,200 tons of iron, and 200 tons of cast steel, are by machinery wrought annually into tools. In the most recent process, hammered bar iron is heated to a red heat, cut of the requisite length, and the eye, which is to receive the handle, punched through it. It is then reheated, and pressed between concave dies, until it assumes the proper shape. It is now heated, and grooved upon the edge, to receive the piece of steel which forms the sharp edge. To make the steel adhere to the iron, borax is used. This acts as a soap to clean the metal, in order that it may adhere. At a white heat, it is welded and drawn out to a proper edge, by trip hammers. The next process is hammering off the tool by hand, restoring the shape lost in drawing out; it is then ground, to form a finer edge. It is then ground upon finer stones, and made ready for the temperer. The axe is now hung upon a revolving wheel in a furnace, over a small coal fire, at a peculiar red heat. It is cooled, successively, in salt water and fresh water, and then tempered in another furnace, where the heat is regulated by a thermometer. It is then polished to a high finish, which will show every flaw, and enable it to resist rust. It is then stamped, and the head blackened with a mixture of turpentine and asphaltum.

The manufacture of scythes has reached a high state of perfection in the western states, and the patterns have been imitated to a great extent in Europe.

The manufacture of surgical instruments has become large in the cities, mostly in Philadelphia, where the manufacture has acquired much celebrity. The ingenuity and skill with which an infinite variety of instruments are adapted to the purpose of operations upon the living fibres of the body, are marvellous in their way. The quantities supplied to the west and south are large.

The production of cutlery and edge tools in the Union, according to the census of 1850, was as follows:—

Number of factories	401
Hands	4,275
Capital	$2,321,895
Cost of labor	1,420,844
Cost of material	1,439,462
Value produced	3,813,241

This was for the year 1850. The quantities that are exported from the United States are small, not amounting to above a few thousand dollars. The imports, however, continue to be large. In the year 1857, they reached $2,140,000; of which, $1,953,396 was from England. The quantity imported is far from keeping pace with the number and wealth of the population. The great demand from the latter is supplied by the increasing home production of individual operatives.

FURS AND FUR TRADE.

Among the natural products of the new world, the valuable furs of the various wild animals which peopled its boundless forests, its rivers, lakes, and seas, were soon appreciated by the early discoverers and explorers. For many centuries the choicer varieties of fur had been held in the highest estimation, and the use of such as the ermine and sable was monopolized, by special enactments, by the royal families and nobility of both European and Asiatic countries. A market was therefore ready for the large supplies which were soon furnished to the early settlers by the Indians in exchange for the trinkets, liquors, and numerous articles of trifling value brought from Europe for this trade. The English and French competed with each other to secure the control of the business around Hudson's Bay and in the territories now constituting British America, extending from the Atlantic to the Pacific. Each nation established its own trading posts, or "factories," and protected them by forts, and the possession of these often passed by conquest to the rival party. The incorporation of the Hudson's Bay Company in 1670, by Charles II., gave a decided stimulus to the English interest, by securing to men of great influence and wealth, the control and monopoly of the fur trade throughout the possessions claimed by the British. The enormous profits realized by this company induced the Canadians, in the latter part of the last century, to form another company, which they called the North-west Fur Company, and whose field of operations was nominally limited to the territories ceded to the English by the French in 1763. Early in the present century their factories were extended westward to the rivers that flow into the Pacific, and they employed of Canadian voyageurs and clerks, who were mostly young men from Scotland, about 2,000 persons. They acquired possession of Astoria, at the mouth of the Columbia, in 1813, and vigorously competed with the old company—the two associations carrying on open war throughout the wild territories known only to these fur traders and the Indians they controlled. By act of parliament, the two companies were united in one in 1821, and their operations have been continued under the name of the Hudson's Bay Company until 1859, when their last special license of 1838 expired. The company has exercised a despotic sway throughout the territories it occupied, compelling the labor of the poor French voyageurs and the Indians, and causing them to subsist upon the most meagre fare and pitiful allowance. Sad tales of their sufferings are familiar to those who have visited these northern regions. The company established an express by the way of the great lakes and the western rivers, and by numerous relays, always ready, information was conveyed by canoes and by land travel in an incredibly short time from the head-quarters of the company at Montreal to the most distant posts on the Pacific. Their furs collected on both sides of the continent were transported to London for the great annual sales of March and September. From London many were sent to Leipsic, for the great annual fair at this famous mart.

While these extensive operations were in progress, the inhabitants of the provinces now constituting the United States derived little or no benefit from the trade so long as they remained British colonies. In 1762, an association was established among the merchants of New Orleans, for conducting the fur trade in the regions on the waters of the Missouri and its branches; and this led to the founding of St. Louis in 1763, by Laclede, the leader of the organization. This place was made their head-quarters for the reception of furs collected by their voyageurs in distant excursions by canoes and Mackinaw boats toward the Rocky Mountains, among tribes of Indians who often attacked their parties, but who, controlled by the talent and wise policy peculiar to the French, became at last firm friends of the enterprise, and bound to the interests of the Chouteaus and others by whom it was conducted. From St. Louis the peltry was boated down the river to New Orleans, or up the Illinois to Lake Michigan, and thence to the great trading post of Mackinaw. From this it was forwarded by the lakes and the St. Lawrence to Quebec, to be shipped to England. Over the same routes were returned the groceries, etc., for the supply of the traders, which, so slow were the means of transportation, were the returns in part of the furs collected the fourth preceding year. But though the expenses of the long voyages more than doubled the cost of the supplies after they left Mackinaw, the profits of the business were not rated at less than 300 per cent. For fifteen years preceding 1805, the annual value of the peltry collected at St. Louis is stated to have been $203,750; and the value of the goods annually sent up the Missouri during about the same period was estimated at $61,000. Deer skins constituted the greater portion of the product, and they were, indeed, the chief medium of exchange, the value of articles being rated at so many shaved deer skins. Beaver and otter were the next in importance, and buffalo skins, which are now the chief object of the trade, were then scarcely collected at all.

From the year 1818, the fur trade of the north has been conducted almost wholly by organizations which have sprung from these early operations. It was extended by the associations established at St. Louis to the regions beyond the Rocky Mountains, and there carried on at immense sacrifice of human life, from the dangers naturally incident to the pursuit, and the unappeasable hostility of the savage tribes. In 1847 it was estimated that the annual value of the trade had averaged for forty years from $200,000 to $300,000, and the latter portion of this period much more than the larger sum named. But, like the discovery of gold in California, its greatest importance was the opening of uncultivated territories to the advance of civilization, and the introduction of a permanent population for the establishment of new states.

During the last century the fur trade had attained to no importance in the eastern states. Mr. John Jacob Astor, of New York, engaged in it in 1784, buying in Montreal and shipping to England. But under the treaty of 1794 he was enabled to introduce fur from the British provinces into New York, and he then opened a new trade direct with foreign countries, shipping peltries even to China, and receiving in exchange the rich products of the East Indies. As his operations prospered, he engaged in the early part of the present century in the collection of furs along the northern frontier, a field which had before been in exclusive possession of the North-west and Hudson's Bay Companies; and he labored zealously in the great national enterprise of diverting this important trade from the exclusive control of foreign companies, and causing it to contribute to the commercial interests of the United States. With wonderful energy, and dependent almost solely on his own resources, he carried on these gigantic operations, having in 1808 a capital of no less than $1,000,000 invested in them. In 1810 he established the Pacific Fur Company, for the purpose of forming a settlement on the Pacific coast, and by means of it carrying out the grandest commercial scheme that had ever been undertaken. His ships, leaving New York with supplies for the colony, were to obtain from it and by trading along the coast cargoes of furs to be sold in China, and there loading with teas, silks, etc., would return to New York, making a complete circumnavigation of the globe. Mr. Astor was bound by his articles of agreement to furnish capital to the amount of $400,000 if required, sending each year an expedition around by sea and another across the country to the mouth of the Columbia, and the profits were to be equally divided between his associates and himself. Notwithstanding a succession of disasters, Mr. Astor continued for three years to despatch a ship bound around Cape Horn, to the mouth of the Columbia, having unshaken confidence in the final success of the enterprise. And such, no doubt, would have been the result, had not his principal Canadian partner, who controlled the affairs at Astoria (the settlement on the Pacific), proved treacherous and given up the post to the rival North-west Fur Company for a mere nominal price, on the pretence that it would certainly be seized by the British cruisers during the war. This occurred on the 16th October, 1813.

From that time the operations of Mr. Astor were restricted to the northern territories lying east of the Rocky Mountains. His factories were at Mackinaw, and at the foot and head of Lake Superior, upon whose waters he maintained sailing vessels long before they were visited by the explorers of copper mines. Up to the year 1845 the only business prosecuted upon its distant shores was that of the fur hunter, and they were, in fact, known only to this class and to the wandering Chippewa and Sioux tribes of Indians. The territory of Minnesota, also, and the still more western regions, were frequented only for the same object previous to 1848. From that period, or even earlier, the fur trade has declined in importance, and its profits have been divided among larger numbers of adventurers. The house of Pierre Chouteau, jr., & Co. has been distinguished for many years as the most enterprising of those engaged in the trade; and in 1859 one of their steamboats ascended the Missouri river to the Great Falls, near the Rocky Mountains, about 3,950 miles from the Gulf of Mexico, and returned laden with buffalo robes. Thus the trade still continues to be the pioneer of civilization—opening new roads into wild territories for the advance of permanent settlers.

At present, St. Paul, in Minnesota, is the chief trading post of the fur trade of the United States. Until the year 1844, the furs from the valley of the Red River were sent to Hudson's Bay by Nelson's River, but from that period they have been collected at St. Paul, whence they are transported down the Mississippi, and are brought at last to New York. In 1857, the value of the furs shipped from St. Paul was $182,491; and in 1858, when the price of furs was lower, the shipments amounted to $161,022. The following table exhibits the varieties and value of the exports of 1856:—

Animals.	No. skins.	Value.
Muskrat	64,292	$11,572 56
Mink	8,276	18,621 00
Marten	1,428	3,570 00
Fisher	1,045	4,702 00
Fox, red	876	1,095 00
" cross	20	100 00
" silver	8	400 00
" kilt	2,542	1,271 00
Raccoon	3,400	2,550 00
Wolverine	2,032	3,048 00
Otter	405	1,417 50
Beaver	586 lbs.	881 00
Bear	610	6,700 00
Lynx	50	125 00
Buffalo robes	7,500	41,200 00
Total value		$97,252 56

From this table it is apparent that the character of the important furs has greatly changed since the early periods of the trade. Buffalo robes, then esteemed of no importance, are now the largest and most valuable item; while the beaver and otter, and even the marten and fisher (two animals of the sable kind) have greatly fallen off in relative importance. The skins of some of the smaller animals, as the mink, assume the greatest importance for their numbers and value, and next to these, in aggregate value, are the skins of the common muskrat. The highest-priced furs are the Russian sable, the sea-otter, and the black or silver fox. For its size, the first named of these is the most valuable, but the sea-otter brings the highest price of any single skin. This is collected chiefly on the American and Asiatic coasts of the North Pacific ocean; and its greatest demand is among the Chinese and Russians, though its use by the former is restricted to the mandarins and high officers of state. In the latter part of the last century it was in such demand, that several expeditions were fitted out from this country, and also from Europe, expressly for collecting this fur from the islands and coast about Nootka Sound. The present value of the skins is from $100 to $125 each. The silver fox is found in the northern part of this continent, and is occasionally captured in the region about Lake Superior. The value of the skin is even greater than that given in the above table—being often rated at $60 apiece; in Europe, when well dressed, they have been known to bring nearly as many guineas. They are in demand chiefly by Russian noblemen for their most costly outside garments. Of late years the skins of the skunk have been largely collected, and thousands of them have been annually exported from New York. Those of black color were worth the most, and sometimes brought seventy-five cents each. The demand, however, has fallen off, as it is found impossible to entirely remove the disagreeable odor of the animal, so that it will not be given out when the articles made of the fur are moderately warm. Rabbits' fur, as described in the account of the hat manufacture, is an article of considerable trade. It is obtained chiefly from Europe, and is mostly consumed by the hatters, for whose use nothing but the fur itself in fleeces is imported. The whole skins are used to some extent by the furriers for cutting. The present character of the trade, and value of skins, are seen in the following statement from the circular of one of the oldest and most extensive houses in this business—that of Messrs. C. G. Gunther & Sons, of Maiden Lane, New York. To their experience we are indebted for many of the particulars that follow:—

Silver fox, according to size and color	From	$10 00	to	$30 00
Otter, northern and eastern, and north-western .... do.	“	3 50	to	5 00
“ Pennsylvania, New Jersey, Ohio, and western .... do.	“	3 00	to	4 00
“ Kentucky, Maryland, Virginia, and vicinity .... do.	“	2 00	to	3 50
“ North and South Carolina, and Georgia .... do.	“	1 50	to	3 00
Fisher, northern and eastern, according to size and color	“	2 50	to	6 00
“ Penn., Ohio, and southern “ “ “	“	2 00	to	3 50
Bear, northern “ “ “	“	5 00	to	8 00
“ southern “ “ “	“	2 00	to	3 00
Martens “ “ “	“	1 50	to	1 65
Wolf skins	“	50	to	1 00
Cross fox, northern and eastern, according to size and color	“	3 00	to	6 00
“ Pennsylvania, New Jersey, and Ohio, do.	“	2 50	to	5 00
Red fox, northern and eastern, do.	“	1 25	to	1 50
“ south Penn., New Jersey, and Ohio, do.	“	1 00	to	1 75
“ southern and western, do.	“	50	to	75
Gray fox, northern and eastern, cased	“	40	to	50
“ southern and western	“	30	to	40
Beaver, northern, parchment, per skin	“	1 00	to	1 50
“ southern, and ordinary, per skin	“	50	to	1 00
House cat, ordinary	“	8	to	10
“ black furred	“	15	to	20
Mink, New York and eastern, according to size and color	“	1 50	to	2 25
“ New Jer., Penn., Ohio, Mich., Ind., Ill., Wis., and Iowa, do.	“	1 25	to	1 75
“ Maryland, Virginia, Kentucky, Mo., Iowa, and south, do.	“	1 00	to	1 25
“ North Carolina and Tennessee, do.	“	1 00	to	1 25
“ South Carolina, Georgia, Florida, and Alabama, do.	“	50	to	1 00
Wild cat, northern and eastern states, cased	“	35	to	50
“ southern and western	“	20	to	40
Raccoon, Mich., north. Ind., Indian handled, ac'd'g to size and color	“	60	to	1 00
“ northern Ohio, Illinois, Wisconsin, and Minnesota, do.	“	50	to	60
“ New York and eastern states, and north Penn., do.	“	40	to	50
“ New Jersey, southern Penn., Ohio, Ind., and Ill., do.	“	30	to	40
“ Maryland, Virginia, and Kentucky, do.	“	25	to	30
“ North Carolina and Tennessee, do.	“	20	to	25
“ South Carolina, Georgia, Florida, and Alabama, do.	“	10	to	20
Muskrat, spring	“	14	to	16
“ fall and winter	“	7	to	8
“ southern, average	“	5	to	6
Opossum, northern, cased	“	6	to	8
“ southern	“	5	to	6
Rabbit, cased	“	1	to	2
Skunk, prime, black, cased	“	10	to	12
“ white and black	“	3	to	5
“ out seasoned and very white	“	0	to	0

Although the supplies of furs are diminishing, the trade in fancy furs, such particularly as are used for ladies' wear, is increasing in importance; and in the city of New York the wholesale and retail trade for the year 1856 was estimated to amount to about $1,375,000. The sales of a single house amounted in 1858 to about $800,000, and consisted altogether of fancy furs, such as sleigh-robes, caps, coats, gloves, and all articles worn by men and women. The same house exported, in addition to this, $350,000 worth of shipping furs, consisting of otter, beaver, muskrat, fisher, bear, silver fox, wolf, cross, gray, and red fox, raccoon, opossum, rabbit, and skunk. A decided change in the requirements for furs for ladies' wear has taken place within a few years. Instead of the cheaper sorts which formerly supplied the market, the more costly kinds are now largely in demand. Russian sable, which, since the opening of the Amoor river, is furnished in larger quantities and at lower rates, is much worn, and so are opera cloaks of the white ermine, tipped with black tabs, from the tail of the animal. A full set of the best Russian sable, consisting of a fichu Russe, muff, and cuffs, has been sold for $1,800. The fichu Russe is a large cape, falling below the waist, and from twenty-eight to thirty-three inches in length. Around the neck, it is finished with a collar four inches deep, and slightly pointed at the back. The usual prices for a set of this fur are from $700 to $1,500. Made of Hudson's Bay sable, the set is worth from $200 to $800. Some specimens of this fur are nearly equal in beauty, and quite so in quality, to the lower grades of Russian sable. The mink is the most popular fur for the same use, owing to its moderate price, combined with good qualities, and a set of the finest is worth from $100 to $200. This and the sables are often ingeniously imitated by dyeing some of the cheaper sorts, as rabbit's fur, so that even experienced persons are sometimes deceived. The stone marten has been a fashionable fur, but though very handsome, it is giving place to those sorts of darker shades. It is distinguished by a white underground, and over this is the exterior shading of a light brown stone color. A fine set of this has usually sold for from $125 to $150. Fitch makes a good serviceable fur, but was never very fashionable. It is of yellowish hue, mellowed down in the best varieties by a long, thick overgrowth of dark brown. Sets of the darker shades are worth from $50 to $75, and others considerably less. Muskrat furs are sold under various names, as river mink, marsh marten, American sable, and French mink, and are worth in a full set from $28 to $35. The French cony. called also French sable, is a French rabbit, colored brown, with black stripes through the middle of the skin, in imitation of mink and sable. A set of this fur, of best quality, costs from $20 to $25. Two sorts of squirrel furs are made up, and mostly for children's wear alone. One is entirely gray, and the other mixed gray and white, and their value is from $25 to $40 the set. The white fur worn by children is of the miniver and white cony. Sets of furs are complete with a victorine or small cape in the place of the large one, and are, of course, furnished at considerably less cost. Fur overcoats for gentlemen are rarely seen in this country. A few have been introduced from Russia of great elegance, both sides being of rich fur, so that either might be worn outside. Ladies in the cities often preserve their expensive furs during the summer, by depositing them with the fur dealers, who take the same care of them as of their own stock.

The mechanical processes to which furs are subjected are few and simple. The skins when stripped from the animals are merely dried in the sun, in order to protect them against putrefying. Those of small size are often first steeped in a solution of alum for more efficient protection, but the operation is objectionable, as the alum weakens the pelt. They are made up into bales, and are called peltry. When stored, it is essential to keep them perfectly dry; and to guard against injury from moths, camphor and tobacco are strewed among them; and they must be examined every few weeks, and each skin be beaten with a stick in order to cause the worms of the moth to fall upon the floor, when they are crushed by treading upon them.

The first process of the furrier is to soften the pelt. This is done, with the finer kinds, by placing them in a tub with a quantity of butter and trampling them. After stripping off the loose pieces of skin, they are again trampled in sawdust (that of mahogany being preferred), the effect of which is to remove the grease, and the cleaning process is completed by occasionally beating with a stick and combing the fur. The skins are now ready for the cutter, who from a large number cuts out pieces of various shapes, which are then sewed together to make up the various articles of fur dresses. Each cape, muff, etc., is thus made up of pieces from different skins, and the numerous seams are concealed on the outside by the fur itself, and on the inside by the lining.

Furs that are to be used for felting require first the separation of the long hairs. This is effected after the skins have been split, scraped, and pressed, by either clipping them down to the length of the short hairs, or pulling them out one by one as each is seized between a knife-blade and the thumb. When carefully trimmed and pressed, the skin is well moistened with water, and being held upon a board of willow-wood, the fur is cut off close to the pelt by means of a sharp, rough-edged knife. The whole clipping is kept in one fleece by means of a piece of tin held in the left hand, and up which the fur is slipped as it is cut. The rabbits' fur imported for the hatters is received in these light, loosely cohering fleeces, each being the fur of one animal. The skins of the beaver and nutria require much more thorough cleaning to remove the fat from the pelt and the grease from the fur, as by repeated scrubbing with soap and hot water. The thick, closely matted fur of the former has been successfully cut by machine knives, an operation that has always failed when applied to the more uneven and thinner kinds of fur. Some chemical preparations have been used to separate the fur from the pelt, but they are generally found to be objectionable, as they destroy in part the felting property.

HATS.

CHAPTER I.

EARLY HISTORY—MANUFACTURE—IMPROVEMENTS.

From an early period in the history of manufactures in the United States, the production of hats appears to have been prosecuted with considerable success. As far back as the year 1732, the business was so successfully carried on in New England and New York as to lead to complaints among the hatters of London, and representations of the injurious effects upon the trade were in consequence made by the London Board of Trade to the House of Commons. Being the most conspicuous article of dress, the hat naturally was an object of particular solicitude, and much more latitude was allowed in giving to it peculiar and fanciful forms than at the present time. And if our fathers failed to produce fine specimens of manufacturing skill, we must admit that, in adopting the graceful forms of the high Spanish hat, with its rounded brim, and ornaments of plumes, or loops and tassels, they certainly excelled us in their appreciation and selection of pleasing shapes, instead of such stiff and awkward forms as those of the fashionable hat of the present day. There was, however, with them, quite as great a variety of hats as with us, both in material and in figure. The common hats were of rough felt, usually of wool, or of wool and fur—sometimes of fur alone—and the practice was early introduced of covering the wool body with a plating of fine fur, felted by hand into the outside of the coarser material. The body was stiffened or not with glue, and sometimes water-proof stiffened with gum shellac. The round crowns of the early part of the century had given place, in the better kinds of hats, to flat tops, and the broad brims of some were turned up and looped, first on one side, then on another, and at last on the third, till it became the regular three-cocked hat. This, from being a fashionable hat, finally came to be appropriated to military officers, by whom it is still worn as a badge of rank. The Quakers alone adhered to the old broad brims, making it, it is said, a point of faith not to wear a button or a loop, and wore their hats "spread over their heads like a pent-house, darkening their outward man to signify they have the inward light." In the other extreme there were fashionable hats, like ladies' bonnets of the present time, too small to serve as a covering for the head; such a hat was conveniently carried under the arm, and in fashionable calls furnished a pleasant diversion to its owner, who twirled it upon the head of his cane.

Many of the soft hats of our ancestors were, no doubt, very fair articles of hand workmanship. They possessed abundance of material, and used the choice fur of the beaver more lavishly than hatters have of late been able to afford. Their mode of felting was the same as that now practised where machinery is not introduced, and their methods of shaping hats over blocks, or "sizing," were probably as skilfully conducted as at the present time. But in the production of the stiff pasteboard hats, covered with a sheet of fur or other material, the processes in use were comparatively rude, and have so continued down to within a few years past. Within our own recollection, the hatter in almost every village made the hats he sold, felting his own materials and forming the bodies over his blocks, and covering with them the stiff and clumsy cylinders of pasteboard, shaped, as near as might be, to the prevailing forms of the day. The fur of the musquash and beaver were used, often plated upon a body of lamb's wool; and the choicest beaver hats were plated with the finest fur of the animal, taken from the belly and cheeks. This, too, came to be used upon bodies of rabbits' fur, of which the so-called beaver hats at last were chiefly made; and as beaver became scarce, nutria, from a South American animal of this name, was very generally substituted for it. The hatter was provided with dyeing kettles, in which the complex materials of his hat bodies were brought to a uniform black shade; and there was a variety of apparatus for steaming, shaping, and finishing, all of which involved laborious hand-working, and more or less mechanical skill, to produce the small number of hats required by the men and boys of the village.

Within a few years a complete revolution has been effected in this business. Machinery has been almost wholly substituted for hand labor in preparing the materials of hats, and this is now done upon an immense scale in a few of the large cities, whence the hat bodies, or the finished hats, are sent for the supply of the country. The effect of this has been to furnish hats of uniformly better quality than were made by hand, at greatly reduced cost, and to carry the manufacture to such perfection that the American hat is now distinguished as the lightest and best produced in any country. In England, the American is often recognized by the excellence of his hat. For this we are in part indebted to the greater dryness of our climate, the moisture of England rendering it necessary to give more body and stiffening to the hats exposed to its influence. This is not so much the case in France, and hats there approach more nearly the quality of our own.

In New York city the business in the common felted hats of wool and of fur, which make no pretensions as works of mechanical skill, is carried on upon an immense scale in numerous establishments; and it is stated that the commission houses and agencies engaged in this trade, which are concentrated chiefly in the lower part of Broadway, sell over 5,000,000 hats annually.

The business in stiff hats is quite a distinct branch, and their manufacture is extended through several different establishments. The making of the bodies is almost monopolized by the firm of Messrs. Henry A. Burr & Co., of New York city, and by their patented machinery, supplied to agents in a few other cities. They receive from the hatters, who buy of the importers, lots of rabbits' fur—the chief supplies of which come from towns near the German Ocean, as Frankfort-on-the-Main, Brussels, etc. Some of poorer quality is also obtained from Virginia and North Carolina. The fur of each lot is mixed together, and to every 4 or 5 ounces (the usual quantity for a felt hat) $\frac{1}{4}$ to $\frac{1}{2}$ an ounce of the finest carded cotton is added; and at the same rate for the lighter fashionable hats, the weight of which is about 3 ozs. Picking machines, revolving with great velocity, and creating, in a capacious box, a powerful current of air, cause the fur to be well mixed, the operation being repeated to make it thoroughly effectual. The long hairs and bits of pelt are then separated by what is called the blowing machine. This consists of pickers, which revolve several thousand times in a minute, and strike out the coarse hairs and heavy particles, which fall upon a screen, while the light hairs are blown upward and carried forward to another compartment, where the same process is repeated. The screens are kept in agitation, and the coarse particles are finally shaken off at the feet of the man who feeds the machine, and by him they are again passed through to save the fur that adheres to them. The dust escapes through the perforated copper covering of the machine, and the clean fur is delivered at the extreme end in a fine flocculent condition, readily worked into a mat by felting, as is shown by rolling a little of it between the fingers. In the large factory of the Messrs. Burr & Co., about 30 of these machines are kept in operation, and the quantity of fur prepared by them is enough for about 10,000 hats daily. This number of hat bodies has been produced at this factory for several months together. Two steam engines are employed by turns, one of which is of 400, and the other of 200 horse power.

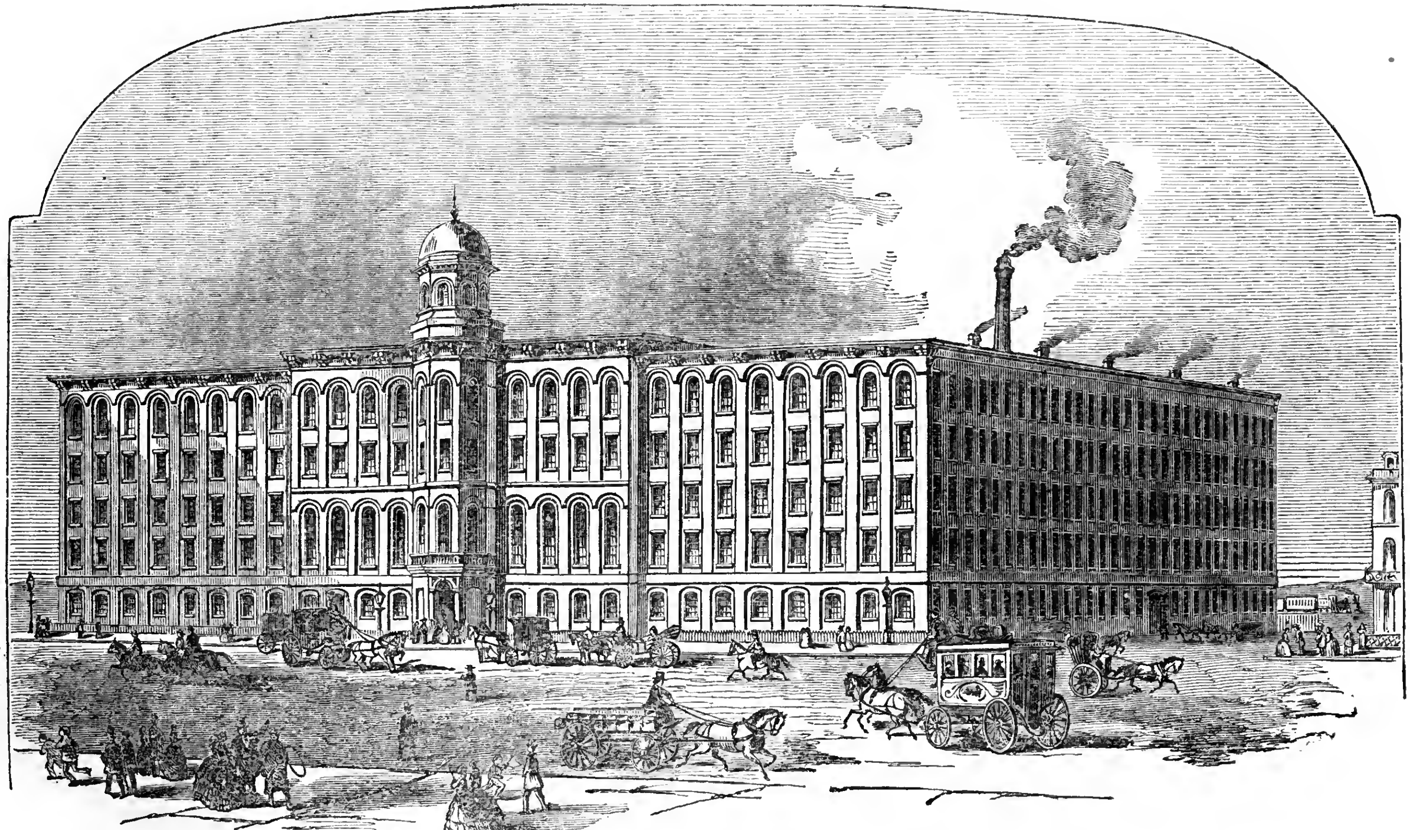
The fur used to be felted altogether by the hand process: but various improved methods have been devised for lessening the labor; and the best of these are of American origin. By the process invented by Mr. Thomas Blanchard, of Boston, the fur was made to collect upon a fine wire gauze, and there take the form of a matted ribbon, by exhausting the air beneath so as to create a strong current of air from the receptacle in which the particles of fur were kept floating in the air. This ribbon being wound around a double conical block, of the size of two hat bodies, was then joined along the overlapping edges by rubbing. The method of Messrs. Burr & Co. is an improvement upon this, perfected by Mr. Henry A. Wells and Mr. Burr. A cone of sheet copper, considerably larger than a hat body, punched full of small round holes, is set upright, and made to revolve slowly upon a vertical spindle. An exhausting fan under it rotates about 4,000 times in a minute, causing a strong current of air to draw through the holes from the outside. Against the cone is the mouth of a sort of trunk, or long box, in the opposite end of which the fur is fed in quantities just sufficient, each time, for one hat body. The fur is taken up from the feeding apron by a cylindrical brush, and thrown forward by the rapid revolutions of this, which also create a current of air that blows the fur toward the mouth of the box. From thence it is seized by the exhausting current, and drawn down upon the cone, covering this completely, while it is turning round sixteen times. The workman standing by picks off any coarse particles that fall in with the rest, and as soon as the deposit is completed, he lays a wet cloth over the cone, and places over all a loosely fitting metallic cover. He then lifts off the whole, and immerses it in a tank of hot water, replacing a new cone immediately, to receive the next hat body. The effect of the hot water is to make the particles of fur cohere more closely together. When taken out of the water the mat is placed in a piece of blanket, and worked by the hand upon a table. It is then squeezed, to press out the water, and folded, to be pressed with others, and made up with them into bundles for the hatters. The shape of these bodies is that of a wide, open-mouthed bag, of a size much larger than the hat. They are very soft, and tolerably strong, and are afterward reduced to the required dimensions and shape by the process called "sizing," which is done by the makers of felt hats for themselves, and for most of the larger manufacturers of silk hats by intermediate establishments specially devoted to this object.

The immense advantage gained by these improvements, is seen in the enormous production of the factory of Messrs. Burr & Co., which, in 1856, amounted to about 3,000,000 hat bodies, besides about an equal number made by their machines in other cities. These were, moreover, of uniform quality, according to the kind of fur used, and every one free from imperfection. By the old method, it was the labor of a skilful man to form four or five bodies in a day; and these were generally inferior to the machine-made bodies. Their cost was estimated at 56 cents each. The new machines, called "formers," employ, each one, two men and a boy to tend them, and another man is occupied in rolling and putting up the bodies. Their production is 400 a day, and the cost of the labor employed is rated at from six to ten cents for each hat.

The "sizing" of the bodies, as performed by the manufacturers of felt hats, and those who prepare them for the makers of silk hats, consists chiefly in rubbing a pile of the bodies after they have been dipped in hot water, and rolled in a blanket upon a sloping plank table, that forms the margin of a large central tank. This is called the hat-maker's battery, and is large enough for eight to twelve men to work around it. By rubbing the bodies they soon felt together more closely, and are reduced to the proper sizes for hats. Those intended for silk hats are called shells; and in this condition are sent to the factories where these hats are made up.

Silk hats, which are the latest and most perfect improvement in this art, are made by covering the stiffened fur bodies or shells with black plush specially prepared for this use, and supplied to the trade from France, the best dyed coming from the manufactory of Martin, of Paris. This business is carried on in several large establishments in New York, Philadelphia, and other cities; and from these the fashionable hatters are supplied with hats made to order and marked with their names. The country trade is also supplied from the same sources, but with hats rather heavier and stronger than those made for city wear. The latter weigh when finished only about three ounces, and are not usually expected to continue in wear more than a few months; not because of their becoming shabby in this time, but because slight changes in the form are continually introduced, which wearers must adopt to keep in the fashion; and in the city there is more disposition and means for always wearing the best.

The manufacture involves a variety of processes, each of which, after the most economical system of division of labor, is conducted by workmen specially devoted to this alone. By one set of hands the soft shells are first subjected to the operation of waterproof stiffening. They are dipped one at a time in a weak solution of shell-lac, then slipped over a block, and partially brought into shape by rubbing with the hands. The brim and tip (or edges of the top) are then brushed over with a thicker coating of the gum to give additional stiffness to these parts. When dry, a hot iron is applied, which has the effect on cooling of giving greater hardness and solidity to the material. The next application is a coating of fine glue or gelatine, the object of which is to prevent the varnish of seed-lac, which is next laid on, from striking in. The hats are after this taken to the finishing-room, and here are first shaped and trimmed, to the exact pattern sent with the orders from the retail hatters. In this operation brass gauges of a variety of forms are made use of, by which the exact dimensions and shapes required are secured without the slightest deviation. The silk plush has been in the meantime already prepared by sewing a circular piece for covering the top, with great nicety to the piece which surrounds the body, the two edges of which meet in a line up and down the side of the hat. The brim is covered by a separate piece above and below, and the edges of these pieces are afterward concealed under the binding and the band. A hot iron is applied, in order to smooth the plush and cause it to adhere to the varnish, which is softened by the heat of the iron. After being lined and trimmed, the hat is finally smoothed and shaped with a hot iron, and the precise curve required is given to the brim, the finishing of which demands the skill of a practical workman.



VIEW OF CHICKERING & SONS' PIANO-FORTE MANUFACTORY, TREMONT STREET, BOSTON.

INDIVIDUAL INDUSTRIES.

The great progress of this country, as evinced in the developments of the preceding articles, is manifest to the civilized world, in the position which the country occupies among the nations of the earth. If we have followed the progress of each leading branch, from small beginnings up to the magnificent results that they now display, it has been to show that these results, great as they are, are but the preliminary to that career which the future promises. It is to be borne in mind that the capital of the country had to be created, and that the large enterprises could be carried out only by an accumulation of capital that grew as it was applied. The manufactories, the mines, the finances, the railroads of the country, were nearly all carried on by associated capital acting through corporate bodies. Underlying those vast undertakings, however, are the broad fields of individual industry, where every man, depending only on his own skill and perseverance, not only, as it were, created an industry, but devised the means of making it useful. The inventive genius of the people has been systematically applied to the improvement of qualities of goods made, at the same time that the cost of manufacture has been cheapened. The field of individual industries may be explored with quite as much interest and admiration as those which have been opened by the application of incorporated capital. The wonderful results that have been obtained have been accompanied by the fortunes of the enterprising men that have produced them. It is the case sometimes with corporate capital that the greatest enterprises are carried out successfully for the public interests while the capital invested in them has been sunk. In the case of individual operation, a combination of mechanical inventions, of industry classified, of raw materials judiciously assorted, and of directing skill, produces articles that, before unknown or unappreciated by the public, have become necessities, and the demand rewards the genius and judgment of the manufacturer with a fortune. In almost all cases, but little money capital was possessed at the commencement, but there was a better capital than mere money in the self-reliant genius of the indomitable American. These individuals have remodelled old manufacturing processes with improvements, and created others, giving employment to thousands of workers, and creating interchangeable values for the great natural products of the country; in other words, finding a market for labor which would otherwise not have been available. In the present article we will explore a number of the leading industries of this nature.

BUILDINGS AND BUILDING MATERIAL.

Among the marvellous evidences of the advancing wealth and luxury of the American people, the multiplication and improvement of dwellings are very conspicuous. The official figures in relation to the numbers and values of dwellings in the country are indeed not very abundant or very precise. There are materials, however, which, put together, give a pretty accurate estimate of the enormous investments in dwellings.

In 1798 the number of dwellings and their value in all the states, was given in the tax-list laid before Congress. The values given in the official tax list at the end of the last century not only apply to a class of dwellings far less costly than the average of those now in vogue, but it was at a time when money or capital was of a higher value relatively. The number and value of the houses then reported may be compared with the number of dwellings reported in the United States Census of 1850, as follows:—

NUMBER AND VALUE OF DWELLINGS IN THE UNITED STATES.

	1798. No. dwellings.	1798. Value.	1850. No. dwellings.	1850. Value.
Maine	part of Massachusetts.		95,802	$72,109,000
New Hampshire	11,142	$4,146,938 90	57,339	43,004,250
Vermont	5,437	1,558,389 36	56,421	42,315,750
Massachusetts	48,984	24,546,826 46	152,835	114,626,250
Rhode Island	7,037	2,984,002 87	22,379	16,784,250
Connecticut	23,465	8,149,479 28	64,013	48,009,750
New York	33,416	25,495,631 39	473,936	354,452,000
New Jersey	19,624	9,149,918 84	81,064	60,798,000
Pennsylvania	51,772	29,321,048 33	386,216	289,662,000
Delaware	5,094	2,180,165 83	15,290	11,464,500
Maryland	16,933	10,738,286 63	81,708	61,281,000
District of Columbia	..	..	7,917	5,937,750
Virginia	27,693	11,248,267 67	165,815	124,361,270
North Carolina	11,760	2,932,893 09	104,996	78,747,000
South Carolina	6,427	5,008,292 93	52,642	39,481,500
Georgia	3,446	1,797,631 25	91,206	63,404,500
Florida	..	..	9,022	6,766,500
Alabama	..	..	73,070	54,807,500
Mississippi	..	..	51,681	38,760,750
Louisiana	..	..	49,101	36,825,750
Texas	..	..	27,988	20,991,000
Arkansas	..	..	28,252	21.189,000
Tennessee	1,030	286,446 83	129,419	97,065,750
Kentucky	3,339	1,139,765 13	130,769	98,076,250
Missouri	..	..	96,849	72,344,850
Illinois	..	..	146,544	109,908,000
Indiana	..	..	170,178	127,629,500
Ohio	..	..	336,098	252,073,530
Michigan	..	..	71,616	53,712.000
Wisconsin	..	..	56,316	42,237,000
Iowa	..	..	32,962	29,971,500
California	..	..	23,742	17,806,500
Minnesota Territory	..	..	1,002	751,500
New Mexico Territory	..	..	13,453	10,089,750
Oregon Territory	..	..	2,374	1,780,500
Utah Territory	..	..	2,322	1,741,500
Total	276,559	$140,683,984 77	3,362,337	$2,520,967,400
Number of churches	..	..	36,221	87,049,459

The national census of 1850 did not give the value of the dwellings, but the state census of New York for 1855 gave not only the dwellings but their value and material of construction. By that census it appears there were in New York 522,325 dwellings, worth $664,899,967, or an average of $1,267 each. The average for stone houses was $6,526. These are mostly the better class of houses belonging to the wealthy inhabitants of towns. The whole number of these is 7,536, of which 1,617 are in New York city, and worth $32,267,340, or an average of $20,000 each. In the remaining portion of the state the stone houses are 5,919 in number and $16,917,479 in value, or an average of nearly $3,000 each. The New York stone houses and hotels are exceptions, being the most luxurious display of the wealthy few. The number of brick houses is 57,450, average, $5,433; and of frame houses, 397,638, average value $748. If, then, we assume $750 as the average value of the dwellings in the whole Union, the result for 1850 will be an aggregate of $2,521,752,750 invested in dwelling-houses, being an increase of $2,381,068,765 in 52 years, or nearly $50,000,000 per annum for 52 successive years, in addition to the $87,049,459 invested in churches. The sums absorbed by other public buildings are not specified. The building which has been done in the last ten years by far exceeds that ratio. Thus the New York State census gives the number of dwellings in 1855 at 522,325 against 473,936 in 1850, an increase of 48,389, or more than 10 per cent. in five years. Comparing dwellings to the population, the results are as follow:—

UNITED STATES.

	No.	Free population.	Persons to each house.
1798	276,659	4,412,884	19.00
1850	3,362,337	20,059,399	5.94
1860	4,333,730	28,000,000	6.00

NEW YORK STATE.

	No.	Population.	Persons per house.
1798	33,416	586,754	19.00
1850	473,936	3.097,394	6.53
1855	522,325	3,466,212	6.64

The number of persons to a dwelling was greater in New York in 1850 than the average of the Union, and that number slightly increased; in the next five years that increase was again narrowed to the city of New York, where the crowd of foreign arrivals and large hotels and boarding-houses raised the number of persons to 15 for each house.

The population of Philadelphia and the number of dwellings are as follow :—

	Population.	Dwellings.	Persons per dwelling.
1850	408,762	61,278	6.10
1860	568,034	89,978	6.05

In Philadelphia the increase of dwellings per cent. appears to be greater than the progress of the population.

The general result in the Union is a house for every free white family, and these families average 5½ persons each. From these figures it is apparent that the number of houses in the Union progresses in the ratio of its free inhabitants. Thus, in 1850, the number of houses was to the population of the whole Union as 1 to 5.94; assuming that for 1860 there are 6 persons to each house, there must now be 4,333,333 houses, an increase of 970,996 houses in 10 years, at a value of, in round numbers, $800,000,000. In the same proportion, there must be, in 1870, 5,600,000 houses, which, at the value of 1855, would be $4,200,000,000. In other words, during the present decade, 1,300,000 houses must be built, and it is probable, from the advancing luxury of the age, they will cost more than those of 15 years before, and one thousand three hundred millions may be required for the expenditure. This is a necessity of increasing numbers, and provides nothing for re-construction, or churches, or public buildings. This item of house-building in an increasing country stands out in contrast to the demand in the same line in old and stationary countries of Europe. Some of those old cities were built 500 to 1000 years ago, of solid masonry, and very few houses have since been added. There is no active and continued demand for labor and capital to provide new dwellings to accommodate swelling numbers. On the other hand, the empty dwellings frequently give melancholy signs of a departing population.

In the United States, not only does this vast annual demand for 130,000 new houses exist, but every year brings improvements in the style of construction and the luxuriousness of accommodation. The simple frame buildings that generally spring up on the outskirts of cities, are, before they are yet old, required to give place to brick buildings, since the spreading population carries the municipal laws which forbid wooden structures over larger limits. The brick buildings that supplant the frame must also be more substantial, since the same fire laws also prescribe the thickness and stability of the walls. Wealth follows with its more pretentious style, and brown stone or marble palaces rear their stately fronts on what was lately an open lot. With the improved style of houses there is a constant ambition to occupy a "modern house," or one with the "modern improvements," which may be enumerated as, warming apparatus, whether by hot-air, water, steam, or gas; the water-pipes in all the rooms, connecting with the cooking-range for facility of heating; water-closets and bath-rooms connected with street sewers to carry off the waste water; bells, speaking-tubes, telegraphs, ventilation, burning-gas, dumb-waiters to communicate with different floors, and all the luxury of arrangement and embellishment which makes a modern private dwelling so far in advance even of the fairy palaces of the Arabian Nights' Entertainments. There is a natural desire on the part of all to obtain, as circumstances will permit, a better house, and if these are not built in the substantial manner which in Europe defies the ravages of time, they are in the fashion and luxury of the day, and may be altered or re-constructed as fortune changes. The railroads that give access to the neighborhood, in such a manner that a business man may take his breakfast at 7½ o'clock, ride 40 miles, and be at his office before bank opens, has, so to speak, carried city houses into a broad circle of country, and "villas" rise rapidly from the soil, also provided with all city improvements. Thousands of miles are within this influence. In sections which, a quarter of a century since, were shadowed only by the native forests, in which the scream of the panther and the gleam of his eyes startled the benighted traveller, streets of marble fronts now emit the glare of gas and the latest creations of the opera. In all directions the gaze of the traveller falls upon new creations, where lumber, brick, stone, and lime are combining into a dwelling or a factory, a school-house or a church.

The increase of houses being proportioned to the increase in the numbers of the people, their value has risen in the ratio of their growing wealth. It is remarkable that the country, in all its sections, abounds with the best materials for all description of dwellings, and yet these materials were very slowly discovered. For long years the bricks with which the best houses of New York were built, were brought from Amsterdam in those stately old droguers which, on their arrival in the bay of New Amsterdam, were regularly dismantled and laid up over the winter, setting out on their homeward voyage with the early spring. The bricks were probably used as ballast, but even then the cost of a house so built was something important. The early houses of the settlers were log huts, but subsequently frame houses were raised by the more ambitious, and, as wealth increased, those "shingle palaces" that became famous in the stories of New England manners, began to dot the country. In the cities, frame houses were the rule down to a comparatively late date, when the fire laws forbade the erection of wooden tenements within certain districts. The abundance of timber not only for building purposes, but for fuel, was a great advantage to the country. But as the population increased, the inroads upon it became very heavy, and the forests were rapidly thinned out. The annual consumption exceeded the growth, according to the estimates of the most experienced lumbermen, by about 30 per cent., and this notwithstanding that coal came to supply the drafts made for fuel, and the substitution of bricks for city houses. The sources of lumber for building purposes have become more diversified as the demand has increased. The State of Maine was for a long time the head-quarters of the trade for pine, spruce, and hemlock lumber; but hard pine comes from North Carolina, Georgia, Florida, and Alabama; Ohio and Michigan supply black walnut, cherry, ash, white oak. The exports from the country are about $2,500,000 per annum, and ship-building makes large drafts upon it. The lumber trade at various leading points, where the lumber resources of the back country are most readily concentrated for market, may be given as follows:—

	Feet.	Lath. M.	Shingles.
Detroit....	76,537,000	13,491,000	36,647,000
Savannah .	23,365.656	..	..
Charleston.	15,312,128	..	..
Albany...	291,771,762	..	48,756,000
Bangor....	176,187,016	..	..
Cincinnati.	32,000,000	..	..
Chicago....	300,982,207	49,102,000	165,927,000
Milwaukee	65,000,000	..	..
Oswego ..	144,654,572	1,643,500	7,653,250
Cleveland .	28,950,000	..	..
Baltimore .	100,000,000	..	28,000,000
Boston ...	131,000,000	20,000,000	10,000,000
Buffalo....	68,558,151	2,026,000	1,768,300
Philad'phia	162,879,722	..	21,220,937
Total...	1,661,568,214	86,262,500	320,072,487
Value...	$31,931,364	$138,797	$1,280,289

The Bangor lumber is derived from the forests of that region, and it composes a part of that sent to Boston, Philadelphia, etc. The Savannah and Charleston trade is that shipped from those ports, mostly North. The Albany lumber is derived from the canal deliveries and the northern section. The Philadelphia lumber comes mostly from the canals and rivers; about one-third comes through the Chesapeake and Delaware Canal, as much more down the Delaware river from southern New York: about one million feet only comes from Maine. The Baltimore supplies are mostly from the Susquehanna river, being rafted down from Pennsylvania and New York. From 150 to 200 millions of feet go down the Alleghany river every year. Chicago is by far the largest lumber market, and the supplies are derived from the Michigan Lake shore, the largest quantity from the Green Bay district. The supplies are sent through the state by canal and the various railroads that radiate through the prairie country, where wood of natural growth is scarce, and which scarcity was one of the objections to settling until railroads became the means of furnishing the supplies. The largest quantity goes by the canal, and the next largest by the Illinois Central railroad.

With the vast supply of lumber and timber to meet the additional demand for building purposes, it followed that improvements in the mode of preparing it would not fail to make their appearance. It is obvious that inventions are more likely to take place when the quantities handled are very large, than where but little is done from year to year. Thus if a few houses are built occasionally, the want of great facilities will not be so marked as when twenty hundred million feet of lumber is to be worked up every year for building purposes, mostly in the construction of dwellings. The carpenter, in the building of houses, receives the beams, scantlings, planks, and boards, and out of them he makes bond-timbers, wall-plates, roofs, floors, etc., and with the completion of strong skeletons his labors end. The joiner, plasterer, and plumber succeed him. In the formation of his frame, the first is employed in notching, cogging, tenoning, pinning, and wedging. For many of these operations very effective machines have been introduced, especially for mortising, floor planing and grooving, etc. Some of the inventions, like the planing machines introduced in 1837, are of great value and influence. Circular saws, scroll saws, and a crowd of inventions bearing upon every part of the work, have wonderfully facilitated the work of the carpenter and joiner. The blinds, sashes, doors, window-frames, have become separate trades, each of which supplies its portion much cheaper and more perfect than formerly. When the demand is large, these are supplied with great precision. House-building thus becomes a trade. In the large cities a speculative builder becomes possessed of a number of open lots. On them money is borrowed to build a block of houses, 4 to 12 in number. With the money thus borrowed the work is hurried on until the roof is on, when the whole is regularly mortgaged to secure first loans and to obtain enough to complete the buildings. In the mean time they are offered for sale, and generally sold by the time they are done.

In order to facilitate the sales much credit is granted, a little money above the sum of the mortgages being all that is required. The mortgages remain at 7 per cent., which, with the taxes, etc., make the rent rather high to the owner. It not unfrequently happens in some neighborhoods that houses may be rented for an annual sum far less than the interest on the sum demanded for the house. Nevertheless, the person who has paid a little money, and lives under a mortgage larger than the whole house would cost if built with ready money, has the pride of a house-owner.

Sometimes the builders, carpenters, plumbers, painters, all furnish their parts of the work, and grates, furnaces, etc., also put in either on shares or secured by " mechanics' liens,"—all these to be paid out of the purchase money. It not unfrequently happens, however, that the expenses of raising money to go on carry the cost of the houses too high to get the money back, and foreclosure finally settles the account. Houses are also made for exportation, as well of iron as of wood, as in the case of the early times of San Francisco, which received many of its dwellings from New York. The settler on the new lands of the West is now not always required to plunge into the wilderness and rear his first shelter from logs, but may have his house sent from Chicago or other cities by railroad, and put up to await his coming. In all this lumber figures largely. With the settlement of the western country, the demand for lumber is urgent, and new supplies are opened up. The most extensive of them is round the Falls of St. Anthony, where about 100,000,000 feet of new logs come down in the spring from the waters above. These logs are manufactured into lumber at the extensive mills round St. Anthony. One of these mills will cut 92,000 feet of lumber, 50,000 lath, and 20,000 shingles in a day of 12 hours. The mill employs 150 men. There are cut probably 200,000 feet per day for the supply of the lower country with lumber. At the extreme South lumber is also supplied. Some 20,000,000 feet are shipped from Pensacola to the Atlantic and Gulf cities, in addition to the large quantities used in the place. The Dismal Swamp Canal at Norfolk delivers 3,000,000 feet of plank per annum, and 50,000,000 shingles, 400,000 feet of timber and 8,000,000 staves.

The material for dwelling-houses is thus liberally supplied at the leading points, to and from which means of communication have been so extensively provided. The majority of country houses are of lumber, or frame houses. In the cities the majority are brick, and, as we have said, many New York houses are still standing built from the small yellow brick brought from Holland. Brick clay is found in most of the states, but not of the same quality. The best brick are Philadelphia and Baltimore, but Chicago is famous for its straw-colored bricks. This color results from the absence of peroxide of iron in the clay. Some Milwaukee bricks were brought to New York city for the construction of Trinity Building, head of Wall street, and they assimilate in color to the old Holland brick, also "far fetched and dear bought." It is curious, however, that the brick of the far West should mingle with that of Europe in the composition of the city of New York.

In the manufacture of the brick the clay is obtained as pure as possible; but it must be exposed for some time to the air and weather, which soon disintegrates its particles, and fits it to be kneaded into a mass. The clay is then soaked in a tank. The kneading was formerly done by animals or the naked feet of men, which machinery has superseded. The clay is now first ground in the pug-mill, which is a tub in which revolve on a shaft blades that cut and knead the clay as it is fed in from above, and passes out at the bottom. It is then cut into pieces and stacked for use. The old hand mode of moulding was to throw the clay into the mould by force and then scrape off that which was superfluous. The labor of this process was reduced by causing the moulds to receive the clay from the mill in successive sets. It is obvious that the clay must be cleaned from all stones, sticks, etc., that would disfigure the brick. When the bricks are moulded they are dried. For this purpose a level yard is prepared, and bricks are brought in the moulds, which are removed, leaving the bricks to dry, a longer or shorter time, according to circumstances. If the bricks are not thoroughly dry they will crack in baking. For the purpose of baking, the bricks are piled one upon the other, to make the kiln or clamp. These contain from 500,000 to 1,000,000 bricks. A central double wall is built, lengthwise the lower portion, of baked bricks. On both sides longitudinal fire flues of green brick are built. Over them the mass of bricks is laid, with flues leading to the top, and in an open manner, with small scuttles through the heap as it is built up. The top and sides are built of baked bricks. Over all loam is laid to prevent the fire from burning too rapidly. The time required formerly on the Hudson river for burning the great clamps of 1,000,000 bricks was two weeks, and there were required 40 cords of wood for 100,000 bricks. About the year 1838 fine anthracite coal dust was introduced into the clay in the proportion of 75 bushels to 100,000 bricks, and thoroughly mixed in the kneading. The effect of this was to reduce the time to four days, and the wood to 16 cords for 100,000 bricks. Thus 16 cords of wood is rated at $80; 75 bushels of dust, $3; 4 days' attention, $6; total cost, $89, against $212. It follows that, as the heat is very unequal in a clamp, some bricks are underdone, while others are slightly fused on the surface, called "clinker brick."

It is obvious that in brick machinery the saving of labor is the great object, and to attain that a great number of machines have been invented. One of this class forces a lump of clay of the breadth and depth of a brick along a trough; and it is cut off the proper length by a wire. Other machines have been made to stamp the brick out of a lump of clay. Again, the clay is forced into moulds by a heavy roller. There are machines which pulverize the dry clay, and press this with great force into moulds, ready for burning. A patent for this, taken in Baltimore in 1847, and another in Boston, pulverizes, screens, moulds, and presses 2,500 bricks per hour. On this plan bricks are made on Staten Island. They present a smooth surface, but they are not so good as the Philadelphia and Baltimore. Bricks have been made partly hollow to diminish the weight. The size of bricks is $7\frac{3}{4}$ to $8\frac{1}{8}$ inches long, 4 to $4\frac{1}{2}$ wide, and $2\frac{1}{4}$ to $2\frac{1}{2}$ deep. In New York 5 courses of brick are allowed to the foot in height. In New England 5 courses make a foot, without the mortar. The weight of a brick is about 4 lbs., and 21 make a cubic foot of wall. The Philadelphia brick are the best in the country, and are made mostly by hand. The clay and sand give the brick a better color. The Baltimore brick bring a better price because the clay is purer, and therefore stronger, are better burned, and less liable to damage by transportation. The quantity made in Philadelphia is reckoned at 100,000,000 per annum.

The lime used in New York and on the Atlantic coast is mostly of Thomaston, Maine, where it is manufactured of limestone and oyster-shells. Its quality is much superior to that of the lime of other sources. The chief use of lime is for making mortar for cementing brick and stone work and plastering walls. The best qualities, made from pure stones or shells, slake rapidly, and are called fat. This kind more than doubles in bulk on being slaked, and falls into a soft, white paste. The inferior qualities slake slowly, and give out but little heat in the process. The value of lime with masons depends upon the quantity of sand it will bear in the manufacture of strong mortar. Thus the best Thomaston lime will take 8 bbls.

of sand for one of lime. It is stated that an excellent lime is made near New York city from white marble, and that it will take 9 bbls. of sand. The Thomaston lime is burned with anthracite coal. In New York it is used for plastering, at a price of $1 to $1.30 per bbl. of 2½ bushels. A cheap lime from Ulster county is sold at 70 cents for stone work. In the mortar each atom of sand is surrounded with lime, which adheres closely to it, and attaches it to adjoining portions, becoming hard by exposure to the air.

The building stone of Boston for the best houses has been derived from the immediate neighborhood, and is called Quincy granite. It is a handsome gray stone, hewn for dwellings, but sometimes used unhewn for public buildings. The stone is derived from Quincy, and the first railroad started in the country was for the service of these quarries, having been introduced shortly after their opening. The stone now so well known and extensively used, not only in Boston but in most of the Atlantic cities, as well as the West India Islands, was a discovery of the present century. It was formerly supposed that, where there is but little soil there is also no stone, and it is recorded that stone for the foundation of the dwelling of Governor Phillips was brought from Rhode Island. The State House was, through scarcity of stone, built with brick. Granite quarries are also now worked near New York and in Delaware Bay. These sources supply some of the stone for New York city, where a coarse marble, known as Sing Sing marble, is also used. The chief stone relied upon for the fashionable dwellings is, however, "brown stone," from the Portland quarries of Connecticut. It by no means follows, however, that a brown stone palace "on an avenue" is built of brown stone, any more than a brown painted house is built of "paint." The house is usually built of lumber and brick, and a thin coat of brown stone put on the front. The difference in cost between a plain front of stone and one of Philadelphia brick, with stone trimmings, will be from $700 to $1000. For the construction of large and fashionable stores, the Sing Sing marble is mostly used, but iron fronts have come latterly much into use. These are cast in ornamental styles, and put up piece by piece, each being riveted to the other, the whole front thus forming one piece, and then painted to resemble stone. Marble is the favorite material in Philadelphia, notwithstanding her superior brick. It is procured in abundance a few miles from that city.

Stone at the West is not so abundant, but discoveries of good building stone have been made. A yellow stone in the neighborhood of Cincinnati supplies a handsome material to that city. The canals of Ohio and Illinois carry considerable quantities, and marble has been found near Dubuque. There are valuable quarries in the neighborhood of Chicago. Iron is destined to figure largely in fronts for stores, as well as for the construction of fire-proof grain depots.

How long the once mighty forests of the country will supply the prodigious and growing demand for the use of dwellings, is a problem; but long since, the demands of shipwrights have so thinned the Atlantic forests, that it has become cheaper to build upon the lake harbors and western rivers. The scarcity of knees and bends for ship-building, led to the invention of the timber-bending machine, by which the straight oak timber was claimed to be bent in curves or at right angles for knees without decreasing its strength. The ports of the West, however, have of late been appealed to, and vessels built at Cleveland and other lake ports, at a small cost for lumber and labor, find their way to sea much cheaper than the same class built on the famous old ways of Maine, Massachusetts, or Baltimore. The white oak becomes less abundant, and live oak no greater in supply, while the pine and other woods used in the floors and trimmings, compete with the demand for dwellings. The number of vessels built in 1858 was 1225, of 242,286 tons. Of these nearly one fourth were built in the state of Maine, one eighth in Massachusetts, as much in New York, and ten per cent. in Philadelphia. If we compare the number and class of vessels built in the western states of Illinois, Ohio, Indiana, Missouri, Wisconsin, Michigan, in 1859, with 1829, we shall observe the progress in 30 years:—

	Ships.	Brigs.	Schooners.	Sloops and canal boats.	Steamers.	Total.	Tons.
WEST.							
1829	..	1	12	4	25	42	9,032
1859	4	1	65	37	98	205	45,731
ATLANTIC.							
1829	44	67	473	141	18	743	68,066
1859	118	44	366	365	128	1,021	196,555

The tonnage built at the West has increased fivefold, while that on the Atlantic has increased less than threefold. In 1860 an enormous stimulus was given to ship-building in all the western ports. Milwaukee did a large business, and the lake tonnage was greatly increased. The whole quantity of tonnage built since the accounts were kept has been 5,212,743 tons, or a value of $260,637,000. Of this amount 3,400,000 tons, or a value of $170,000,000, have been built in the last ten years. The annual value built is over $16,000,000, and the value of the lumber used $9,000,000, and there are about 13,000 men employed. The census of 1850 gives the statistics of house and ship building as follows:—

	No.	Capital.	Material.	Hands.	Cost of labor.	Value produced.
Carpenters	2,790	$3,289,308	$7,011,930	15,276	$5,559,320	$16,886,819
Ship-builders	892	5,182,309	7,286,401	12,623	5,922,576	16,595,683
Bricks	1,603	4,367,912	1,474,023	16,726	4,235,088	6,610,731
Lime and plastering	761	1,124,072	1,106,775	2,834	735,746	2,286,242
Lumber-yards	17,895	40,038,427	27,593,529	51,766	16,022,052	58,520,966
Masts and spars	39	124,130	89,719	154	63,216	189,482
Plumbers	124	646,225	1,297,119	1,037	377,944	2,343,607
Sashes and blinds	433	1,066,355	859,827	2,448	860,920	2,277,061
Shingles	520	823,940	406,932	2,127	425,328	985,957
Quarries	1,144	4,032,182	2,475,760	9,996	3,431,194	8,180,115
Timber-hewers	129	222,479	14,742	414	67,508	132,246

The New York census of 1855 gave the number of feet of lumber used per annum in house-building at 5,953,000; ship-building, 16,938,000 feet; boat-building, 7,673,000. The number of brick made in the state was 408,052,000, and 4,214,000 bushels of lime.

CARRIAGES AND COACHES.

The improvements in the means of transportation in the United States are very manifest in the number and quality of private carriages of all kinds that are now kept by almost all who live out of cities, and by very many of those who reside in them. With the multiplication of railroads, which were to supply the place of stage-coaches, it was supposed that the number of horses employed would be greatly diminished. The contrary seems, however, to be the fact, since the greater breadth of land by their means laid open to market, and the resulting general wealth have enabled all to keep pleasure-vehicles, when formerly the saddle only was used outside the stage-coach. The plain springless box-wagon of the farmer conveyed his family to and from church on Sunday, and hauled his produce on week days, until within a very few years, when the idea of extravagance attached to the possession of pleasure or spring-wagons began to give way, and those vehicles were found in the carriage-house before the piano supplanted the quilting-frame in the parlor. So far from a decrease in horses, new ones and of better breed were required for fast and stylish driving. The well-to-do, permanent business man must have his business-wagon of tasteful appearance, case hardened iron axles, steel springs, and a top buggy. A rockaway, or even a coach, in many cases, is required in addition, and furnishes labor for fancy horses. The multiplication of vehicles is caused on one hand by the greater means of the people, and on the other hand by the great improvements in manufacture, which have diminished the prices while they raised the quality of the almost infinite variety of styles offered. These are so admirable as to have elicited not only the surprise, but what is better, the custom of the citizens of Europe. The tide of improvement ran naturally at first in the line of stages and coaches. The object was to make them strong and light, and with such proportion of all the parts as would facilitate the draft; in other words, to avöid loss of the power of the horse. In the cities the improvements are of recent date, and arose out of the magnitude of the business. The style adopted in 1830 was the omnibus or long coach. One vehicle was then started to run up Broadway for 12½ cents per head. The success was complete, and the number multiplied, while the fare fell successively, until at the present time the most successful charge 5 cents in common with the rail-cars. The number of omnibuses now running in New York is 440, and the use of them has spread all over the country, giving birth to very numerous and extensive factories for their production. About 300 per annum are made in New York, and larger numbers in Newark, New Jersey. The experience, skill, and capital that had been applied to the production of the old post-coaches were applied to the construction of the new vehicles. The work to be performed by the coach requires the utmost care in the selection of the materials and in the manner of combining them. The frame is a piece of the nicest joiner's work, of the toughest ash, that has grown in exposed situations, and been seasoned at least two years. For some portions, oak and hickory, equally well selected, are used. The planking is of the strongest elm, and the panels of Spanish cedar; mahogany and rosewood for ornamental portions. The frame and axles are thoroughly ironed with the best metal. The springs are of the best steel, and of these many of the improved forms are of quite modern dates. The elliptical spring was introduced in 1825. The leather is of the toughest and finest description. The upholstery is of fine cloths, nets, damasks, plushes, with coach-laces, extensively manufactured in New England. The most important part of the construction is probably the wheels. These must be so put together as to give the greatest amount of strength with the smallest weight of material. For this purpose the felloes are of ash, the spokes of oak, and the nave of elm. All these are so arranged as to receive the weight of the coach as far as possible longitudinally of the fibres of the wood. A very important American improvement in the strength of the wheel took place some 30 years since. Up to that time the iron tires had been put on in separate plates, breaking joints with the felloes. An American blacksmith conceived the idea of making the tire whole and driving it on when hot, so that its contraction as it cooled would bind the whole wheel together almost as one piece. This invention has been universally adopted. The tires of New York omnibuses are, when new, an inch thick; but so great is the wear, that they require renewal in 4 months. The size of the wheel is regulated by the ease of draft. Thus it is found that the greatest ease requires that the line from the centre of the forward axle to the shoulder of the horse should form an angle of 15 degrees with the horizon. This principle will not admit of the fore wheels being more than forty-four inches in diameter, while to diminish the draught, the hind wheels are 56 inches, and the width of track is 4 ft. 8 in. The naves of the wheels have a lining of metal, forming a box that excludes dust and retains oil.

It will have been remarked by the observing reader that, in every branch of industry which has been recently taken hold of by the American manufacturer, the facility of production and cheapness of sale-prices have hand in hand made rapid progress. This remarkable feature has been due mostly to one principle: it is that of reducing the manufacture to its utmost subdivision, and making a distinct branch of each separate part of the object to be completed. A pattern being once fixed upon, all the parts of that pattern are given out to workmen, who confine themselves each to the manufacturing of the part he undertakes. The parts so produced are made in the best manner. Each man strives to improve in the work, or to do more and better in a given time, and his native intelligence does not fail of results. The products of all their labors are then combined in complete articles in number and quality to defy competition. This mode of manufacture is a cause and a consequence of large sales. By improving and cheapening the goods the demand is increased, and thus reacts upon the power to produce. The carriage manufacture is another illustration of this principle. The Messrs. G. & D. Cook & Co., of New Haven, when they engaged in the manufacture, nine or ten years since, introduced this way of systematizing the work. The mode of building carriages then was for each man to have a hand by turns in all the processes until the manufacture was completed, and that was of uncertain time. The Messrs. Cook were enabled by this plan to turn out a complete carriage in a day, of a quality which enhanced the admiration that the time of the operation had awakened. Their business has gradually expanded, until they now turn out ten per day, with the same facility with which they formerly turned out one. The engraving on another page gives an idea of the extent of their establishment, which covers two acres, and affords 85,000 square feet of floor room. It has grown to this extent from one building, on one third of an acre, with 3,000 feet of floor room. There are in the concern 24 separate departments, under 24 distinct foremen, each of whom is responsible for the part of the work performed in his department. All of them cover every branch of the business, from the rough lumber to the boxing up of the complete vehicle. The orders are all laid before Mr. Kimball, one of the firm, and by him 24 blanks are filled up with minute particulars of the jobs delivered to each foreman, with the time specified for the completion. These foremen have 300 workmen employed in all the departments, each of which is also supplied with every variety of machine that invention and experience have suggested to facilitate the work, and these are driven by a steam engine of great power. This huge giant with its thousand arms obeys every movement of the 300 human workers, and the surprise of the observer who sees rough lumber wrought up into pleasure-wagons at the rate of *one an hour* is merged in admiration of the intellectual combination that produces such results.

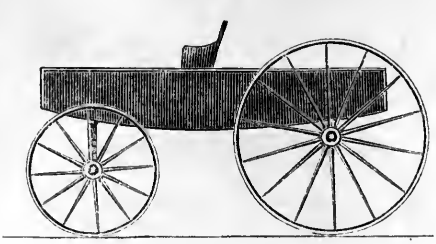
It is such enterprise and success as this that drew from the London Jurors of the World's Fair, the following remarks in their report: "Comparing the state of the art of carriage-building," say the London Jurors, in their report on carriages exhibited at the World's Fair, "of former and not very distant times, with that of the present, we consider the principles of building in many respects greatly improved, and particularly with reference to the lightness, and a due regard to strength, which are evident in carriages of British make; and especially displayed in those contributed by the United States, where there is commonly employed in the construction of wheels, and other parts requiring strength and lightness combined, a native wood (upland hickory), which is admirably adapted to the purpose. The carriages from the continental states do not exhibit this useful feature in an equal degree."

The woods most used in the construction of carriages, ash, oak, and hickory, grow of superior quality and in great abundance in the neighborhood of Philadelphia, and the fact gives the art of carriage-making there great advantages. There are in that city over 30 factories that produce pleasure-carriages. The capital invested is some $600,000, and over 800 hands are employed. The vehicles are mostly for city use, with some export demand. One of the largest factories of the city, Roger & Co., occupies 40,000 feet of work room, and employs 125 men in all the departments of designers, body-makers, wheelwrights, carvers, painters, platers, trimmers, upholsterers, etc. The wagons of that establishment have a good reputation. In New York, the carriage business is pushed to a great extent. The demand for heavy vehicles for the great cities is large, and the effect of railroads, in spreading the population of the city over a radius of 40 miles around it, has caused a considerable demand for pleasure-wagons. Some persons who would have no use for a vehicle in the city, in adopting a suburban home, found a carriage a necessity. The aggregate of the business in the state of New York in 1855 was given by the state census of that year as follows:—

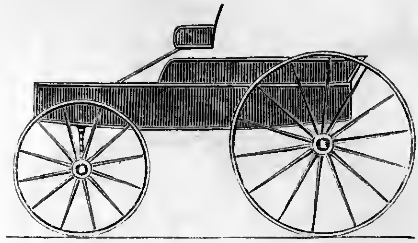
CARRIAGE AND CAR MANUFACTORIES IN NEW YORK.

	No.	Hands.	Capital in tools.	Value of materials.	Value produced.
Felloe factories	6	30	$13,250	$21,450	$45,174
Wheel "	2	12	3,500	2,800	11,100
Hub "	1	5	600	400	9,000
Spoke "	16	64	15,950	14,966	52,331
Coach and wagon factories	1,397	6,391	471,530	1,712,256	5,005,125
Car factories	26	1,547	264,784	679,239	1,274,768

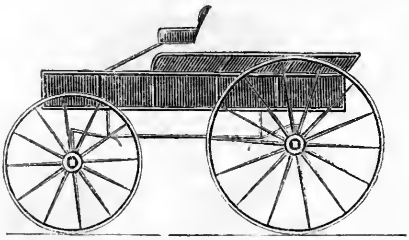
The number of cars made per annum is 580, and there are used 1,472,000 feet of lumber in their construction, and in that of wagons, 6,562,200 feet. There are 11,151,500 spokes made. The number of wagons turned out is 33,138, and of sleighs 3,838. The size of some of these factories, and the number of vehicles turned out, are surprising. The numerous depots for carriages in the city, contain every possible description of vehicles, and of all manufactures. The carriage manufacture in New Jersey stands next in magnitude to that of New York. This is mostly at Newark, where great numbers are turned out, of an approved quality. A feature of the carriage and wagon business that has been introduced of late years, is that all possible parts of vehicles can be purchased in any quantity, consequently the wheelwright business of small towns has been entirely revolutionized. They can no longer make an entire vehicle as formerly with any success, but purchase wheels, axles, top frames, springs, etc., of any and every pattern, to put together and finish. All these parts are produced in great quanti-



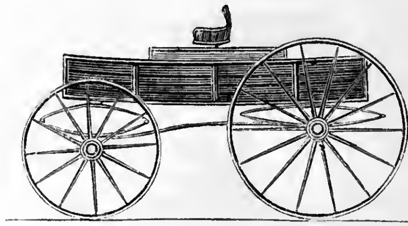
1810.



1820.

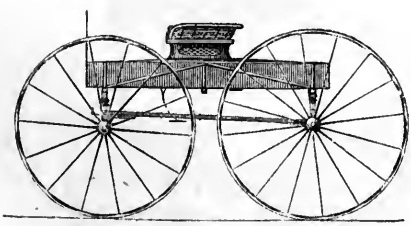


THOROUGH BRACE—1825.

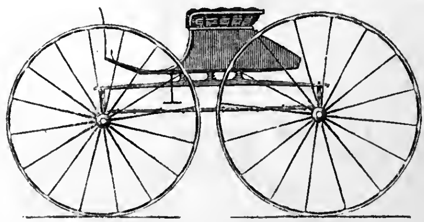


FIRST ELLIPTIC SPRINGS.

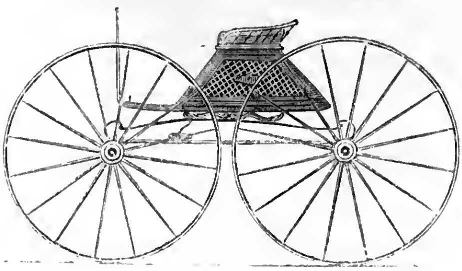
The following are a few of several hundred styles manufactured by Messrs. G. & D. Cook & Co. at the present time.



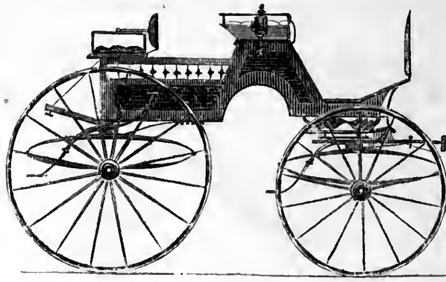
JAGGER.



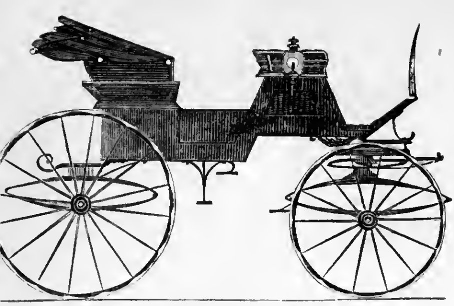
GAZELLE.



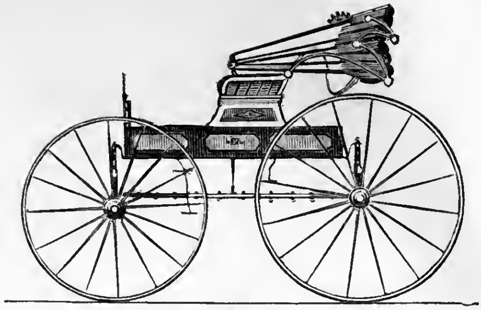
CRICKET.



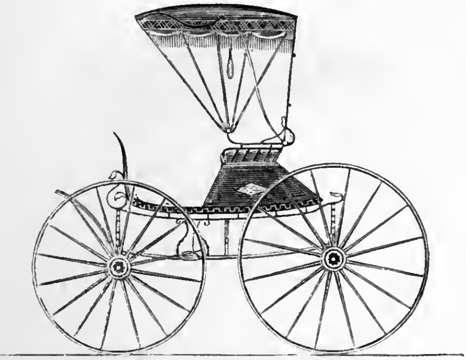
FRENCH DOG CART.



ENGLISH PHAETON.



BOX JUMP SEAT.



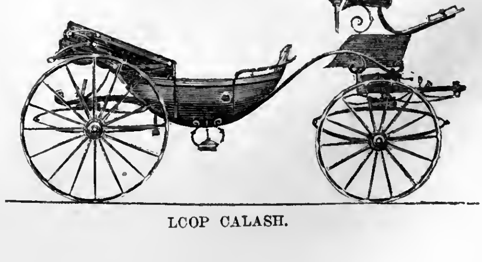
WORLD'S FAIR BUGGY.

EUREKA JUMP SEAT.

CHILD'S SEAT DROP FRONT.

CRESCENT CITY.

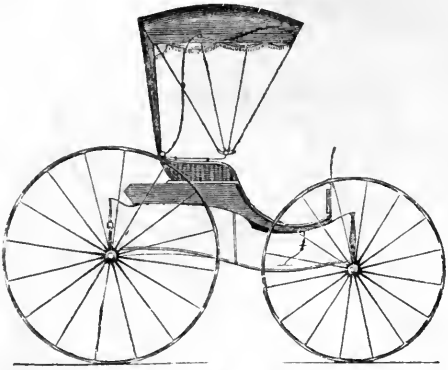
LAWRENCE BRETT.



LOOP CALASH.

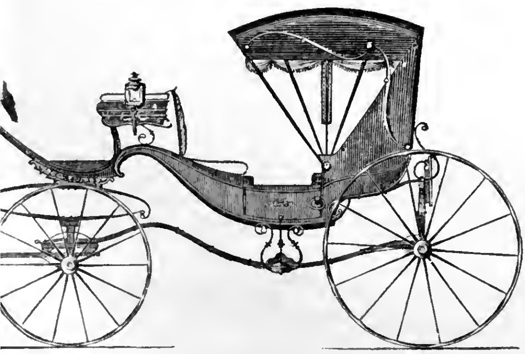
DOCTOR'S PHAETON.

FULL TOP CABRIOLET.

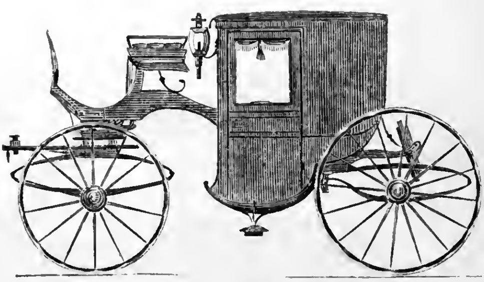


CHAMPION.

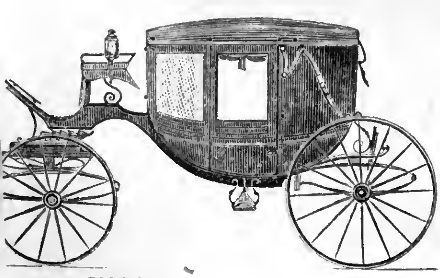
PRINCE OF WALES



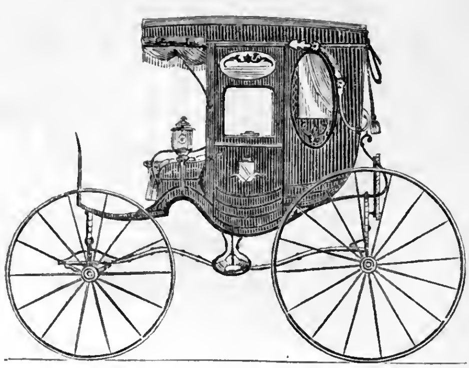
DAYTON BRETT.



CITY COUPE.

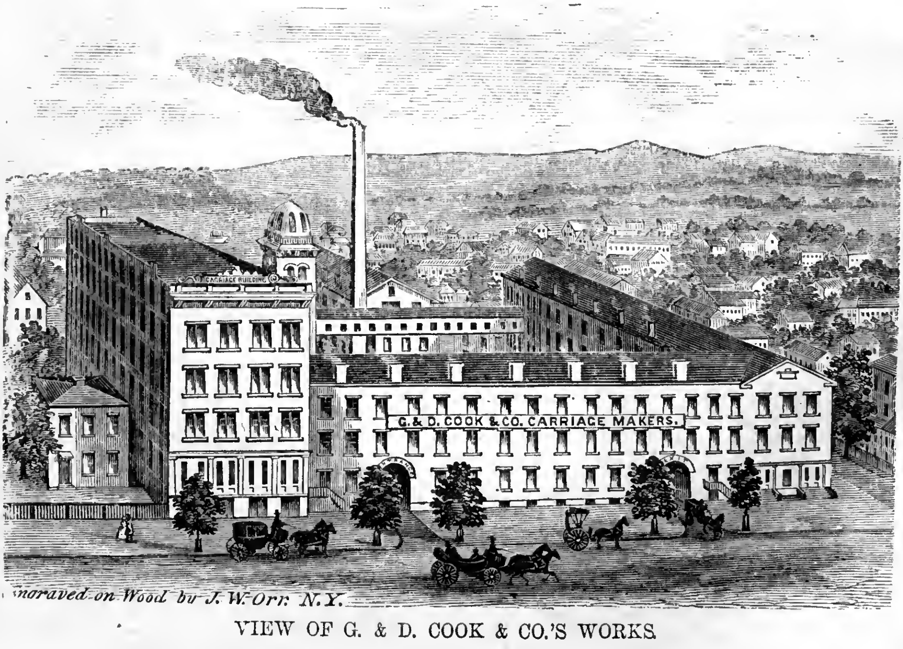


BREWSTER CALASH COACH.



COUPE ROCKAWAY.

PREMIUM TOP.



VIEW OF G. & D. COOK & CO.'S WORKS.

ties, by machine. Hence, as we see, there are in New York, 16 spoke factories, which turn out 1,115,500 spokes per annum, also felloe factories and hub factories, etc. The largest city factories, however, make most or all the parts within themselves. In the production of a vehicle, the design is first prepared, whether buggy or coach or rockaway, on paper, $\frac{3}{4}$ of an inch to the foot. The design being approved by the purchaser or owner, a geometrical plan is executed upon the black-board. The patterns are then cut in the wood, and from this skeleton the shape and proportions are determined. There must be exercised in this process, the utmost mathematical exactness. The wooden frame is now removed to the smithy; then come in requisition, springs, tires, hinges, axles, bolts, locks, and every variety of form by which iron can conduce to the strength of the fabric. This being completed, the skeleton is moved to the body department, to receive its floors and panels, the sides with their proper curvature, the seats of the destined construction, and the doors with their trimmings. From this room, the body goes to the paint room. This is a tedious process. From 15 to 18 coats of paint are applied, each being rubbed down with pumice stone. When it is dry, several coats of white lead and litharge, succeeded by a number of white lead and yellow ochre, complete this "priming," on which the finishing coats of ornamented colors are charged. When it is clothed in its pride of paint, it seeks the trimming room, to be decked with fine cloths, silks, lace, carpet, embossed leather, or the finest morocco, and becomes as tasteful as art can make it. While the body of the vehicle is thus being prepared, the carriage, or wheels, axles, perches, and shafts have also been approaching a state ready to receive it. The felloes, shafts, and nave, each of its appropriate and well selected wood, are combined into wheels, that must in size bear a certain proportion to the body. The average difference between the fore and hind wheels is eight inches. In the combination each department supplies its proper part, and when ready to receive the body, that is hung upon the springs, and the whole is ready for the final polish. Apart from the coach or pleasure-vehicle business, is the wagon business, which is of great extent, all the parts being formed by machines of late invention. The lumber for these heavy vehicles is of considerable dimensions. The plank used is three to four inches thick. This must be all well seasoned. Hence capital is required to keep a sufficient stock on hand, since it requires four or five years to season, or one year for every inch of thickness. The timber for hubs is of black locust. This, of different sizes, has the bark removed, and is bored through the centre to facilitate the seasoning. All the lumber thus seasoned in stock, is, when ready, removed to the saw mill. Here machines are usually ready to shape every part: upright and circular saws to cut the plank into shafts and felloes after it is marked; planing machines, and mortising machinery; lathes for turning spokes and hubs; for boring holes for the spokes; for driving in the spokes; for shaping and finishing the felloes; for boring holes in the hubs to receive the boxes, so as to insure a solid bearing, and for turning the hubs, of which the two ends are cut off at once by circular saws. All these machines soon turn the solid plank into finished wheels, while the body is growing under similar applications in another room, under the direction of various departments. The iron axles are turned in the machine shops, where also all the tires, bands, straps, bolts, rivets, etc., are prepared and applied. The wagons are then ready for the paint. This is the general operation of wagon-making in large establishments. In Philadelphia two concerns furnished 550 wagons for the Utah expedition of the government in five weeks, or at the rate of 16 wagons per day, or a wagon in 45 minutes.

The demand for express wagons that has grown up of late years, has become very large, and they are produced in great perfection as respects strength and price. Another large demand for vehicles has taken the shape of railroad cars, and these almost rival coaches in the extent of manufacture. In New York, the value of production is nearly $1,500,000 per annum, mostly at Troy. The car wheels are of iron, and the utmost care is taken in the manufacture of them, that when cast the iron shall cool equally in all its parts. For this purpose, when the wheel is cast in a mould, it is removed as speedily as possible into a circular chamber or furnace, composed of fire brick, $4\frac{1}{2}$ inches thick, and surrounded by an iron case. When they are there deposited, the opening is closed, and the heat of the whole is raised to nearly the melting point. All the avenues to and from the interior are then closed, and the whole is left to cool gradually. By this process of raising the heat, the temperature of the wheel is equalized in all its parts, and as the heat can then only subside through the wall, it cools so gradually that all parts of the wheel contract alike. For this cooling 4 days are required. While red hot the wheel is removed, and having its edges packed round with sand, the centre is made to communicate, by means of a flue, with a chimney 120 feet high. The draught thus created cools the centre. The same, if not far greater importance attaches to the uniform toughness of the iron of a wheel as to that of a cannon. The lives of hundreds of passengers are always depending upon the soundness of the running wheels, and the utmost care is taken to make and keep them sound.

The census of 1860 gives the following statistics of the production of carriages, wagons, carts and children's carriages for the year ending June, 1860. There has been, generally, an increased production since that period, though what were distinctively known as "southern carriages" are manufactured in less quantities than formerly. During the war, immense numbers of army wagons and ambulances were built.

	No. of Establishments.	Capital invested.	Cost of raw material.	Males employed.	Females employed.	Annual cost of labor.	Annual value of product.
Carriages	3,917	$14,131,537	$9,085,301	27,304	157	$10,001,891	$26,848,905
Wagons and carts	3,305	4,591,968	2,812,981	9,639	2	3,415,925	8,703,937
Children's carriages	32	134,470	108,393	335	22	129,540	374,350

CLOCKS AND WATCHES.

Perhaps there is no one article of more general utility than "Yankee clocks," and none on which more small wit has been expended both at home and abroad. The land of "wooden clocks and nutmegs" has been a standing jibe against those who have so cleverly and perseveringly executed those practical ideas that tend directly to the amelioration of the human condition. When we look around and reflect that every house, hut, and hovel in the length and breadth of the land is, or can be, supplied with an accurate time-keeper for one dollar, that is to say, a bushel of grain, and reflect that thirty years since comparatively no time-keepers existed within reach of the masses of the people, we begin to perceive that Yankee clocks are by no means so contemptible a commodity. Doctor Franklin demonstrated that "time is money," but the people at large had no more means of measuring their time than of money to count. Alfred the Great and other old progress men discovered the value of time, and were hard put to it to measure it out. Some of the old fellows sought to do it by the dropping of water; many marked the progress of the sun; and other devices were employed without very great accuracy. Alfred contrived twelve candles, which being burned one after the other, divided his day into twelve portions, which had each their special employment. Twelve candles were not convenient, however, to carry in one's fob, and were troublesome to light and snuff. If a Yankee peddler had walked in upon him with a wooden clock under his arm to sell for a dollar, he would far more likely have been hanged as a wizard than sneered at as a humbug. Time-keepers were invented, however, in the process of time, and gradually found their way into the hands of the rich. They were imported into this country from Europe down to the formation of the federal government, at high prices. Some of these were the pendulum clocks, some six feet high, and generally stood in the landings of the old houses. About the time of the formation of the federal government, however, Eli Terry, of Windsor, Connecticut, made some clocks of wood, of a small size, to hang up against the wall. In 1793, he began making them, as a business, in Plymouth, Connecticut. Then he made a few in the year by his own labor. In 1800 he had procured the help of a couple of young men. The wheels were marked out on the wood with square and compass, and then cut out with a fine saw and jack-knife, the teeth of the wheels being formed in the same manner. Twice a year Mr. Terry would pack up some of these clocks and make a journey into the new country, by which name the region west of the North River was then called. There he found sale for his wooden "movements" at $25 each. He so prospered in this, that by the year 1807 a number of persons in Waterbury associated themselves into a company to furnish Terry with stock of which he was to make the movements. To execute this formidable work, he bought an old mill, introduced some machinery, and laid out a lot of 500 clocks at one time, a larger number, it is said, than was ever before undertaken at one time in the world. Mr. Terry used to sell his clocks himself at a price of $25, but of course money was not then obtained. Salt pork was currency, and when he took the clock out of his saddle-bags, he put salt pork in the place of it. In 1810, Mr. Terry sold his factory to Thomas & Hoadley, and competition springing up the price of the wooden movements was reduced from $10, the then price, to $5, at which low price some of the manufacturers failed. In 1814, Terry invented a new style, called the pillar scroll top case, about 21 inches high. These sold for $15 freely, for many years, and he made a fortune of some $200,000. At this juncture Chauncey Jerome became an apprentice to Mr. Terry, and the works being extended, a circular saw was introduced for the first time, and it was a great curiosity. Jerome began when of age to make a few clocks for himself, and sold them at $12 each. He continued the business under many vicissitudes, making large quantities of clocks that were sent all over the Union, and sold by means of peddlers. An occasional new form to the clocks gave a renewed impulse to the sales, the growing competition between the clockmakers continuing to force down prices. The panic of 1837 had a disastrous influence upon the trade, ruining almost all the manufacturers. Up to that time the clocks had been altogether of wood, of which it was difficult to procure the right description. When this was obtained it required a year's seasoning, and then it was a slow process, even with machines, to cut out the works. The largest manufacturer had never made more than 10,000 per annum. These clocks were one-day clocks, but good time-keepers. In 1837, Mr. Jerome invented the one-day clock with brass works. This invention proved a new era in the clock business, and buried the old wooden works. From that time the business made very rapid progress, and the clocks not only found their way all over the Union, but also to Europe, India, China, Australia, and elsewhere. The old wooden clock could not well be exported, because exposure to the humidity of the ocean air caused the works to swell in a manner that ruined them. This difficulty the brass works did not encounter. The new business improved very rapidly under the demand for the clocks, which was continually stimulated by the gradually falling prices. The old wooden dial was supplanted by one of zinc, and an eight-day clock, which would have cost $20 in 1837, can now be had for $4. The one-day clock is sold for 75 cents, and is an excellent timekeeper. The brass works of the clocks are made from the metal sheets with the greatest rapidity. The oldest manufacturer, Mr. Jerome, states that three experienced men can make 500 clocks in one day from the sheets. There are in every one-day clock from 8 to 10 wheels; an eight-day clock requires more. All these wheels are cut from the brass at one operation, pressed out and levelled for use. The expense of three days' work is thus distributed through 500 clocks, not quite 1¼ cents each clock. The whole cost of the movements was 50 cents each. The frames of the clocks are also made in large quantities by machine. For the body of the case, common merchantable pine lumber is used. The boards are by circular saws cut into suitable lengths for sides and tops. Those free from knots are then by another saw cut into their proper widths, and go to the planing machine. They then are by an appropriate instrument cut in the shape designated for the fronts. The pieces are then taken by a workman who spreads glue upon them, to receive the rosewood or mahogany veneer. These are then in lots of a dozen placed in hand-screws until dry. When ready, the veneer is polished by applying it to a revolving cylinder covered with sand paper, by which it is soon sufficiently polished to receive the varnish, of which several applications are made, and it requires about ten days to dry. They then receive a polish and are put together in the form of the case. It was usual to have 10,000 clocks undergoing this process at once. In this manner a case would cost 50 cents, 20 for labor and 30 for stuff; a cabinet-maker could not make one such under $5. The dials are cut by machinery from sheets of zinc, the holes being punched by the same operation. They are then painted and the letters and figures printed on. One man could print 1,200 to 1,500 in a day. The whole dial would thus cost 5 cents. The tablets printed in a similar manner, and colored by girls, cost 1½ cents each. The glass and work 4 cents. The weights cost 13 cents. Thus the complete clock would cost about $1.25, a price brought about by the systematizing of the labor.

The great clock factory of Chauncey Jerome was one of 31 that were in operation in 1852. It had been merged into a joint-stock company in 1850, called the Jerome Manufacturing Company. In 1853 and 1854 that concern produced 444,000 clocks per annum; another factory, that of J. C. Brown, produced 100,000 clocks per annum, and failed subsequently; and the Ansonia Company, which was afterward formed, 150,000 clocks per annum. The sharp competition of all these companies reduced the price to such a degree that many stopped. In the ten years ending with 1856, four factories were destroyed by fire, nine failed, and five closed on account of low prices. There remained 13 factories, of which six produced 95,000 per annum, and the remaining seven, 48,000 clocks. In 1855 the great showman, Barnum, became a member of the Jerome Clock Company by selling a clock factory which he owned in Bridgeport to the Jerome Co., and taking stock of the company in payment. In the same year the Jerome Co. failed utterly; its owners allege, because the debts of the company bought from Barnum ruined them, while the assets of the concern were of no value, and the extensive financiering to stave off these liabilities, swallowed up all the means of the Jerome Company. The result was almost a complete sweep of the clock business. The New Haven Clock Co., which succeeded to the business of the Jerome Co., is now the largest factory. Its method of making dials, etc., is the same as was that of the old company. There is also the Benedict & Burnham Co., at Waterbury, Conn. The factory of Seth Thomas & Co., at Plymouth, is the next largest. The factory of William L. Gilbert, of Winsted, is also important. The factory of E. N. Welsh, of Bristol, is the successor to the business of J. C. Brown, who failed. These five companies now make most of the clocks manufactured in Connecticut. The New Haven Co. produces about 200,000 per annum, and the other four companies about 300,000. There are other parties engaged in making clock movements and parts of clocks, and one house in Bristol makes thirty-day brass clocks that keep excellent time.

From Connecticut, by the perseverance of these energetic men, the clocks have spread over the face of the whole country, ticking in almost every store and dwelling of the Atlantic cities, and almost every log hut of the frontier. Nor have they been confined to this country. In 1841 they were introduced by Mr. Jerome into England, exciting there great surprise and indignation at the presumption of the Yankees with their wooden tickers. The tariff laws of England permit the owner of goods to enter them at his own price, on which the duty is to be cast. If the officer thinks that price too low he can take the goods at 10 per cent. advance on it. The first cargo sent by Mr. Jerome were entered at regular prices, but these appeared so ridiculously low to the officer that he paid the 10 per cent. and seized the goods. The owners, nothing loath, brought forward another lot, which met the same fate; but on presenting the third the officer had become a wiser man, and let the Yankees do their own business. Jerome's clocks had there a great run, and they also tell the time to the people at Jerusalem and Joppa. The Chinese have been taught to use them, and a Yankee clock marked the time when the emperor fled from Pekin.

While Yankee clocks have had such an extensive and important run during the present century, the making of watches has been undertaken only within the last ten years. The originator of the business was Mr. E. Howard, of Boston, and a successful business is carried on at Roxbury, Massachusetts. A distinctive character of these watches lies in that part of the watch which constitutes the main feature of difference between the English and Swiss watches, and which gives to each its national characteristics, so far as the principle of their construction is concerned. In the English watches, the motive power is conveyed to the train or wheel-work by means of a chain and fusee; in the Swiss watches, the motive power is conveyed to the train directly by means of what is termed the "going barrel." In the American arrangement, is employed neither the fusee nor the going barrel, but the stationary barrel, in combination with the maintaining power. The stationary barrel has indeed been found in watches made a hundred years ago; but in all such watches the stationary barrel is very impractical, as they are minus the maintaining power, and are consequently liable to stop while being wound up. But by the direct application of the maintaining power to the fixed barrel, are obtained several very important advantages over the chain and fusee, and also over the going-barrel arrangement. These facts add much to the character of American-made watches, and in point of nationality, afford features of difference to distinguish them from the foreign watches.

The perfection with which machinery is adapted to fine work, is beautifully illustrated in the works of the Waltham Co., which we believe is the only one in the world where all the parts of the watch are perfected under one roof, and systematized so that all the parts of one will fit any number of others. The different parts of the mechanism of foreign-made watches are cast and cut laboriously by hand, separately, and often in places remote from each other, then sent to the finisher's to be polished, fitted together, and set up. Not only does this arrangement involve a vast amount of expense for the time and labor employed in the execution, but it necessarily results that no two of these pieces can ever be so precisely alike as to render it possible to substitute one for the other, and that the whole mechanism, made thus in different places by skilful, mediocre, and inferior workmen, can never be adjusted with the same precision as though manufactured in one establishment, under the supervision of a single head. These difficulties have been obviated by the American Watch Company. Every part of the watch is cut in their establishment by the aid of machinery, graduated to microscopic exactness, and working with a delicacy of touch that the fingers would strive in vain to emulate. The pieces are thus cut exactly alike. The jewelling department in this establishment is under the direction of the most skilful artisans. The precious stones, rubies, sapphires, or chrysolites, inferior only to the diamond in hardness, and resembling grains of brilliant sand, are drilled by the diamond's point into pivoted reliances. They are then opened out with diamond dust, on a soft, hair-like iron wire, their perforations having certain microscopic differences. In like manner, the pivots of steel that are to run in these jewels, without wearing out in the least, must be exquisitely polished. By this operation their size is slightly reduced. The jewels and pivots, after being thus finished, are classified by means of a gauge, so delicately graduated as to detect a difference of the *ten thousandth part of an inch.* The jewels are classified by means of the pivots, the jewels and pivots of the same number fitting each other exactly. The sizes of the several pivots and jewels in each watch are carefully recorded under its number, so that if any one of either should fail in any part of the world, by sending the number of watch to Waltham, the part desired may be readily and cheaply replaced with unerring certainty.

By the old method, the processes of boring holes and shaping wheels and pinions, and bringing them to a size, were done by the drill-bow alone, a slow method, and depending wholly on the quick eye and steady hand of the workman, who only acquired the requisite skill by long years of apprenticeship. At Waltham, all this is done by lathes connected with a steam-driven shaft, and the boring or cutting tools guided by machines of most ingenious contrivance, so as to make the pieces absolutely uniform in all their dimensions.

Take, for instance, a pinion, which is made out of the solid steel wire drawn for the purpose. Some of this is drawn plain and some with grooves for the teeth. In either case, the arbor or axle is turned to the exact size and taper required to fit the holes in the jewels, and the teeth cut to their shape and distance, all by various machinery, and with such absolute uniformity that any one piece will fit to its place in any other watch of the same pattern. In like manner, the stones for pivots are first cut, and then rounded and brought to a size, polished, and fitted for use by machines, tended by young women, who acquire the requisite skill by a few weeks' practice. Little screws, so minute that it takes one hundred and fifty or two hundred thousand to weigh a pound, are cut from the wire with surpassing rapidity, threaded, and the heads finished with complete accuracy.

The tools and mechanical movements by which all these results are so completely accomplished, are nearly all of original contrivance, and if fully and scientifically described, would excite general admiration for their ingenuity.

The works admit of the employment of 220 hands, and can turn out 50 watches per day. Of about 125 pieces that go to make a watch, some pass through 50 hands before they are finished.

ELECTRO-PLATING.

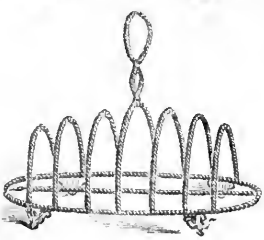
It is now scarcely a score of years since this wonderful art began to attract attention, and it has become of great importance in many departments of industry. By its means an exact copy of any surface may be obtained in a metallic layer, as of a page of type, a medal, or coin. This impression obtained, being backed with more fusible metal, becomes a duplicate of the original article. This branch of the art is called electrotyping, and some account of it is given in respect to type elsewhere in this volume. The other branch of the art, by which the metal held in solution may be made to settle upon and to cover permanently the surface of objects ornamental and otherwise, is called electro-plating or electro-gilding. The discovery that this might be done was made early in the present century, but it was not followed up as a useful art until 1839, when Mr. Jordan published an account of the manner in which he obtained impressions of engraved plates and other matters. Attention was then directed to it. Previous to 1836 silver-plating or gilding was executed in the old way or various ways. Iron was gilded by polishing its surface and then heating it till it acquired a blue color. When this was done leaf gold was applied, slightly burnished down, and exposed to a gentle fire, after which it was burnished again. Copper or brass may be gilded in the same manner. Gilding metals by amalgamation was effected by forming the gold into a paste or amalgam with mercury, and was chiefly employed for gilding silver, copper, or brass. The metal being well cleaned, is dipped into the amalgam or spread over with it, when a quantity will adhere to the surface. The metal is then exposed to the heat of a furnace, which volatilizes the mercury, leaving the gold adhering; this is afterward burnished. In this way buttons and similar articles are gilded.

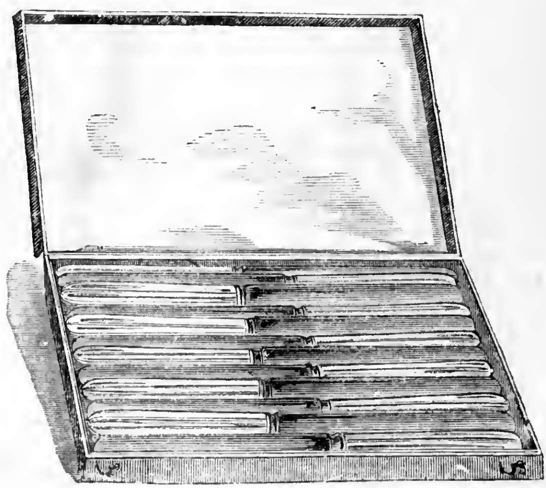
Ornamental figures may also be delineated in gold upon steel by a very ingenious process, by means of ether. Gold is dissolved in nitro-muriatic acid, and a quantity of ether is added, and the mixture shaken. The ether will then take the gold from the acid, and an ethereal solution of gold will be produced, which is separated and applied to the surface of the steel by a camel hair; the ether will evaporate, leaving the gold on the surface of the steel. The metal is then heated and the gold burnished. In this way sword-blades are ornamented. Instead of ether the essential oils may be used.

Making gilded trinkets was brought to such perfection that the use of real gold was very much diminished. The most elegant patterns are struck in thin copper, and then gilded so perfectly as not to be distinguishable in a general way, while new, from gold, and with proper care they will last for a considerable time; but when the gilding does wear off, the color cannot be restored, as in the case of jeweller's gold. These were the processes in use up to 1836, when Mr. Ames was one of a committee sent to England by the government to acquire knowledge in aid of a government arms manufactory, and his attention was attracted to the subject of depositing silver by electricity, which was then being discussed, and its theory established. No process of depositing the silver upon any base metal, as german-silver, had been discovered. Subsequently, pursuant to some suggestions of Professor Silliman, it was discovered that prussiate of potash would hold the silver in solution without oxidizing the baser metals. This removed a part of the difficulty, but there yet remained to deposit any given weight of silver that might be required. This was also removed by the discovery of the cyanide solution. From that time the art of depositing the precious upon base metals gained ground, and has since become important.

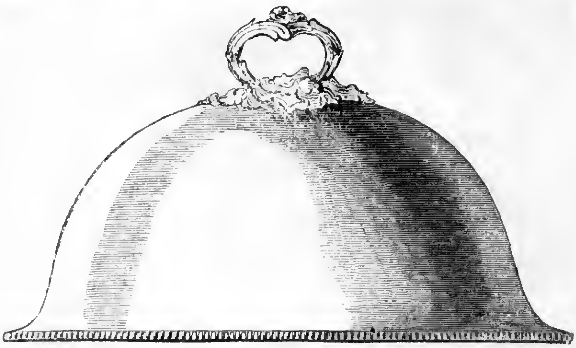
The early process was to dissolve sulphate of copper in a vessel, and to suspend a zinc plate by wires soldered to it, and the object to be coated by the same wires in the liquid facing the zinc and very near to it. On the application of the electric battery, the zinc dissolves, and about the same amount of copper deposits itself upon the object to be coated, which is attached to the negative pole of the battery. A quantity of sulphate of copper is suspended in bags in the upper portion of the liquid to supply that which deposits. In electro-plating with gold or silver there should be a constant motion sustained, in order to aid in equalizing the deposit. In plating, the utmost care is to be taken to remove all traces of grease by boiling the object in alkali. This process is extensively employed for giving a very thin coating of silver to german-silver, britannia, pewter, or brass, by which they have all the apparent beauty of the precious metal. The mode of dissolving the silver

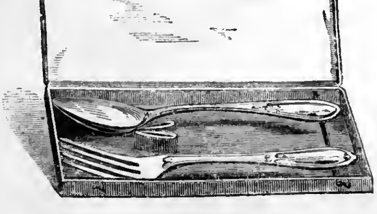
The following few engravings are a selection from among 500 different patterns of articles manufactured by Messrs. ROGERS, SMITH & Co., in Hartford, and show the beauty of design and elegance of finish to which this branch of American industry has attained.





HOFFMAN—KNICKERBOCKER, ALBANY.





was originally by pure nitric acid; distilled water then being added, the silver is precipitated as a cyanide by a solution of cyanide of potassium. The precipitate being collected and washed, is dissolved in a solution of cyanide of potassium, and this is used for silver, in place of the sulphate of copper used for the deposit of that material. The object is more conveniently obtained by connecting a plate of silver with the positive pole of the battery, suspended in a solution of cyanide of potassium, and allowing the current to pass until the silver begins to deposit upon the negative pole. To insure the adhesion of the silver to every part of the object to be coated, it is well washed in an alkaline lye. The copper wire is then attached to the object, which is dipped in nitric acid, and then placed in the solution; after being in it some minutes it is taken out and well brushed with sand. It is then replaced in the solution, and in several hours' time it will have acquired a coating of dead white silver as thick as tissue paper. It may then be burnished or polished with a hard brush and whiting. The strength of the battery makes a difference in the hardness of the silver. When the battery is weak, the deposit is soft, and it hardens with the increase of the magnetic strength, accompanied by continual motion, which also equalizes the deposit up to a certain point, beyond which the silver changes to a black powder. To produce the natural hardness of the hammered metal, it is requisite to preserve certain proportions between the size of the silver plate and the object to be plated. If the time of the operation is prolonged, the deposit may be thickened to almost any extent. To deposit a plate as thick as ordinary writing paper, will require $1\frac{1}{4}$ or $1\frac{1}{2}$ oz. of silver to 12 square inches. The pure metal thus deposited is as durable as that used for silver coin. By the electro-plating process all ornaments, however elaborate as designs, however complicated they may be, can be produced as readily and in as great perfection as in solid silver. The most elaborate epergne or the plainest tea or dinner-set is wrought and plated in the perfection of the purest silver. Door-plates, knobs, bell-pulls, cutlery, etc., all come within the scope of this rare art. The manufacture is carried on in New York, New England, and Philadelphia, on a great scale; but perhaps the house of Rogers, Smith & Co., of Hartford, the first that engaged largely in the business, has retained the relative magnitude of its position. Their manufactory is a very extensive one, employing many hundreds of hands at the same time. They make more than fifty different patterns of tea-sets, and their ware excels in richness and durability. Their ware has found its way into private families, hotels, and steamboats to a considerable extent, and also swells the volume of the national exports.

In electro-gilding the metal is dissolved in nitro-muriatic acid, when the chloride of gold thus obtained is digested with calcined magnesia. The oxide precipitated is washed by boiling in nitric acid, and is then dissolved in cyanide of potassium. The temperature in gilding copper should be at least 130° F., and in gilding silver still higher. The positive plate of the battery must be of gold, and the negative of iron or copper. Some of the metals, as iron, steel, lead, do not readily receive the gold in deposit (unlike banks in that respect), but, being first covered with a light coat of copper, the gold is deposited upon that. The copper may be said to act in this case like the mordant in calico printing. The solution should contain as much gold as will perfect the desired work at once. In this operation the smallest quantities produce the most extraordinary effects. The almost infinite malleability of gold is well known, and its capacity to "spread itself" upon properly prepared metals beats that of a 4th of July orator. An ordinary watch-case may receive a heavy coat on the outside and be well covered within, and yet the expenditure of gold will be only 20 grains, or the value of one dollar. "A magnificent gold pencil-case" will have cost 3 grains of gold, or 16 cts. worth. The expense of tipping a taper finger with gold for sewing is 5 cts., and probably that is all it is worth since sewing-machines have laid both thimbles and sailors' palms upon the shelf.

It is easily understood that the introduction of such an art as this should have at once superannuated the old system of plating. Progress is being continually made, and in New York machines have been introduced and applied to practical operation in electro-plating.

FISHERIES.

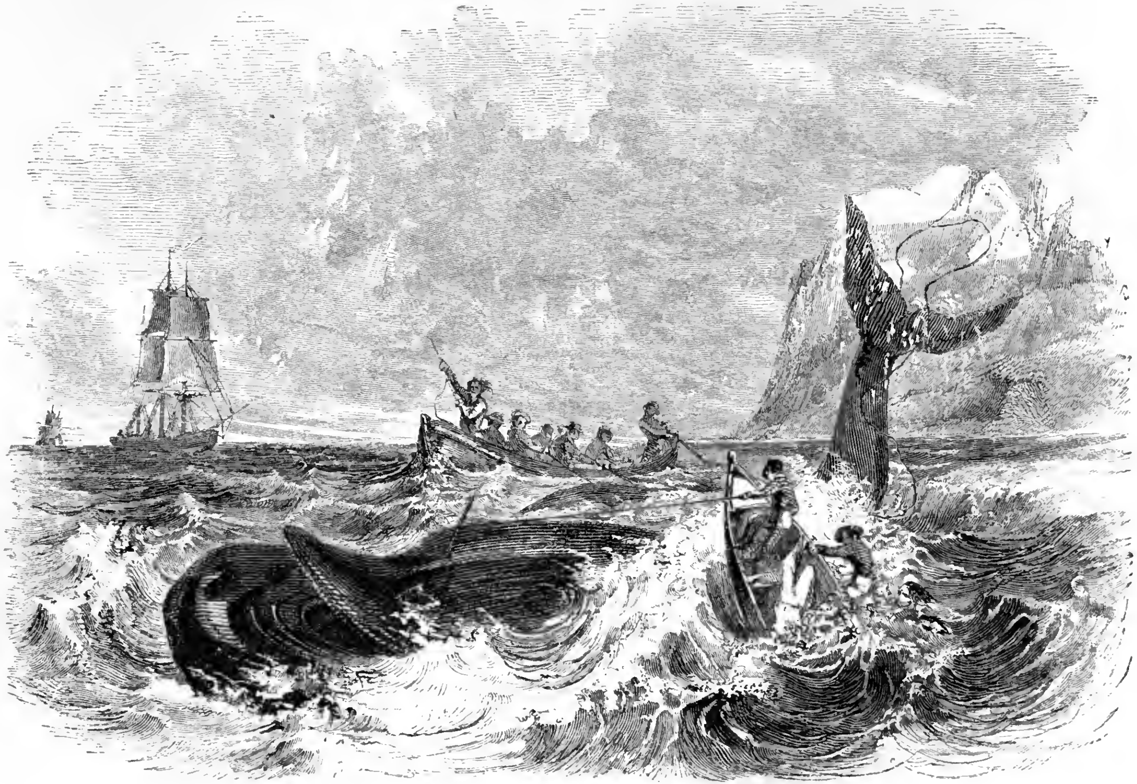
The fisheries, as we have elsewhere shown, were the first successful industry of the colonies, and they laid the foundation of our national commerce and marine. The results are not singular in this respect, since the most flourishing commercial countries of the modern world owed their origin, like the Romish church, to the "poor fisherman." When the subjects of ancient Rome, flying before the hordes of Attila, retreated to the lagunes of the Adriatic, nothing remained to them but the sea and its treasures. This pursuit enabled them to rear on the rocks that had sheltered them, the proud Venice which awed the world, and whose power fell only when the republic had become a corrupt oligarchy, and the young general Bonaparte, the agent of a new republic, called them to account. With the same origin Genoa grew into the dominion of the seas, and encountered the same fate when wealth and corruption succeeded the humble virtues of the founders. The Dutch, from a band of herring-catchers, whose collection of fishing huts was called Amsterdam, carried on that system of energetic industry that conquered Holland from the sea, and prevented the future encroachments of that element by dikes; while the country grew rich and so powerful that the successors of those old herring-busses carried a broom at the mast-head in token of the sovereignty of the seas. To them succeeded the English, whose fishing-nurtured marine, coupled with an aptitude for commerce, gave them the mastery over the wealth-enervated Dutch. The English felt the maritime sceptre to tremble in their grasp for the first time, when the New England trained fishermen met them in battle, and almost every engagement resulted in the triumph of the "bit of striped bunting." But warlike supremacy is the least of the triumphs, since the commercial and maritime superiority has every day become more manifest, from the moment Paul Jones "began to fight" and "old Stewart" out-manœuvred the Engish fleet, to the success of the yacht America in the British waters. In that period the Yankee fishermen have carried the stars and stripes to every corner of every continent and shown them to every isle of the ocean. The vigor and address with which the New Englanders early embarked in the cod and mackerel fishing, and built vessels with which to prosecute it, not only excited the admiration of the mother country, but roused the alarm of the government, who foresaw, in their industry and intelligence, the causes of the defeat they sustained a century later.

About the time of the Declaration of Independence, the trade growing out of the cod fishery furnished the northern colonies with nearly one half of their remittances to the mother country, in payment for goods. All the seaport towns were engaged mostly in it, and thus grew in proportion to the success of that business. Under these circumstances, the fishing rights were a very important part of the negotiations entered into at the peace. The general result of the negotiations was that the Americans might catch fish anywhere except within three miles of certain English colonial coasts, and might land to dry and cure on the southern side of Newfoundland and other convenient coasts. Congress, by law, also granted a bounty to vessels of which all the officers and three fourths of the crew were American citizens. The bounty was altered from time to time, and as it now exists under the law of 1855 is as follows: If the vessel is more than five tons and not more than 30, $3\frac{1}{2}$ per ton; more than 30 tons, \$4. The allowance of one vessel during the season, whatever may be her tonnage, cannot exceed \$360. The bounty paid out in the last 12 years amounts to \$4,046,929, or \$337,244 per annum average. The whole amount paid since the formation of the government has been \$12,944,998, and the following states were the recipients:—

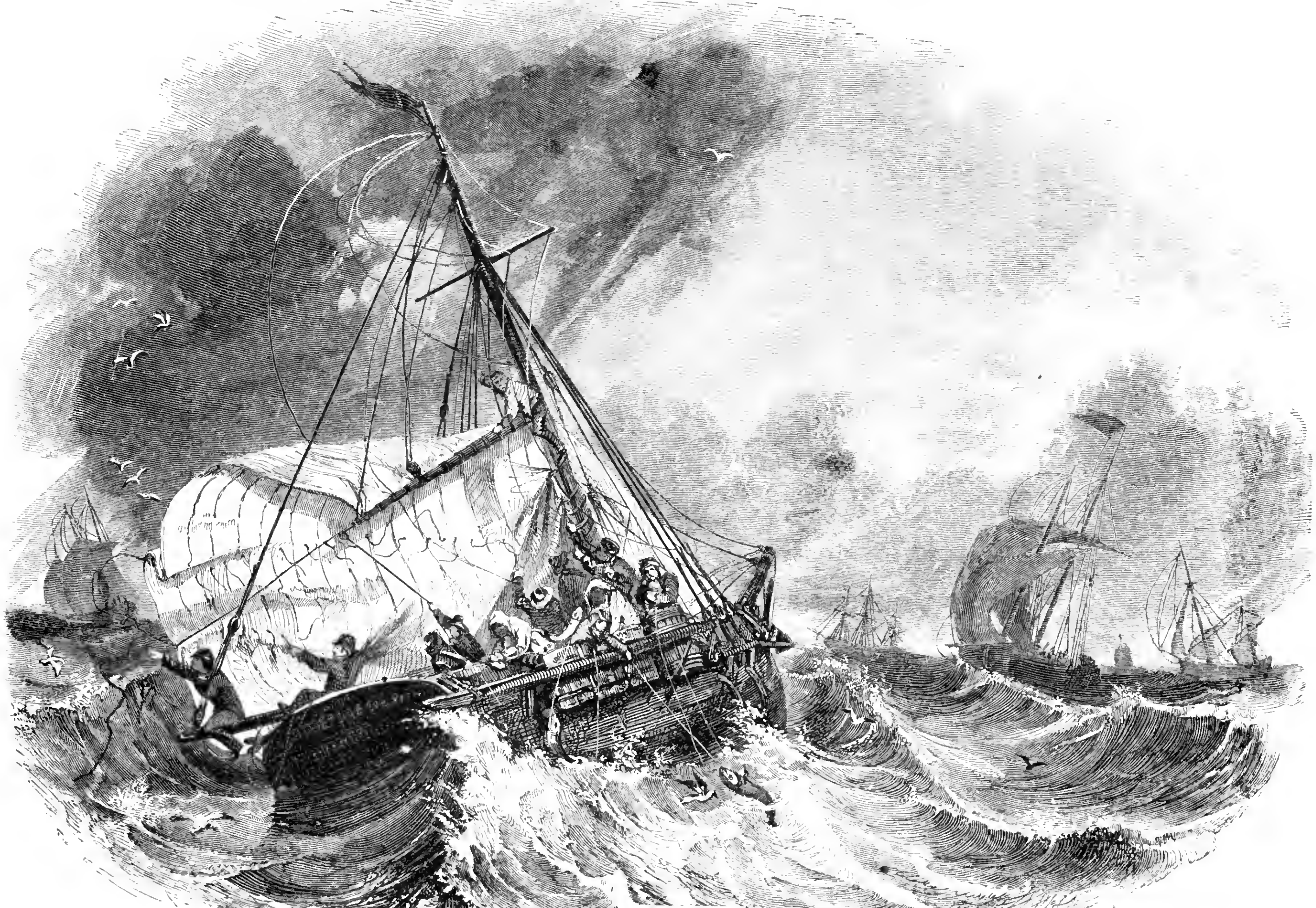
STATES THAT RECEIVE THE FEDERAL BOUNTY.

Maine	$4,175,050
New Hampshire	563,134
Massachusetts	7,926,273
Connecticut	182,853
Rhode Island	78,895
New York	18,319
Virginia	479
Total	$12,944,998

The cod fishery is the most important, if we take the number of tons employed as the guide. In 1795 there were 37,000 tons of shipping so employed. At present there are 110,000 tons employed in the business. There are several ways in which the fishing-vessels are fitted out. The leading one is for six or seven farmers with their sons to build a schooner during the winter. When the spring crops are in, they fit out the vessel with the necessary stores and go on board to make the voyage before harvest. They proceed to the "Banks," the Gulf of



WHALE FISHERY.



COD FISHERY.

St. Lawrence, or Labrador, and, with a good catch, get home in time to harvest. From the proceeds of the voyage they pay any outstanding claims for outfit, draw the government bounty, and divide the proceeds. After harvest they make another voyage, the catch of which is not dried, but salted down for home use, under the name of mud fish. Another plan is to charter a vessel from the owner, merchant, or other, in a company of 10 or 15, on shares; the owner finding the vessel, and nets, and salt for his share, which is usually three eighths of the whole catch. The men supply provisions, hooks, lines, and the salt for their share of five eighths of the fish. One of them is selected to navigate, for which service he gets $4 or $5 per month; otherwise he turns in to catch fish, or to work with the rest. The first spring voyage is usually made to the Banks; the second either to the Banks, the Gulf, or Labrador; and the two fall voyages also generally to the Banks.

Fish here are all caught with hooks, and are taken from the bottom. Each fisherman has a strong line, of from sixty to seventy fathoms in length, to which is attached a lead of a cylindrical shape, weighing about five pounds. This of course is the sinker. From this proceeds the "pennant," which is a cord about twice the size of the line, and is about three feet in length. To the lower end of the pennant, and attached to it by a small copper swivel, is the "craft," which is a small stout cord about two and a half feet in length, having three strips of whalebone laid around it at the middle, where it is attached to the swivel of the pennant. The whole is then serried or wound round with tarred twine. On each end of the craft is a smaller swivel, to which the gauging of the hooks is attached. The whalebone serves to keep the hooks about a foot apart, so there is little danger of their becoming entangled with each other.

The men arrange themselves on the windward side of the deck, throw over their leads, and unreel their lines, till the lead rests on the bottom. It is then drawn up so that the hook will be on the bottom with the down pitch of the vessel, and with nippers drawn on their fingers to keep the line from cutting them, they lean over the bulwarks, patiently awaiting a bite, which is known by a slight jerk on the line. They then give a sudden pull, in order to hook him, stand back and haul in the long line, hand over hand, until the fish is hauled up to the surface, when he is taken in on deck, unhooked, and thrown into a square box, which each man has fastened by his side, called a "kid." The hooks are then baited and hove over again, and the fisherman, while the line is running, picks up the fish caught, and cuts out his tongue.

Toward night, the fish are counted out from the kids, each one separately, and thrown into a large kid near the main-hatch, called the "dressing-kid." They are counted aloud as they are thrown along, and each man is required to keep his own account and report to the skipper at night, who keeps a separate account for each man on the log-book. The dressing-gang, consisting of a "throater," a "header," a "splitter," and a "salter," now commence dressing down. After passing through the hands of the first three, they assume somewhat the shape seen in market. They are then passed down between decks to the salter, who puts them up in kenches, or layers, laying the first tier on the bottom of the hold, and building up with alternate layers of salt and fish till the kench reaches the desired height. The decks are then washed down, sails taken in, and the vessel anchored for the night.

A popular, though somewhat dangerous method, called "trawling," has been employed of late years. The trawl is a long rope, with from twenty to a hundred lines depending from it, to which hooks are attached as to the common line. The rope is kept at the surface by means of keg-buoys, each one marked with the vessel's name, to prevent any dispute as to ownership. The hooks are baited and the trawl got clear and ready, and it is then taken in a dory some distance from the vessel, and set. It is generally, we believe, set at night, and hauled in the morning. The very laborious duty of hauling the trawls is performed also in dories, by two or three men in each. Occasionally, nearly every hook has done its work, but most frequently from twenty to fifty fish are the reward of their toil. Sometimes trawls are set at a distance of five or six miles from the craft, and not unfrequently do the trawl-men get astray from their vessel. In this case, they generally board some other vessel, if one is lying near, or drift about for hours until they find their own.

The herring fishery, which was formerly very abundant, has of late years fallen into decay, for the reason that the great schools that formerly visited these shores have ceased to come, most probably because the waters resorted to by the fish to deposit their spawn have been obstructed by dams, mills, etc. For the same reason the once abundant salmon has now become scarce. The indentures of the apprentices in colonial times were said to have contained clauses that the apprentice should not be compelled to eat salmon oftener than thrice a week. Since then, through scarcity, that fish has risen to $2 a pound, at certain seasons. Streams that once afforded supplies for domestic consumption and thousands of barrels for export, now supply less than the local demand. Along the Maine waters forty years ago two hundred a day for three months in the year was not extra. A boy of 15 would take 1500 in a season with a dip-net. They probably caught them all, for very few are seen of late years. Until within twenty years salmon were plenty in the Merrimac river, but they have been driven away by turbine wheels. Of the Delaware, Susquehanna, Hudson, Connecticut, and Thames, the same story may be told of former abundance and present scarcity. As an instance of relative values, one shad was formerly thought equal to three salmon, but in certain seasons one salmon will now be worth a bushel of shad. The Aroostook river is now the source of greatest supply, but the chief quantity that comes upon the market is from the colonies. On the Pacific coast, as far south as the Columbia river, they are still abundant. In that river a navigator asserted he purchased a ton of salmon for a jack-knife. There are those who already anticipate a dinner in New York upon a Columbia river salmon, to be brought by the Pacific railroad. Some seven years ago the same table on Lake Erie presented Kennebec salmon side by side with Lake Superior salmon-trout.

The halibut fishery on George's Banks is an enterprise of recent years. It is pursued in mid-winter, and few occupations, even on the ocean, are more hazardous. This delicate fish is packed in ice, and sent by railroads, sound and sweet, to the most distant markets.

Before the construction of railroads, the whole number of halibut annually caught and brought into Cape Ann, did not exceed 2500, which were nearly all sold fresh for immediate consumption; for not having been in demand, when cured in any manner by salt, for the domestic or foreign markets, but few were prepared for that purpose. In fact, so worthless were they considered as salted fish, that the owners of the vessels employed in the fisheries generally instructed the crews to cut adrift all the halibut which were drawn up, and every year many thousands had been thus turned back to the deep with a fatal wound. But such was now the facility of transporting them *fresh* to the New York market, that at least 16,000 were taken, and a large portion of them sent to that city by the railroads and steamboats.

The mode of taking halibut is as follows: The lines are thrown over and allowed to sink to the bottom; a heavy lead is attached, for the under current on the Banks is very strong; the fish takes the hook by suction, but the force of suction is sufficient to enable the fisherman to discover that he is "thar;" then commences the "hauling in," and the reader may believe it is no joke to haul in a line, in a rough sea, of some eighty or ninety fathoms in length, with a fish of from twenty-five to two hundred pounds' weight at the end. Sometimes the fish comes up very readily to the surface, but in most cases it is necessary to "drown" it, by drawing it some ten or twenty feet from the bottom, and very suddenly letting go. This last process is of course a very tedious one. The fish upon coming to the surface is seized by a "gaff," an oaken pole or stick with a strong hook attached, drawn on board the vessel, and thrown into the ice-house. Each man keeps account of the number of fish he takes, of which he receives the proceeds from one half the amount of sale.

Formerly the halibut was only caught late in the spring and during the summer and autumnal months, on the south shoals of Nantucket, along the coast of Cape Cod, in Barnstable Bay, on Cash's Ledge, and some other places, where they were most abundant at certain seasons of the year, and always in deep water, being considered, as it is termed, a *bottom* fish. But since the demand for this American turbot, as it may with propriety be called (for it much resembles that delicious fish in form and flavor), has so vastly increased, the fishermen have made explorations in search of other haunts, and, to their great astonishment, found them in immense quantities on

George's Banks, early in March; and what was still more surprising, and a fact until then entirely unknown to them, they appeared in extensive shoals on the surface of the water, like mackerel, and were taken with but three or four fathoms of line, instead of from 26 to 70, which they had been accustomed to use time out of mind in the *bottom* fishing. The Cape Ann vessels take from 200 to 500 each trip, weighing from 25 to 200 pounds.

The fish is packed and shipped mostly, if not altogether, in Boston, and thence sent to the most distant points of the South. It much surprised the epicures of New Orleans when it popped out of the ice-box in the market, not only by the strangeness of its appearance, being altogether unknown in those parts, but also by the delicacy of its rich flavor.

The growth of this fishery has been so rapid that from a small beginning it has in a few years increased to $60,000 per annum, and employs 75 nearly new and well-adapted vessels, chiefly owned at the port of Gloucester.

The mackerel fishery was one of the earliest pursued, but it did not reach much importance until the close of the last century; and it is now mostly confined to Maine and Massachusetts. There are about 30,000 tons employed in it, and the number of barrels caught annually will vary from 131,000 to 360,000 barrels. Nearly the whole of the business is carried on in Massachusetts, the other states doing but little in it. A few vessels from Maine and Connecticut fit out at Gloucester, the chief place for that industry. The merchants of Philadelphia, New York, and Boston have their agents at that place to purchase and ship for them. There are now employed in it over 1000 vessels and 10,000 men. The value is given as follows by the inspector general of Massachusetts:—

Value of vessels and outfits in Massachusetts, ...	$6,032,000
Value average of catch, ...	4,400,000

The American mackerel-catchers took of this fish one year as follows: 188,336 barrels in American waters, and 140,906 barrels in waters now claimed as the exclusive right of the Earl of Derby.

Gloucester sends out annually about four hundred schooners, ranging from 65 to 110 tons, and averaging 90 tons. Their crews for the mackerel fishery generally consist of from 10 to 14 men, according to the size of the craft; for the cod and halibut fishery, of about 8 men. The vessels are nearly all of a clipper build, fore-and-aft rig, and are valued at an average of about $4000. Most of them have all the conveniences of a mechanic's house on shore, and their cabins will generally compare, in a due proportion of course, with the cabins of any merchant-ship. It is the fisherman's pride that his craft shall compare in beauty with any other he may meet. In Gloucester the value of shipping tonnage is $1,600,000. In the months of May and June, nearly all the vessels owned in the port commence "fitting out" for the Bay of St. Lawrence, in which locality, for the past few years, mackerel abound in the greatest numbers. The "fit-out" consists in the craft being newly painted, rigging and sails renovated, anchors and cables replenished, if necessary, men shipped, and bait, salt, and provisions taken on board. She is then ready for a start. For the first few days of the passage all hands are busily employed in arranging or deciding for their fishing quarters at the rail. The best men are generally given positions near the main rigging, which is considered the most advantageous, as the fish usually rise there in greatest numbers. The men are shipped "on shares," as it is termed, *i. e.* each man is entitled to one half the fish he takes—the other half going to the vessel. After about a week's sail they arrive at their destination, which comprises the Bay of St. Lawrence, from Cape Breton island on the south and Prince Edward's island on the west to the mouth of the St. Lawrence on the north. When arrived, bait is got up and ground. The "toll-bait," as it is called, is generally menhaden, or porgies, a small bony fish, little used as an article of food. This is supplied in great quantities to each vessel. It is finely ground in a mill provided for the purpose, then mixed with water, and it is ready for use. Upon the appearance of a school of mackerel, which is indicated by a rippling of the surface of the water not unlike that of the schools of herring, the vessel is "hove to," and the "toll-bait" thrown. The fish will generally follow this bait to the side of the vessel, where all hands are at their quarters, and anxiously awaiting the first "bite." And now commences a general excitement. Each man has his barrel by his side, and to those who have never seen the operation, the rapidity with which the fish are taken from the water is almost incredible. The men are also provided with two lines each, and upon a "strike," which means when the fish bite rapidly, these lines are in constant motion, and what seems strangest of all is the fact, that although a space of only about a foot and a half or two feet is allowed to each man for himself and his barrel, it is very seldom that the lines become entangled, even when the school being at some distance from the vessel, some 15 or 20 fathoms of length of line is required, and the fish, as soon as the hook is felt, dart hither and thither with the rapidity of lightning. After a "deck" of mackerel is obtained (which signifies a goodly number of barrels), all hands immediately prepare to put them in salt. The operations of "passing up," "splitting," and "gibbing" are gone through, and they are packed in salt in the barrels. This, with a plenty of leisure, when the fish are "slack," or do not take the hook, is the routine of the Gloucester mackerel fisherman's sea life.

The process of netting and seining is used very little, it being a much easier and safer method to take them by the hook and line.

Numbers of city and country people make trips in these fishing craft in summer season, from the fact that the business is of a healthful nature, and is a pleasant and very convenient manner of enjoying a few weeks' leisure.

These schooners make two or three trips each season, starting about the middle of May or first of June, on their first voyage, and returning in October or November from their last one. A "good trip" is considered to be about 250 to 300 barrels.

The oyster trade is a large and general one, and pervades most of the towns and cities of the Union, having spread with the facilities of transport to points that distance before deprived of the bivalvular luxury. The oysters are of a great variety of species, seemingly dependent upon the locality where they are fatted. Large numbers of oysters taken from the original beds are unfit for market until they have been *planted* or transferred to a favorable locality for them to fat. The different localities impart to them various flavors, more or less salt, and which are difficult to discriminate otherwise than by the name of the place where they were fatted, as "East Rivers," "Shrewsburys," etc. The setting, planting, and bringing them to market occupy a great number of men and no inconsiderable tonnage. They attain a marketable size in about eighteen months, and breed very rapidly. When the oyster vessel arrives in the spring from the South, it is anchored near the site of the proposed bed. The cargoes are then put into small boats that come alongside. The beds having been staked off into small squares, about 50 bushels are spread over one of the squares in such a manner that no oyster shall be upon another. By the fall, the oysters will have considerably increased in size, and greatly improved in flavor. If allowed to remain too long in sheltered waters, the oyster not long acclimated will perish with the rigor of the northern winter. The breeding time of native oysters is in April and May, from which time to July or August, they are said to be sick, or *in the milk*, and in most localities laws forbid taking them until the first of September, with a view to favor their growth. They are then caught in a net, which has on its lower edge an iron scraper. This being attached to a rope and cast over from a boat, is dragged along the bottom by a forced motion when rowed by the fishermen. The iron scraper turns up the oysters and they are retained in the net, which from time to time is drawn up to be emptied. When the water is shallow a pair of huge tongs are used to pick up a number at a time. In some places the drag or dredge is very large and heavy, and is drawn along by the vessel under sail. This process is forbidden by law in some districts, since the heavy drag crushes and destroys as many as it catches. When the season sets in, the fishermen crowd the waters where the oysters are to be had, and sell their catch in the neighboring cities. The larger dealers buy their oysters in Virginian waters, and carry them North to plant until they are fat. The value of the Virginia oyster trade has been given as follows, showing the destination of the oysters :—

	No. of bushels.	Value.
Virginia cities..........	1,050,000	$1,050,000
Baltimore..............	3,500,000	3,500,000
Philadelphia...........	2,500,000	2,500,000
New York.............	6,950,000	6,950,000
Fair Haven	2,000,000	2,000,000
Total.............	16,000,000	$16,000,000
Other cities, Providence, etc.	4,000,000	4,000,000
Total	20,000,000	$20,000,000

It has been estimated that the oyster trade of Baltimore is more valuable than the whole wheat trade of Maryland. The whole shores of the Chesapeake Bay are admirably adapted to their growth, and they reach maturity in one year. There are there 250 vessels engaged in the business, and their catch is 900 bushels every trip of ten days, and the annual aggregate is 4,800,000 bushels. The average value being 50 cents per bushel, the value is $2,400,000 paid by the Baltimore dealers. Some of these houses send West over the railroads 8 to 10 tons of canned oysters per day. The shells sold for manure are put at 6,000,000 bushels annually, worth two cents per bushel, or $120,000. The Long Island Sound oysters were originally from Chesapeake Bay. These oysters cost originally 25 cents, and the freight is 15 cents. The native oysters, or what are considered such, being propagated from old plants, are taken mostly for the city trade, while the transplanted oysters find their way all over the country by railroad. To preserve them they are first opened and put into kegs or cans of a capacity of 12 to 20 gallons each. These are then put into boxes and surrounded with ice. There are some 250 vessels employed in carrying oysters to New Haven. There are about 20 houses engaged in the business, the largest having branches in Buffalo, Cleveland, Hamilton and elsewhere. These firms employ a great number of boys and girls in opening the oysters. The operation is performed with incredible dispatch by the experienced hands. The instruments used are a hammer to crack the edge on a slip of iron fixed upright in the bench, and a knife. The latter is always held in the hand, while the hammer is seized, the blow given, and dropped, the knife inserted, and the oyster being seized between the knife and the thumb is pitched into the tub. The movement produces a constant click-gouge-splash, click-gouge-splash, as the tub rapidly fills with the "bivalves" previous to packing. The openers get 2 cents a quart, and they earn from $1 to $2 per day. There are 150 oysters to the gallon, and to earn $2, 100 quarts, or 3750 oysters must be opened, or during 12 hours 50 per minute!

The sea-coast by no means monopolizes good fishing. In and about the great lakes there are 35 varieties of fish, and it is said that a larger number and variety of fish ascend the Maumee river in the spring to spawn, than in any other river on the globe. These fish give rise, as a matter of course, to a large business. The number of barrels caught annually is some 42,000, which may be divided as follows: Lake Superior, 3000; Michigan, 15,000; Huron, 14,000; Erie, 3000; and 7000 barrels in Detroit river. Being sold at an average of $11 per barrel, the aggregate value is some $462,000. About one sixth of the whole quantity is trout, the remainder white fish. The mode of taking them is by "gill nets" set some ten miles from the shore. Considerable numbers are taken when, having been up Detroit river from Lake Erie to spawn, they are on their return. There are about 50 fisheries on the river. In some of the rivers that flow into the lakes, great quantities of pickerel are caught, say Fox river, Wisconsin, 1000 barrels; Saginaw river, 1500 barrels; St. Clair, 15,000 barrels; Maumee, 3000 barrels, and as much mullet, bass, etc. The annual product of the lakes and tributaries is given as follows:—

	Barrels.	Value.
Lakes	35,000	$385,000
Detroit river	7,000	77,000
Other rivers	10,000	85,000
	52,000	$547,000

One of the most remarkable fisheries is carried on in Long Island Sound and some other localities. It is the taking of what are called bony fish for manure. These fish go in immense schools, which show themselves in ripples upon the surface of the water. They are taken by nets, which may be seen by the steamboat traveller, hung upon immense reeds at the water's edge to dry. These nets are weighted with lumps of lead at the lower edge, having floats at the top, so as to keep them upright in the water. The fishers, in boats, pay out the net from one and the other, and encircle the school with it. The two ends then being carried to the shore are drawn in with great force, and an immense haul of fish results. With the bony fish, many of a better class are caught, but if the aggregate will not equal 150 cart-loads it is not thought large. These fish are spread upon the land as fertilizers. They are far better for the land than for the neighbors, who for miles round suffer odors not from "Araby the blest."

The whale fishery began at the close of the 17th century, in Nantucket, and that has been, until very recently, its chief location. About the close of the revolutionary war, Massachusetts employed 183 vessels, of 13,820 tons, navigated by 4,059 men, and producing about $2,000,000 per annum. The business has progressed until the American seamen have nearly driven all others from the seas in that pursuit. England, to encourage her whalers, imposed a duty on foreign oils, but finding her fishers coming home more frequently without oils, while her wants were greater, and the American whalers offering to supply it, she "caved in," and took off the duty, in order to encourage her own manufacturers. Our own whalers have never had the bounty of the government like the cod fishery, to encourage them, but have on the other hand been compelled to encounter the opposition of "prairie whales," which yield their lard oil, and the multitudes of inventions of patent oils from coal and other substances, while from the growing scarcity of whales, that desert their old feeding grounds, the extreme difficulties and dangers of the business are continually increasing. Nevertheless, the hardy American seamen continue to chase them, even into the extreme arctic regions, whither the whales resort, as it was said by an old "ship's lawyer," to supply the "northern lights" with oil. In spite of all these difficulties the business has grown, probably in consequence of the peculiar manner in which it has always been conducted. The voyage being projected by the owners, the officers and crew are shipped on "lays," every man having an interest in the voyage. If the voyage is not successful he gets nothing, but if the usual success is met with, he gets a certain number of gallons proportioned to the whole, and is thus interested in the price as well. The shares of officers and men equal one third of the whole. This system has developed a spirit of enterprise and hardihood never surpassed, if it was ever equalled by any other nation. The largest seat of this business is now New Bedford, and the next in importance is New London. Fair Haven ranks next, and Nantucket has declined to the fourth position in relative importance. The annual report of the United States Secretary of State of a late date contained the following statistics of the trade, to which is added a summary of the capital and value of all the fisheries, according to the best authorities, official and experienced:—

				Value.
Vessels employed,	661	Sperm oil, bbls.	193,300	$7,571,812
Tonnage, "	203,062	Whale " "	153,850	3,392,392
Seamen, "	16,370	Whalebone, lbs.	1,538,000	1,076,600
Total value of product				$12,040,804
Value of vessels, outfit, advances to seamen, etc				$16,625,000
Supplies by masters				793,000
Money paid to officers and men for their shares				4,013,601
				$21,431,601
Add interest and wear and tear				2,004,621
Total investment				$23,436,222

The value of all the fisheries, including the whale, may be summed up as follows:—

	Vessels.	Ton'ge.	Capital.	Persons.	Valne.
Whale	661	203,062	23,436,226	16,370	$12,040,804
Cod, mackerel, etc.	2,280	175,306	7,280,000	19,150	8,730,000
Oysters, etc.					25,000,000
Lake, etc.					2,375,000
Fish for manure					260,000
Total					$48,405,804

The "cod, mackerel, etc.," includes shad and other marketable fish. The item for oysters, etc., includes the turtle, clam, and other shell-fish.

ICE.

"Hast thou entered into the terrors of the snow, or hast thou seen the terrors of the hail?"—Job.

For how many years, not to say centuries, was the vast icy wealth which nature confers upon northern latitudes in such profusion, and within reach of every individual, utterly unappreciated and neglected! The use of ice was indeed known to the luxurious few in remote ages. The ancient Romans learned to cool their choice wines with frozen water, and almost in every age, the "upper ten" were acquainted with its merits. Like education, and suffrage, and freedom of opinion, and toleration in religion, it however became known to and extended among the people only under our federal government. It is now no longer regarded as exclusively a luxury, but has become a necessity. Under almost all circumstances water is made palatable by it, and wines are improved by its application. The introduction of water into large cities by aqueduct, is made acceptable to citizens not only in the summer but also in the winter by the use of ice. The excuse for ardent drinks based on poor water, is removed by the possession of ice, since tepid water is rendered attractive by it. When water is thus rendered agreeable, the temptation to indulge in strong drinks is diminished. By its use, also, the supply of food is virtually enhanced, since the surplus of districts, that might otherwise be lost, can be sent to a considerable distance to supply the wants of large cities. The surplus supplies that may thus accumulate, can be preserved for a longer time by the use of ice. The fruits of the West Indies may be preserved in the northern cities, and those of our own orchards are by the same means preserved for the markets of India, Brazil, and the West Indies. Packet ships no longer carry live fowls and pigs, since a small ice-house may be packed with fresh provisions for the voyage. The markets of all large cities are provided with hundreds of ice-chests, in which fresh provisions are preserved free from taint. Fishermen have become greatly dependent upon ice, which enables them to keep a large and full supply of fish in every variety, and almost every family has its refrigerator or ice-box, which, regularly supplied, is the recipient for butter, milk, and other food. Thus families are as readily furnished with ice as with milk. To country houses and substantial farmers, ice-houses have become a necessity for the same general reasons.

Not the least important use of ice is its medical applications. It is a reliable tonic and of the safest. In cases of fever it has become of general use. In India the first prescription of a physician is ice, and sometimes it is the only one, and the ice is always American! If India sends us her opium, she gets as valuable a return in ice. That article is also a styptic, and has many important medical applications. All these benefits and many more were annually provided for humanity in the frosts of winter and in the congealing of water, but were disregarded until an enterprising Yankee adopted the notion of harvesting that crop. Massachusetts to be sure has but two crops, and it required two centuries to discover them. For more than 200 years the snow fell upon and melted from her granite hills, before speculation, putting its hand upon them, sent them along the coast by schooner loads as material for palaces. For more than 200 successive winters the clear and sparkling ice showed itself upon her ponds, and vanished under the vernal sun, before enterprise detected in its preservation the means of increasing human enjoyment. Those frozen lakes were each winter covered with gold, but, like that of California, it was long undiscovered. It will, however, never run out, since, without ploughing or sowing, nature sends the annual crop, which like the manna has only to be gathered, and the market for it is ever increasing.

There were many farmers possessed of ice-houses in the middle states, at a date as far back as the formation of the government. But the idea of making a trade of it seems to have occurred first to Frederick Tudor, Esq., of Boston, in 1805. He shipped a cargo in that year from Boston to Martinique. The ice was cut with axes, and carted in wagons to Gray's wharf, Charlestown, where it was shipped. The voyage proved a total loss, as did several succeeding ones, until the war put an end to trade. Mr. Tudor resumed it at the peace, and persevered in face of continued losses, until 1823, when he extended it to the southern states, and the West Indies, and it began to pay. As long as it was a losing business he had it all to himself; as soon as his perseverance had mastered the business and made an art of it, he began to have competitors. Up to 1832, however, he was alone in it, and in that year extended his shipments to Calcutta, Madras, and Bombay, and also to Brazil. These were the first ice shipments ever made to those countries, and they have ever since been good customers. Since 1832, a number of firms have engaged in it. In that year the shipment was 4,352 tons, cut from Fresh Pond. In 1854, it had grown to 154,540 tons.

The use of ice extended itself in all the cities of New England, and in Boston became very general. The quantity there used is about 70,000 tons per annum, against about 27,000 tons in 1847. The ice is cut mostly from Fresh and Spy Ponds; at the former the houses are capable of containing about 87,000 tons. The price of ice for shipping is usually $2 per ton, and rises from that to $6 after mid-winter. The article is served to families at the rate of $5 for the season, May to October, for nine lbs. per day; 15 lbs. are served for $8, and 24 lbs. for $12. When large quantities are served, the price is 17 cts. per hundred, and $3 per ton to hotels when 500 lbs. per day are taken. In New York the quantity used is nearly 285,000 tons. This is supplied in the proportions of 120,000 tons from Rockland Lake; 30,000 from Highland Lake; New Rochelle, 10,000; Athens, 15,000; Rhinebeck, 18,000; Kingston Creek, 60,000; Catskill, 20,000; Barrytown, 12,000. Of this quantity, 113,000 tons are stored by the Knickerbocker Co., and the remainder by four firms. The cities of Newburg, Poughkeepsie, Hudson, Albany, Troy, lay up from 5000 to 20,000 tons each. In central and western New York the use of ice is large. It commenced at Syracuse in 1844 for the supply of a saloon, and it was gradually extended to butchers and families, and the quantity there used is about 10,000 tons, taken mostly from Onondaga Lake, from which it is drawn two or three miles to be stowed in an ice-house. The other cities of western New York have followed the example, and the average price is 20 cts. per hundred. Cincinnati used to draw its supply of ice from its own vicinity; but the railroad facilities permit of drawing it cheaper and better from the lakes. Chicago is well supplied from the same source. In the neighborhood of Peru, Illinois, a large quantity is cut for the supply of the lower Mississippi. It is cut in the winter and packed in flat-boats which are allowed to freeze up in the Illinois river; there is therefore no other ice-house needed. As soon as the river breaks up in the spring, the boats float down stream and supply the markets below. In Philadelphia, Baltimore, and Washington, ice is more important than in the cities of the North. When the weather sets in cold in the early part of the winter, they cut ice in the neighborhood, but the best supplies are from Boston or from more northern lakes. The Atlantic and Gulf cities of the South get most of their ice from Boston, which sends them about 110,000 tons per annum, and further quantities to Havana and the West Indies. Rio Janeiro, Callao, and Peru, Charleston, Mobile, and New Orleans, are large customers of Boston in the article of ice. In New Orleans, substantial brick ice-houses have been erected at a cost of $200,000, and similar arrangements have been made in Mobile for its distribution. The quantity exported to Europe is large, and England takes about 1,000 tons of American ice.

It follows as a matter of course, that where this object of industry and enterprise is formed by nature, the means of conducting the trade will gather around it. Hence the land in the immediate neighborhood of fresh-water lakes at the North rises in value, and good wages come to be earned in the winter by men who at the dull season would otherwise not be employed. The question soon presented itself to those who were engaged upon cutting ice on the same pond as to their comparative rights. This was settled at Fresh Pond by a committee, who decided that each owner should hold the same proportion of the contiguous surface of the pond as the length of his shore line is to the whole border.

The time for cutting is December and January. The "experts" can in the middle of January estimate the value of the crop. When the ice is sufficiently thick to cut, say from nine to twenty inches, the former for home use and the latter for exportation, if there should be snow upon the surface, it is removed by wooden scrapers drawn by horses. There is a layer of what is called "snow ice," that is not fit for market; this must be removed, and for this purpose an iron scraper with a cutting-edged steel is drawn over it by a horse. A man rides upon the scraper, which in its progress cuts several inches of the snow ice from the surface of the clear and glittering article that is to go to market. When this is completed, the field of ice is marked off into squares of five feet each. The marker is drawn by a horse, and is guided by handles like a plough. In the tracks of these marks and cross marks follows the cutter. This is a remarkable invention, which has reduced the cost of cutting ice in the neighborhood of Boston alone, some $15,000 per annum. Acres of ice are thus cut into square pieces, which are then floated off through canals, and impelled by long poles, to the sides of the pond, where inclined planes lead up to the ice-houses; up this inclined plane each piece is dragged with great celerity by a powerful steam engine. In the house it is directed by hand down other planes to be packed away by the requisite number of men. By the aid of steam ten tons of ice may be cut and housed in a minute. With a full power, it is not uncommon to stow 600 tons an hour. Sometimes there are several parties on the pond, each vieing with the other in the rapidity of their operations.

Most of the ice-houses that we have seen are built of wood. Sometimes they are found of brick. They are very high and broad, and are usually from 100 to 200 feet in length. Fresh Pond, Cambridge, Mass., has its shores almost covered with some fifty of these ice-houses. They present a singular appearance, neither looking like barns nor houses; and one unacquainted with the ice business would be almost certain to ask, on seeing them for the first time, "What are they?" The construction of these houses, in which ice is to be stored until sold, must be regulated by the climate—the amount to be stored—the material nearest at hand—and the facility of reaching the shore—the object being to have a cool spot, where the influence of the sun and a warm atmosphere shall be least felt. Added to this, the mass of ice must be preserved as much as possible from wasting, by being surrounded by saw-dust, tan, shavings, rice-hulls, charcoal, or leaves, which must be used in the ice-house, or aboard ship, according to circumstances.

Private ice-houses are constructed in different ways. They were formerly merely cellars; they are now in the most approved methods erected above ground, with a drain under the mass of ice. The opening is generally to the north, and the ice is the better preserved for a double roof, which acts as a non-conductor. The waste of ice is different under different circumstances; shipping ice should not waste more than 40 per cent.; and when shipped on an India voyage of 16,000 miles, twice crossing the equator, and occupying some months, if one half the cargo is delivered it is considered a successful voyage. The cost of the ice delivered is of course affected by this element of wastage. In Boston, it is \$2 per ton; in Calcutta, 2½ cts. per lb., or \$56½ per ton. The use of ice in India, as we have said, is medicinal as well as luxurious, and the demand is generally quick. There is hardly a nook or corner of the civilized world where ice has not become an essential if not a common article of trade. While we admire the persevering energy of the enterprising Yankee, who started the trade amid every discouragement, and carried it to a successful issue, which gives employment to thousands of men, and freights to hundreds of ships and boats, and confers an inestimable blessing upon, we might say, the human race in all warm climates, we cannot but consider how vast a harvest perishes yearly. Hundreds of lakes and rivers in the northern section of the country present their annual harvest of pure ice, and yet they pass away ungathered. How many millions in all parts of the world, even within the limits of the United States, pine during the long summer months of each year for this tonic! The time is coming when every farmer will gather this crop as regularly as his potatoes. When Daniel Webster took his farm at Marshfield, his ice-house cost \$100, and it was filled annually at an expense of \$25. In that he preserved his fresh meat and fish, and prevented his butter from "running away." Sometimes farmers live in sight of fine ponds that would give a plentiful crop, that might be harvested and sent by railroad to good markets, without ever bestowing a thought upon the matter. To get \$2 or \$5 for hauling, would pay their otherwise idle teams at that season well. We may close this notice by an extract from an oration of the Hon. Edward Everett, as follows:—

"When I had the honor to represent the country at London, I was a little struck one day, at the royal drawing-room, to see the President of the Board of Control (the board charged with the supervision of the government of India) approaching me with a stranger, at that time much talked of in London—the Babu Dwarkananth Tagore. This person, who is now living, was a Hindoo of great wealth, liberality, and intelligence. He was dressed with Oriental magnificence—he had on his head, by way of turban, a rich Cashmere shawl, held together by a large diamond broach; another Cashmere around his body; his countenance and manners were those of a highly intelligent and remarkable person, as he was. After the ceremony of introduction was over, he said he wished to make his acknowledgments to me, as the American minister, for the benefits which my countrymen had conferred on his countrymen. I did not at first know what he referred to; I thought he might have in view the mission schools, knowing, as I did, that he himself had done a great deal for education. He immediately said that he referred to the cargoes of ice sent from America to India, conducing not only to comfort, but health; adding that numerous lives were saved every year by applying lumps of American ice to the head of the patient in cases of high fever."

PINS.

The manufacture of pins has reached a great development in the United States, where the most important invention in the art of making them, that of "solid heads," originated. So simple an article as pins formerly required a great manipulation in their production, but are now, like most articles that have been the objects of American ingenuity, produced in great perfection and abundance by machines. Up to the war of 1812, pins, like almost every other article of manufacture, were imported, and, as a consequence, became very scarce when communication was interrupted, and the price rose in 1813 to $1 per paper, of a quality much worse than are now purchased for 6¼ cts. per paper. These high war prices prompted the manufacture, and some Englishmen commenced the business at the old State Prison, at what was called Greenwich village, now a part of New York city. The labor of the convicts was employed in the business. The return of peace bringing a deluge of cheap pins from abroad, put an end to that enterprise. The tools used in the manufacture at the prison fell into the hands of a Mr. Turman, who in 1820 undertook to employ the pauper labor of the Bellevue Almshouse in the manufacture, which was, however, unsuccessful. "Pauper labor" here, it seems, could not compete with pauper labor abroad. A machine had been invented during the war, for making pins, in Boston, but it did not work successfully. The old pins had the heads put on them; but Mr. L. W. Wright, of Massachusetts, invented a machine for making solid-head pins. He carried this to England and operated it there, and the first "solid-head" pins were sold in the market in 1833. In 1832 a pin machine was patented in the United States by John J. Howe. The machine was designed to make pins similar to the English diamond pins, the heads being formed of a coil of small wire fastened upon the shank by a pressure between dies. In December, 1835, the Howe Manufacturing Company was formed in New York for the purpose of manufacturing with this machine. The company moved to Birmingham, Connecticut, where it continues operations with a new patent for manufacturing solid-head pins, got out by Mr. Howe in 1840. In 1838 another company was started at Poughkeepsie, notwithstanding that by an extraordinary oversight pins were under the tariff admitted free of duty, while the wire of which they were made paid 20 to 25 per cent. duty. In 1846 there was much excitement in respect to the pin manufacture, and many machines were invented; few of them, however, succeeded in doing good work. Most of the attempts to manufacture failed. The Poughkeepsie Company was, however, sold to the American Pin Company, Waterbury, Connecticut. About the year 1850 the copper from Lake Superior began to be used for the wire, giving an impetus to the business, and 250 tons were used per annum. Great improvements were made by self-acting machinery superseding a process that formerly required six or seven hands. The old method of sheeting pins, or sticking them on paper, was a tedious process; a good hand could stick five or six dozen papers in a day. By the improved machinery now in use, a hand will stick from 75 to 125 dozen a day, and do the work in far greater perfection. There are three patents in force for improvements in the machines in use for this operation, viz., those of S. Slocum, De Gras Fowler, and J. J. Howe. The present price of American solid-headed pins is only about two thirds of the lowest price at which imported pins of the same weight were ever afforded before the manufacturing was introduced, and for service they are undoubtedly better than the article of which they have taken the place. The American improvements in both the pin-making and the pin-sticking machinery have been for several years in operation in England and some other parts of Europe.

One firm in Waterbury, Connecticut, have in operation an improved machine for the manufacturing of pins which turns out *two barrels* per day. A barrel contains 4,000,000 pins, consequently the product of that little manufactory is 8,000,000 per day, or 48,000,000 per week, and 2,496,000,000 per annum. Well may it be asked "where all the pins go to?" The machine is perfect and simple in its operation. The wire is run into it from a reel, cut off the proper length, pointed, headed, and made a finished pin before it comes out again. From this machine they fall into the hopper of the sticking machine, in which they are arranged, stuck upon papers, and come out perfect, ready for packing for market. This last machine, tended by one girl, does the work of 30 persons by the old process. That is better than pauper labor. There are four other machines in the United States. These operating at the same rate, will make 312 pins per annum for every soul in the Union. There should be a large surplus for export to other countries, and at a profitable rate, after paying freight and charges, since no European machines can compete with this little contrivance.

REFINED SUGAR.

The people of the United States are famous for having a "sweet tooth," and if the story about "pork and molasses" is not quite accurate, it is nevertheless true that a "little sweetening don't go far" in a family, or, to use a New York phrase, *into* a family. The figures show that consumption in the United States is far ahead of any European countries, but is less than that of Cuba, where it is enormous, being to a great extent used in preserves that are largely eaten as well as exported. In the year 1859, the quantity of foreign sugar taken for consumption in the United States was 239,034 tons. The crop of Texas, Louisiana, and Florida was 192,150 tons, making together 431,184 tons of cane sugar. The quantity of sugar made from molasses was 12,053 tons. The crop of maple sugar was 27,000 tons, exclusive of California and Oregon. The result is a total of 470,237 tons, or 1,058,033,000 lbs. Allowing the population of that year to have been 30,000,000, the result is 35½ lbs. per head per annum. In Great Britain the consumption is 28½ lbs. per head, in France 9 lbs. per head, and in Germany still less. In those countries, however, the sugar is used almost exclusively in its refined shape, but very sparingly. During the long wars of Napoleon it was difficult to come by, and the manufacture of beet-root sugar, now so important, grew out of the necessities of that period. A generation grew up in the economical use of sugar, and even to this day in the rural districts, and among some of the old fogies of the cities, no other sugar is used than a piece of the sugar-baker's candy held in the mouth while the unsweetened liquid is drank. The story is told that this piece was formerly, in the times of privation during the war, suspended by a string from the ceiling over the table, and being taken in the mouth by one *convive* when drinking, was allowed to swing to that of her whose turn succeeded. The German idiomatic phrase of "*pass auf*" or "look out" for the next was said to have thus originated. In our own colonies the refiner was not by any means considered a necessary go-between of the cane and the consumer, who went directly to the fountain-head and used the molasses, or "long sugar," not only for his coffee, but to compound his new rum or "white-face" into "black-strap," with which he washed down his pumpkin pie, also sweetened with molasses; and few edibles escaped that sweetening, from a spoonful of brimstone in the spring to a mince pie at Christmas. Refined crept in, and with the use of this article various grades of pure sugars made their appearance. When the plants or canes are crushed in a mill, the juice flows abundantly through a strainer into the clarifier; where, mixed with alkali, which assists the operation, it is raised to a certain heat. It then passes through evaporating coppers, and the scum that arises in the process is removed. In the last copper it is boiled until it will granulate in the boiler. Here it soon ceases to be a liquid, and being placed in hogsheads with holes in their bottoms, the molasses drains out into a cistern below. When quite cured in this manner it is shipped as "brown" or "muscovado" sugar.

The next grade of sugar is "clayed;" when the sugar is properly boiled, it is poured into conical pots, apex down, with a hole in each. When the molasses has drained off, a stratum of moistened clay is spread over the surface, the moisture of which percolating through the mass contributes powerfully to its purification.

"Refined" sugar may be prepared by taking either the clayed or muscovado, redissolving it in water, and after boiling it with some purifying substance, as blood, or other articles, pour it into the conical pots again with the clay application.

The solutions of brown or clayed sugar, boiled until they become thick, and then removed into a hot room, form into crystals upon strings placed across the vessels, and become sugar-candy.

The use of molasses and brown sugar, as we have seen, is by far the most important in the United States. In the year 1857, when the Louisiana sugar crop failed, the importation of these articles reached nearly $57,000,000, and the import contributed principally to the panic of that year. Gradually the use of refined sugar has extended, and in 1850 the federal census reported 23 refineries, having a capital of $2,669,000, and using $7,662,685 worth of raw sugar, perhaps 70,000,000 lbs., and producing a value of $9,898,800. Since that period the business has greatly extended itself. In that year there were two in New York city, Woolsey's and Stuart's. These rapidly increased to fifteen, which together refined 200,000,000 lbs. of sugar, or about half what was produced in the whole United States. The introduction of machinery moved by steam almost revolutionized the business of refining. An important improvement that was made in substituting aluminous finings for bullock's blood, which was always productive of injurious consequences, greatly increased the production and raised the quality of sugar. The raw sugar of the Spanish West Indies and Brazil comes mostly in cases and boxes; that of New Orleans and the English islands in hogsheads; South America generally, Manilla, and the Mauritius send it in bags. When the refiner gets possession of any of these, he empties into a pan with a perforated bottom; through these perforations comes a current of steam which dissolves the sugar. Chemical application then bleaches the sugar or takes all its color from it. It then passes into the vacuum pans to be boiled by steam. The sugar in this process becomes so concentrated that it is held in solution only by the high temperature. The moment it begins to cool, a rapid crystallization takes place, producing the fine grain seen in loaf sugar. When the syrup has boiled sufficiently, it is poured into moulds which are prepared in the loaf form, for the purpose of facilitating the separation of the sugar. The liquor that runs from these moulds is subjected to a new boiling, when it yields lower grades of sugar. The syrup that exudes from this second process is sold as molasses, and the proportion of this is about 20 per cent. of the original quantity.

The art of refining has been carried to greater perfection in this country than in Europe, and so manifestly that no imported article can equal the fine granulated sugars of the domestic manufacturer. The business has spread with the demand for the improved sugars. The increase of the manufacture has also been aided by the federal government, which allows a drawback upon refined sugar exported equal to the duty on the equivalent raw sugar imported. The export of refined sugar was last year 3,141,835 lbs., worth $368,000. The manufacture of sugar into candy and confectionery is carried on to the value of $5,000,000 per annum. Some years since, the bounty or drawback upon refined sugar amounted to more than the duty on the raw article, and was therefore equivalent to an additional bounty on the manufacture. It was not surprising that the business should spread under such circumstances, the more so that modern inventions contributed largely to its improvement. The capital invested in the business is some millions. The value refined in New York is now some $17,000,000 per annum, and the refineiers of Philadelphia have a capacity of some $10,000,000. There are a number of refineries in the eastern states, and some in Baltimore, St. Louis, Cincinnati, and New Orleans. These are sufficient to meet the demand for consumption, and the importation has become unimportant. One of the largest refineries is Stuart's, the annual sales of which are over $3,500,000. The concern works up over 45,000,000 lbs. of sugar per annum, employing some 321 men. The quantity of coal used is from 7,000 to 8,000 tons per annum, and the value of the bone charcoal used in the finery process is $30,000. A week's operation requires a supply of 763 hogsheads of sugar, or at 1,110 lbs. each, 840,000 lbs. This, for the working time of six days, gives one hogshead for every 11½ minutes. The sugar is by steam power hoisted to the top of the building, where it is emptied into an immense copper, when the steam soon converts it into the fluid state. In its descent through the building by pipes and tanks it undergoes the various purifications to which it is subjected. The flow of the vast quantity is like an abundant supply of water, and the rich product finds its way on the ground floor into barrels ready to meet the extensive demand that the high quality occasions. One large refinery was erected and furnished at an expense of $875,000. The growing luxury and refinement of the country is making refined sugar more of a necessity than formerly, and it is to be remarked that the use of refined sugar increases the demand for the raw material nearly 50 per cent., since 1½ lbs. of cane sugar are required to make 1 lb. of white. The concentrated sugar undoubtedly contains greater strength, but the quantity used is not curtailed on that account; on the other hand, it seems to increase, since the custom of "putting down" preserves in families extends, and the purest sugar is required to attain that clear appearance of the preserved fruit on which housewives so much pride themselves. The use of sugar for this purpose fluctuates with the season for fruits. In those years in which peaches, for instance, are abundant, a large number are preserved. A basket of peaches in New York will weigh 50 lbs., and the fruit with the stones taken out, 25 lbs., requiring as much sugar. Some years the peaches are worth $5, of the preserving quality, which is a clear white, and in other years, 50 cents. In the latter case, the sugar is worth four times as much as the fruit; in the former, one half as much; hence a great fluctuation in the use of sugar, which must be of the best refined. This demand takes place for all kinds of small fruits as well as peaches, and it grows in the double ratio of numbers and wealth. Strawberries may be preserved with granulated, but would hardly be palatable done up in "long" sugar.

SILK.

The culture and manufacture of silk are among the oldest industries of the colonies, and many efforts on the part of Congress and of enterprising men have been made to promote them, but the industry has not thriven in any degree to be compared with some of those that have grown steadily under the intelligent perseverance of unobtrusive individuals. No branch of industry is ever planted, promoted, or perfected by means of government operations alone. It must grow, if at all, out of the spontaneous promptings of individual genius, and live upon the necessities that give rise to it or the wants it of itself creates, to be healthily prosperous. Hence all the efforts that have been made to encourage the silk culture and manufacture have proved abortive, while individuals not encouraged have prosecuted branches of the trade not contemplated, with success. The southern colonies were early silk producers. So important had it become in 1753, that at a meeting of the imperial Board of Trade, Oct. 26, of that year, "the state of the colony of Georgia was taken into consideration, at a Board of Trade and Plantations, and it appeared that the colony produced upward of £17,000 [75,000 dollars] worth of *raw silk*, since January 1752, besides what is not yet come to the notice of the board." The other colonies of the South were also well engaged in it. Virginia in particular was largely interested in that industry. The culture of cotton and tobacco, however, in the early years of the Union, were so profitable as to absorb all other culture; and silk nearly disappeared, although numbers of farmers preserved their mulberry groves, and continue to make small quantities of raw silk. The state of Connecticut seems to have made the most decided efforts in that direction. The *New London Gazette* of 1768 informs us that William Hanks of Mansfield, had "raised silk enough for three women's gowns." The gowns of "three women" at the present day would involve a formidable amount of silk, but we are to presume he meant three "dresses" simply. The term gown, like "vandyke," seems to have become somewhat obsolete. Mr. William Hanks also advertised in the *Gazette*, 3,000 mulberry trees, three years old, and of one inch diameter. The best time to set them out, he says, is at the new moon of April. They were to be sold cheap, in order to promote the culture of silk. Sundry gentlemen in Windham had large mulberry orchards, intended to supply a silk factory erected at Lebanon. While all manufactures were in so depressed a state and struggling for life under the disability of deficient capital, it was hardly to be expected that so hazardous an undertaking as silk manufacture could make much progress. When, however, the high tariff policy after the war gave the spur to manufacturing of all kinds, that of silk was revived, mostly in Connecticut and Pennsylvania. This had so progressed that in five small towns of the first-mentioned state, there were raised in 1829, 2½ tons of raw silk, valued at $21,188. In Washington, Pennsylvania, sewing silk was successfully produced, and some garments were made by individuals who performed the whole work, from the management of the worms to the weaving of the fabric. The town of Mansfield, Connecticut, was in that year the great seat of that industry. The population was 2,500, and produced as many pounds of silk. This silk was converted into the most beautiful sewing silk and some other manufactures by the skill and industry of that ingenious people. Thus prepared, the silk was at that time worth $8 per lb. This industry was carried on without interrupting the ordinary occupations of the people, and also employed the young and old not suited to the labors of the field. The mulberry trees are ornamental as shade trees, and do not impoverish the soil as much as fruit; and they will flourish in almost all latitudes, or wherever the apple will grow; and whereever they are present the silk-worm may be reared.

The feeding of the worms commences with the first opening of the mulberry leaf, and continues for the period of 32 days, when the worm commences its spinning and ceases to eat. The leaves are gathered for the worms, and this gathering is the appropriate work of young children. Having wound itself in its cocoon, it requires nursing and watching, that the young may not eat its way out and by so doing destroy the silk. The cocoons being placed in warm water to soften the natural gum upon the silk, the winding is begun by women, one of whom can make 16 lbs. of raw silk in the season of six weeks.

The excellence of the silk depends upon the properties of the mulberry leaf, and these are considerably diversified. The white mulberry is decidedly the best, and of this there are several varieties, each of which depends in some degree upon locality. The kind to be cultivated and the mode of proceeding are to be learned from experience, which was very limited in the United States in 1829, when the attention of Congress was called to the silk culture by the petition of G. B. Clark, of the city of New York, for a grant of 262 acres of land owned by the United States, at Greenbush, New York, and used for military purposes, to aid him in rearing mulberry trees. The grant was made in the shape of a lease, on the condition that 100,000 mulberry trees should be planted, and that he should procure a sufficient number of worms to consume all the foliage that could be gathered from the trees. The public objects to be gained were to ascertain the best kinds to be cultivated, and to obtain a quantity of that description for distribution. No very great results flowed from this movement. The culture never amounted to much, but the tax, 15 per cent., imposed upon imported raw silk in order to encourage the culture, was a great drawback upon the manufacture. Nevertheless, the excitement in relation to the mulberry trees progressed, and in the year 1831, the project of rearing silk-worms was renewed in various parts of the Union, with great vigor; and the subject was deemed to be of so much importance that it not only attracted the attention of Congress, but afterward received encouragement from the legislatures of several states, by bounties offered for all the raw silk produced within their limits for certain periods of time. The business soon began to be prosecuted with extreme ardor, and continued several years, resulting in the establishment of extensive nurseries of mulberry trees, but it ended with the downfall of the famous "Morus Multicaulis Speculation," in 1839. The rates of the mulberry cuttings were at 2 cents each in 1838. In that year, in the neighborhood of Hartford, Connecticut, many thousand trees were sold at 20 to 50 cents each. The trees were sent all over the country, and it was stated that the growth per acre gave from three to five thousand dollars. The demand for trees was from those who undertook, in all sections of the country, to plant mulberry groves for the supply of silk factories that were to be started. The sales of trees were often made on the ground, standing, at the rate of 12½ cents per foot, those "trees" not 12 inches high being rejected. That speculation is yet alive in the public mind as a monument of the folly which at times overtakes a community, even to its own destruction. It was second only to the famous tulip mania of Holland, or the South Sea bubble of England, or the Mississippi scheme of France. The mulberry buds sold at fabulous prices, and passed rapidly from hand to hand of the speculators, multiplying from the nurseries to meet the speculative demand, which suddenly ceased when the test of practicability was applied. The real evil, however, which the mania inflicted, was that the means taken to stimulate a doubtful culture retarded the manufacture of sewing silk and goods, because the high price of the raw material so occasioned made competition with the foreign article impossible. In 1836, the state of Massachusetts paid $71 bounty on silk made in that year. This bounty rose to $2,111 in 1841. All the means used had raised the quantity of silk made in the United States in 1840, to 61,552 lbs., worth about $250,000. In 1844, the quantity was stated in the report of the commissioners of the United States census at 396,790 pounds, worth $1,400,000. In 1850, however, the quantity had fallen to 14,763 lbs., showing an immense decline, which has been ascribed to inherent difficulties of the climate. Nature seems to have put a veto on it at the North, and at the South other cultures have proved more profitable. The effort to produce the silk failed, and caused the failure of, or at least retarded, the silk manufacture, which has grown in England in some degree to rival France, where the silk is raised, by means of entire freedom from tax on the raw article. Of late, some further progress has been made in the manufacture.

In the year 1769, on the recommendation of Dr. Franklin through the American Philosophical Society, a filature of raw silk was established in Philadelphia, by private subscription, and placed under the direction of an intelligent and skilful Frenchman, who, it is said, produced samples of reeled silk not inferior in quality to the best from France and Italy. In 1771, the managers purchased 2,300 pounds of cocoons, all the product of Pennsylvania, New Jersey, and Delaware. The enterprise was interrupted by the Revolution. A similar enterprise was again attempted in 1830, under the supervision of M. J. D. Hornerque, and cocoons were brought in abundance to the establishment from various parts of the country, and so continued for some time afterward; but for want of capital, the undertaking failed. About the same time, however, other undertakings were begun in various parts of the country, and some of these have attained a high degree of success. In 1841, the convicts in Auburn prison, New York, were employed in the manufacture of silk for a time, with much success. In the first year a value of $12,762 was produced of sewing silk, pronounced superior to the imported article. The domestic supply of the raw article running short, through defects of climate, that manufacture began more severely to feel the weight of the duty of 15 per cent. *ad valorem* on raw silk, and of 10 to 30 per cent. on dyestuffs. These duties were a direct discrimination in favor of the English manufacturers, who obtained those materials free of charge. Nevertheless these manufactures here and there had taken root, in spite of this attempt to force the culture of the silk by means that tended to destroy the market for it. Many manufactories of ribbons grew in favor, and produced goods with a texture, finish, brilliancy of color, and general adaptability for an extended consumption that gave them advantage over the imported goods. In sewing silk, particularly, the American manufacturer has excelled. The American article is in every respect equal in color and finish to the imported, and superior in the spinning and "fixing the cord" (the great desideratum in this branch of manufacture) to the Neapolitan article.

The following figures show the rapid progress of the manufacture now that the raw silk is free of duty. From 1830 to 1850, the import of the raw silk increased 300 per cent. The manufacture had, meantime, gathered strength, and in the last ten years it has risen to over $1,540,000 per annum, while the import of sewing silk is nearly extinguished. The largest portion of the silk is derived directly from China.

IMPORT OF RAW SILK.

	Raw. 1830.	Raw. 1850.	Sewing. 1850.	Raw. 1860.	Sewing. 1860.
Hanse Towns.	..	$7,635	$1,873	$6,716	$4,733
Holland......	..	..	16	..	..
Dutch E. I. ..	..	2,073	297	..	..
Engl'd & Scot.	17,985	164,695	112,258	600,901	72,057
B. N. A. Cols.	..	..	43	..	..
B. East Indies	..	18,226	..	..	.
France	3,240	10,606	101,867	15,470	27,699
Italy	8,153	..	187,063	4,604	..
Sicily	..	..	76,782	..	238
Turkey......	..	2,623	..	..	..
China........	89,696	198,619	9,288	915,504	7,185
	$119,074	$404,477	$489,487	$1,543,195	$111,912

FIRE-PROOF SAFES AND SAFE-LOCKS.

But a very few years have passed, since it was a matter of necessity for individuals to keep their valuables in their own houses, and to defend them from the attacks of burglars and the risks of fire, as they best could. For these purposes strong boxes were in requisition. In modern times, paper promises have been substituted for the hard currency of former times, and banks become the depositories for that money, thus relieving individuals of the risk of keeping coin in their houses, to attract thieves. The banks are also depositories for plate and jewelry, and insurance companies guarantee from loss by fire. Under these circumstances, it was hardly to be anticipated that a demand for strong boxes should arise, when the use of them was apparently on the decline. Singularly enough, however, the art of making strong boxes has only been developed in the present century. It is to be considered, however, that with the progress of the credit system in the last 150 years, and the extension of commerce, paper securities and account-books of all kinds have multiplied, causing a greater demand than ever for iron chests. The manufacture of these, and of the locks to secure them, has taken great dimensions.

It is obvious that, in the construction of a chest, designed to be not only burglar but fire-proof, iron, as a material, would naturally suggest itself. Nevertheless, oak seems formerly to have been a favorite material, probably from the facility of working and ornamenting. An example of this kind of coffer is afforded in the chest in which the crown jewels of Scotland were deposited in 1707. The chest, beautifully ornamented, was secured with iron bands, hasps, and staples. There were three locks, which then, no doubt, afforded security, but each of them could be opened in five minutes with a bit of crooked wire in our day. At the close of the last century there began to be made the iron chests, known as "foreign coffers." These were constructed of sheet iron, strongly riveted to hoop iron, crossed at right angles on the outside. A lock throwing eight bolts inside, and two bars and staples for padlocks outside, were employed to secure the lid. Over the door lock was a cap beautifully pierced and chased, and a secretly operated escutcheon concealed the key-hole. These were formidable to look at, and no doubt answered their purpose all the better, that the science of lock-picking was then not so advanced as in the present day.

About the beginning of the present century, cast-iron chests began to be made for common purposes, and the manufacture flourished to a considerable extent. The idea of introducing non-conducting substances as a protection against fire, occurred but some years later. The favorite substance for this purpose is gypsum or plaster of Paris. This material was first used in Paris for the construction of fire-proof houses. The practice for more than fifty years had there been to erect hollow walls with spaces between them varying from five to nine inches in width. Plaster of Paris, mixed with water to a proper consistency, was poured into these spaces, where it set and became hard. After the beams and rafters were fixed in their places, boards were nailed to them, and the same material was spread thereon. The lower floors of the building were of plaster, over which tiles were laid. The same material was applied to fire-safes in Paris, and these were, to some extent, imported into New York about the year 1820. The first portable fire-proof chests introduced for sale in New York, were imported from France, by the late Joseph Boucheaud, Esq., about 1820, and no doubt many of our old merchants and bankers remember them, as many were sold for use in counting-houses and bank vaults. They were constructed of wood and iron; the foundation was a box of hard, close-grained wood, covered on the outside with plate iron, over which were hoops or bands of iron, about two inches wide, crossing each other at right angles, so forming squares on all sides of the chest. Holes were made in the bands and plates, through which well-made wrought-iron nails or spikes, having "*hollow*," half-spherical heads, were driven into and through the wooden box, and then "*clinched*." The inside of the chest was then lined with a covering of sheet iron. These chests had a well-finished but very large lock, having from six to eight bolts, operated by one turn of the key.

The first actual application of plaster of Paris to safes in this country seems to have been by James Conner, the type-founder, of New York. His business made him acquainted with the non-conducting qualities of plaster of Paris, and he applied it to an iron chest in his office, which chest has been in use ever since. Soon after, Jesse Delano, of New York, began making chests of the Paris pattern, substituting solid cast-iron heads, to secure the bands. In 1826, he patented an improvement, which consisted in coating the wooden foundation with a composition of equal parts, clay and lime, plumbago and mica, or saturating the wood in a solution of potash lye and alum, to render it incombustible. These were generally used in the country, and as a curious instance of the *fire-proof* qualities of these safes, we may state that one stood many years near the stove, in the counting-house of Lyman Stockbridge, of Hartford, until its fire-proof qualities seem to have been exhausted, since it spontaneously took fire and burnt up about three years since, without doing other injury on the premises. In this case, it would seem the fire-proof quality was inverted—viz., that the fire could not get *out*, instead of failing to get in. After Mr. Delano, C. J. Gayler began the safe manufacture, and in 1833 he patented his "double" fire-proof chest. This consisted of two chests, one so formed within the other as to have one or more spaces between them, to inclose air or any known non-conductors of heat. In the same year, one of these double chests was severely tested by being exposed in a large building in Thomaston, Maine, that was entirely destroyed by fire. The chest preserved its contents in good order. This excited the public admiration, and one enthusiastic writer described it as a "Salamander," which name has ever since been popularly applied to safes.

The majority of the so-called "safes" in use at the time of the great fire in New York, in 1835, were simply iron closets, and were of little protection against the devouring element. There were then about sixty of Gayler's *double chests* in use, and a few of these preserved their contents. Soon after, John Scott obtained a patent for the use of asbestos for fire-proof chests. In 1837, Benjamin Sherwood obtained a patent for a revolving interior safe, filling the spaces with plaster of Paris and charcoal.

In 1843 Enos Wilder obtained a patent for the construction of a safe of heavy iron plates, filled with hydrated plaster of Paris, and soon after, Mr. Fitzgerald, whose discovery was made previously, was associated with him. About 1841, Mr. Silas C. Herring became interested in Wilder's safes, first as agent and afterwards as a manufacturer. The Wilder safes proved a protection against fires which destroyed the Gayler and other patents. In 1844, Enos Wilder's patent was transferred to his brother, B. G. Wilder, but the safes under this patent were made by Mr. Herring; and not long after, Messrs. Roberts & Rich commenced the manufacture on the same principles, but paid no royalty. After a protracted lawsuit, a compromise was effected by which both parties continued to manufacture. Other parties tried hydraulic cement, soapstone, alum and glue, alum alone, mica, asbestos, and other articles for filling, but none proved as effectual as the hydrated plaster of Paris, which, under the influence of intense heat, gave up its water of combination, and forming an atmosphere of steam in the inner portion of the safe, protected the books or papers from destruction. It was found, however, that the plaster after a time gave up a part of its water of combination, and not only made the interior of the safes mouldy and damp, but rusted the plates of iron till they were eaten through. Messrs. Herring & Co. had offered a reward of $1,000 for any filling which should stand the test better than the plaster which they were using. In 1852, Mr. Spear, a chemist of Philadelphia, discovered that the residuum of the soda fountains, after the liberation of carbonic acid gas, for the so-called soda-water, possessed remarkable non-conducting powers. This residuum, which had been previously thrown away, was, by Spear's process, preserved, washed to free it from the sulphuric acid, which had acted upon the chalk, dried in a kiln, and, when in a dry and almost impalpable powder, rammed into the safes. The safes thus prepared were found to have no tendency to rust, and to be better protected against fire than by the use of the plaster, this powder giving up its water of combination in less quantity, and more slowly than the plaster, but sufficiently to preserve the contents of the safe. Messrs. Herring & Co. purchased Mr. Spear's discovery, and, since 1854, have made their safes mainly on this principle, though the Wilder patent had not expired. Mr. B. G. Wilder had meantime commenced the manufacture of safes under his patent, himself; and the successors of Messrs. Roberts & Rich, under several firm names, as Rich & Roff, Roff & Stearns, and Stearns & Marvin, also manufactured the Wilder safe. In 1854, the safes which had been rusted through by the moisture from the plaster of Paris began to be returned upon the manufacturers, and the cost of repairs and refilling was very heavy. There began a little before this time to be a demand for burglar-proof safes. Lillie's safes were highly commended for this purpose, he using thick slabs of chilled cast iron, and flowing cast iron over wrought iron ribs in their construction. It was found after a time, however, that the burglars succeeded in drilling these sufficiently to blow them up in a few minutes, and that the dependence placed on them was not justified. Messrs. Herring & Co. a few years since adopted the plan of making their burglar-proof safes externally of boiler-plate wrought iron, with an inner safe of hardened steel, and then filled the space between with a casting of Franklinite, the hardest of all known metallic ores, which in casting was incorporated with rods of soft steel, those on one side running vertically, and those on the other horizontally. These castings resist the best drills for many hours. This has, in connexion with the burglar-proof locks, proved the most complete protection against burglars yet invented. Among the burglar-proof locks, the Bramah, invented in England in 1784, was in high repute for many years, but was picked by Hobbs, a Boston locksmith, in 1851. A "permutation lock" was invented by Dr. Andrews, in 1841, and another by Newell, about 1843. Both were finally picked, and Newell then invented one with a detached tumbler, which was, after a time, picked by William Hall, of Boston, by the "smoke process," by which a smoky flame is introduced by the key-hole, and this leaves a fine deposit of lamp-black upon the "bellies" of the tumblers. When the key is next introduced, it removes the lamp-black from the parts it touches. By means of a small reflector, a strong light is then thrown in, bringing the key marks to view. The exact sizes for a false key are thus obtained. To prevent this operation, it was supposed that concealing the tumblers would be all that was requisite. H. C. Jones, of Newark, accomplished this by concentric rings and curtain; and Pyes did it more effectually with eccentric rings and curtain. The lock was now thought perfect. It was called the parautoptic (concealed from view) lock. A. C. Hobbs, with one of these at the English exhibition of 1851, defied the best English operators. One of these locks was used at the Bank of England, and they came into general use in the United States. In 1855, Linus Yale, jr., of Philadelphia, by means of the impression process, picked this great lock. In 1843, Linus Yale, senior, patented a "pin" lock and then the duplex lock, for which two keys are required. One being introduced, it was necessary to unscrew and remove its handle, then close the key-hole entirely with a hardened plate, before the other key-hole could open. The ingenuity of his son dispelled the idea that this was absolutely secure, by picking it. Yale, jr., being convinced that no lock is secure so long as the shape of the key prevents the entire closing of the hole, he set to work upon that principle, and in 1851 he invented the magic lock. In this lock, the key and its bits appear as of one piece; on being introduced into the lock, the bits are taken up by a pin, which enters through them into the centre of the key-shaft. The key then being turned in the usual manner, puts in motion a set of gear wheels. These first separate the bits from the key, and then carry them into the interior of the lock, away from the key-hole. They there operate upon the tumblers out of sight and beyond the reach of any picking tools. The same motion which carries away the bits effectually closes the key-hole. When the bolt is passed, the key-hole re-opens, the bits come back and join the handle to be taken out, as they were put in. The bits may be taken away in the pocket, if desired, leaving the handle with the lock. This mechanism seems to effect perfectly the conditions sought for security against picking. E. B. Denison, the famous clockmaker, of London, remarks in relation to this, as well as to Newell's, "that the casting of both these American locks (which have all their heavy parts of cast iron) is vastly superior to any iron castings 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." This is certainly very gratifying praise to the national pride, when we reflect how few years since we depended entirely upon England for bank locks.

In some cases, burglars introduce strong tools to force locks apart, and others introduce gunpowder to explode them. A device against this is to form a strong slider of cast steel to close the key-hole, and also to cut out a piece of the back plate and screw it on again, with small screws. This giving way on the application of force, saves the rest.

These brilliant inventions have been made to close the doors of safes against burglars, while the improvements in the boxes guard against fire.

GLASS MANUFACTURE.

When we contemplate by turns each of the great materials most conducive to man's advancement in civilization, we are at times lost in the attempt to give precedence to any one, since so many have held so high a rank in the scale of usefulness. Iron has, perhaps, been the most important in respect of industrial purposes, and paper has been the means of recording and promoting that general intelligence without which progress could not be very extensive, but glass has entered more into the necessities of science, as well as those of social life and every-day comforts, than most materials. The great properties of glass are its transparency, its hardness, its power of assuming any possible form when hot, and its non-conductibility. Employed as windows, it transmits light into our dwellings while protecting us from the inclemency of the seasons and permitting a view of exterior objects; wrought into the form of vessels, it preserves all liquids without alteration, while we can inspect the contents. This quality, added to its indestructibility by any of the acids (except fluoric), has much facilitated the investigations of chemists. The physical sciences are not less indebted to it. It is the principal auxiliary of optics. With his glass prism, Newton decomposed light; it is by its means that astronomy makes its observations and discoveries in the infinity of space; combined in the microscope, it carries the vision of the naturalist into the most minute formations of nature; with it, those of short sight have the perception extended, and by it, the flattened vision of age is restored to its natural powers. To the science of fluids it is indispensable, and most of the experiments in caloric and electricity are due to its agency. If all the sciences are more or less dependent upon it, the ordinary usages of life are no less promoted by it. It gives mirrors for the toilet and for ornament to houses; it serves the table with liquids; it preserves works of art from the dust, ornaments lustres, and with it the precious stones can be imitated in all respects but in their hardness. In the arts its wonderfully varied powers may be put in requisition for almost all purposes, from the delicate spring of a chronometer watch to the heavy pipes for supplying water to cities. For the former purpose, its insensibility to climate and temperature gives it advantages over the metals used for that purpose.

The use of glass is of a very remote antiquity—how remote is left to conjecture. It had been supposed that the ancients were not acquainted with its use. Glass beads have, however, been found on mummies more than 3000 years old, and in the ruins of Nineveh bottles and vases have been found of glass; and the exhumations of Pompeii and Herculaneum disclosed the fact that it was in those cities used for windows, as well as for very numerous utensils, all of which gave evidence of great skill in glass work. The manufacture of glass spread from Italy to other countries of Europe, at first into Gaul. Bohemia was, however, possessed of the best materials in the greatest abundance, and the manufacture settled and acquired for Bohemian glass a reputation which has come down to our times for vessels. The use of glass for mirrors seems to have originated in Venice.

The manufacture of glass was carried on in England as early as 1439, according to Horace Walpole. Flint glass was made in London in the middle of the 16th century, and the manufacture of plate glass was commenced by the Duke of Buckingham, who imported Venetian workmen. Since then great progress has been made, and English flint glass has won a great reputation. The manufacture was one of the earliest introduced into the colonies. At Jamestown, Va., a glass-house was broken up by an irruption of Indians in 1632. There appears, however, to have been no accurate account of any until that of Mr. Hewes, of Boston, in Temple, N. H., 1780. Those works were operated by Hessians and Waldeckers, deserters from the British army; and one of the first articles there produced is now the property of Harvard University. Washington, in his diary, 1789, alludes to a glass-house in New Haven. In 1803 a German, of the name of Lint, undertook glassworks in Boston, and the state made him a bounty on every table of window glass made. From that time the works prospered, or at least were sustained.

The manufacture of crown glass was early commenced at Pittsburg, Pa., by Colonel O'Hara, who, in 1798, started glassworks in that city, to which the materials were brought from 30 to 100 miles' distance. The concern had a considerable success, and was followed by others until, in 1814, there were five glassworks at that place. In 1812, Messrs. Bakewell & Co. established at Pittsburg the first flint-glassworks in the Union. They brought the manufacture to great perfection, bringing out workmen from Europe at high wages. The style of cutting and engraving was thought equal to the foreign, and the operations of the house extended until the works became the largest for glass manufacture in the country. There were there made sets of glass for two Presidents of the United States; and a set of splendid vases there produced 40 years since, still adorns the saloon at La Grange, the seat of Lafayette. The house have also received the silver medal of the Franklin Institute. In other parts of the country the manufacture progressed to a greater or less extent, and in 1832 a committee of the New York convention made a report on the glass manufacture, from which it appears there were then in operation 21 glass furnaces, having 140 pots for the manufacture of crown glass; of these, 6 were at Boston. There were also in operation 23 for the manufacture of cylinder glass; of these, 10 were in Pennsylvania, 2 at Wheeling, 2 in Maryland, 2 in New York, 2 in Ohio, 1 in Massachusetts, 1 in New Hampshire, 1 in Vermont, 1 in Connecticut, and 1 in the District of Columbia. The whole value of flint glass then produced was given at $1,350,000. The most extensive green bottle factory was at that time Mr. Dyott's, near Philadelphia. There were there melted 4 tons per day, or 1200 tons per annum. At that period the glass manufacture received an impulse, and in 1834 there were 6 works at Pittsburg, making crown and cylinder glass, green bottles, and apothecaries' phials. One bottle factory produced 1600 dozen weekly, and a phial factory 2200 gross weekly. There were also produced in one concern 5000 boxes window glass annually, of a quality nearly equal to the best crown glass. There were also at Wheeling 2 crown and flint-glassworks, and 1 for phials and bottles. At Wellsburg, 16 miles distant, there were 1 flint glass and 1 green bottle factory.

The census of 1840 showed that there were then in the United States 81 glass-houses, employing 3,236 men. The aggregate capital was given at $2,014,100. Of these, 2 were in Virginia, 28 in Pennsylvania, 25 in New Jersey, 13 in New York, 2 in Vermont, 3 in Connecticut, 4 in Massachusetts, 3 in New Hampshire, and 1 in Michigan. The census did not distinguish the different branches of the glass manufacture, nor the modes of making window glass. The increase up to 1850, by the census of that year, appears to have been not very considerable. The number of works had risen to 94, with an aggregate capital of $3,402,350, employing 5571 men, and producing a value of $4,641,676 per annum. Of these 94 establishments, 28 were in Pennsylvania, and 20 more in New Jersey, mostly owned in Philadelphia; 18 were in New York, 6 in Massachusetts, 2 in Maryland, 1 in Connecticut, 4 in New Hampshire, 2 in Missouri, 6 in Ohio, 6 in Virginia, and 1 in Tennessee. The glass manufacture thus concentrates apparently in Pennsylvania. There has been in the last ten years some progress. In 1853 the first plate glass manufactory in the United States was established at Cheshire, Berkshire county, Mass. The same company now are at Lenox under the name of the "Lenox Rough Plate Glass Co." The rough or hammered plate glass manufacture has also been recently established in Philadelphia; also a new description, called "German flint," of less beauty than the old flint, but better adapted for the use of apothecaries, chemists, perfumers, etc., since it is little affected by acids and alkalies.

The materials for glass are several; the chief, silica, obtained from the sea beaches in the form of quartz sand, and from the quartz rocks of the interior. The name of "flint glass," which originated with the English manufacturers, and long held the highest rank in Europe, came from the use of flints, calcined and ground to powder. This process is now supplanted by the use of sand, of which a highly prized article is imported into England from Austria. The purest article used in the United States is obtained from Lanesborough, Mass., being a disintegrated quartz rock. It is easily broken by the pick, and the lumps may be crushed in the hand. The grains are remarkable for their purity. They appear white in the mass, but under the microscope each appears as limpid as crystal. This is used for the best flint and plate glass. Lime is used in the shape of limestone of the purest qualities, or as quicklime. Potash is derived from common wood ashes, and the ashes of sea-plants supply soda. Pearlash is sometimes used; also the refined alkalies. Common salt is used whence to extract carbonate of soda. In addition to these, saltpetre, alumina, and waste glass, enter into the ingredients of glass, the proportions of many kinds of which are as follows:—

English bottle glass—sand, 100 lbs.; lixiviated ashes, 100; wood ashes 40; kelp, 40; clay, 80; cullet, or waste glass, 100. For Bohemian crystal, are used—100 lbs. sand; purified potash, 60; chalk, 8; cullet and manganese, 40. In window glass, are used—100 lbs. sand; chalk, 40; carbonate of soda, 35; of broken glass, from 60 to 180; and some manganese and arsenic. For plate glass—Lynn sand, washed and dried, 720 lbs.; alkaline salt, of which 40 per cent. soda, 450 lbs.; lime, 80; nitre, 25; broken plate glass, 425. These will give 1200 lbs. of glass. For Faraday's heavy optical glass—protoxide of lead, 140 lbs.; silicate of lead, 24; dry boracic acid, 25; and 100 lbs. of sand. Artificial gems are composed of 100 lbs. of quartz crystal, or sand; pure minium, or red lead, 154 lbs.; caustic potash, 54 lbs.; boracic acid, 7; and some arsenious acid. These are a few of the proportions used, but most manufacturers modify them in various ways, since the same compound will, in the same furnace, under different conditions of fuel, draft, and weather, give different results. Bituminous coal, or coke, or seasoned wood, may be used for fuel, and firewood is preferred. In some glassworks of the

United States, rosin is preferred to all other fuel, since when pulverized it may be added in small quantities at a time. It burns without giving off impurities that may mix with or injure the glass, and it leaves no residuum.

In proceeding to manufacture, when the combination of materials is formed, they are thoroughly ground, mixed together, and sifted. The glass furnace is a large circular dome, in the centre of which is the fire. This is surrounded by 8 to 12 melting pots, which being raised to a white heat, receive the mixed glass in quantities about one eighth at a time. As each instalment melts down, the others are added. The entire quantity being melted, the fires are urged to the utmost, while the workmen watch the operation, with long iron rods, by means of which they extract from the boiling mass portions, from time to time, until transparency, on cooling, indicates that perfect fusion of all the materials has taken place. A scum rises during the boiling which is removed as it appears. The heat is then raised to the highest degree, to perfect the fusion. The glass is now made, but it contains many impurities, being substances that would not melt; and there is also still a quantity of gas, which, if not got rid of, will form those bubbles that are sometimes seen in common window glass. The mass is therefore kept fluid during some 48 hours, by which means the "metal" is fined, that is, all the bubbles of gas will have disappeared, and insoluble matters will have settled to the bottom. The heat is then allowed to subside until the metal becomes thick enough to work, at which point the temperature is maintained in order to keep the glass in this condition. The pots that surround the furnace will generally thus hold enough to employ the force day and night for the first four days of the week, the hands being divided into gangs that relieve each other every six hours.

The glass materials, being thus brought into suitable combination, are ready for some of the numerous branches of manipulation in which that article is employed—the manufacture of window glass, plate glass, bottles, phials, flint glass, vessels of all descriptions, gems, optical instruments, etc. The manufacture of window glass is perhaps the most extensive, and this is conducted in two modes. By one the glass is blown into "tables," like cart wheels, and by the other it is formed into cylinders, that are cut open lengthwise and flattened out. The former is the more generally practised. That description is generally known as English crown glass. In the manufacture, the melting pots, of which there are usually eight, hold about half a ton of metal each, and this will suffice for 100 tables of crown glass. When the glass is in its proper state, the workman is armed with a pipe, or blowing tube, 4 or 5 feet long, with a bore $\frac{1}{4}$ to 1 inch in diameter, and a little larger at the mouth end than at the other. It is, as it were, a long hand, with which, the end being heated red hot, the workman reaches into the pot of melted matter, and gathers up the quantity he requires. By long experience he is enabled to do this with great exactness, and this, for crown glass, will not vary much from 9 lbs. The pipe being cooled to admit of handling, the lump is rolled upon the *marver* (which is a polished cast-iron slab), to give it a conical form. Blowing through the tube, at the same time, causes the lump to swell. It is then heated in the furnace, and again rolled and enlarged by blowing. In this operation, the portion next the tube becomes hollow, and the greater portion of the glass works toward the point of the cone it forms in rolling. The solid point is called the bullion. This being softened in the furnace, the tube is laid across a rest, and made to revolve, while the glass is blown to a globe. During this operation, a boy supports the soft end, or bullion, with an iron rod. The globe, by continually revolving, increases in size, and flattens out, the bullion point still forming a thick centre, to which an iron rod, called a pontil, which has a little molten glass on its end, is applied; at the same moment the globe being separated from the blow pipe by the application of a piece of cold iron to its "nose," remains upon the pontil. As the tube breaks away, it leaves a circular opening, which the workman, holding by the pontil, presents to the furnace. By this means it is softened almost to melting, and being made to revolve rapidly, the opening grows rapidly larger by centrifugal force. The heated air in the globe prevents the two opposite faces from coming together. The portion next the fire appears to roll inside out, and it suddenly, with a noise like opening a wet umbrella, flattens out into a circular disk, which is then removed from the fire, and kept revolving until it is cold. The pontil is then cracked off, and the disk removed to the annealing oven, and set up on edge with the rest, arranged in rows, and supported by iron rods, so as not to press against each other. The annealing is completed in 24 to 48 hours. These "tables" are generally 52 inches in diameter; sometimes, however, as much as 70 inches.

Plate glass imperfectly annealed will, when once cracked, soon fall all to pieces. The annealing process is simply to place the hot glass in a hot oven, and allow the whole to cool gradually. By this operation it is found that glass is deprived of much of its brittleness. The explanation is, that the glass is a non-conductor, and when made, the exterior cools first, forming a crystalline crust which shelters the interior particles, so that these continue longer in the fluid state, and are prevented from expanding as glass usually does when it cools. The interior has thus a constant tendency to expand or burst out. When the whole is allowed to cool slowly in an oven, all the fibres of the glass assume their proper and natural places, and the mass becomes tough and elastic. The effect of sudden cooling is manifest in the toys called "Prince Rupert's drops." These are simply hot glass dropped into water. In so doing, most of the drops burst to pieces, but some retain a pear shape. These, when taken out, will bear a smart blow without breaking; but the smallest break at the stem will cause the whole to fly to pieces with a loud explosion. Bologna phials are formed of unannealed glass 4 or 5 inches long, and ½ inch thick. These will bear a hard blow, or a bullet may be safely dropped in. If, however, a sharp fragment of sand is introduced, the phial will fly to pieces. Annealiug deprives them of these qualities.

From the annealing kiln the tables go to the warehouse, and are there assorted according to defects and qualities. Each one is then laid in turn upon a "nest" or cushion, and is divided by a diamond into two pieces, one of which, the larger, contains the bull's eye. These are then cut into square panes. The circular shape and the bull's eye involve much waste in cutting. The glass thus manufactured, however, has a remarkable brilliancy, and for that reason it is preferred to the cylinder process, by which, however, larger panes are made.

The cylinder process has been pursued to a great extent in the United States. It is practised by a number of workmen. Sometimes 10 are arranged side by side, with a raised platform extended in front of the furnaces 10 feet above the bottom. Standing upon this, each man gathers a proper quantity of metal from the pot before him. By applying the lump to a wooden mould and blowing, it takes a globe form. This he heats, and then holds upon the pipe vertically over his head, at the same time blowing into it. This causes the globe to flatten. It is then held down so as to swing below the platform on which the worker stands. This, with continued blowing, causes the glass to elongate in the form of a cylinder. The workman watches with care lest the elongation should proceed too rapidly, in which case he raises it again over his head. This operation is dexterously continued until the cylinder attains 47 inches in length, and 10 inches in diameter. The end is then softened in the fire, while the pipe is closed with the thumb. The air within the cylinder then expands so as to burst out the end. The edges of the opening thus caused are then spread and trimmed. The tube end is cut off when the glass is cool by the application of a hot iron, and letting fall a drop of water on the heated line. The cylinder is now to be cut open lengthwise in order that it may be flattened out into a pane. For this purpose two methods may be employed —one with the hot iron and cold water, and the other by a diamond applied inside the cylinder along a rule. The cylinders are now carried to the flattening furnace, where they are laid, slit uppermost, on the flattening stone. Here, as they soften, they open out, and a workman with an iron rod aids the operation. Another at the same time, with a rod having a block of wood at the end for polishing the sheets, works down the irregularities of the surface. The sheet is then passed into the annealing oven. In every stage of this process, the sheets are exposed to imperfections, and, in consequence, few are perfect. Most answer for inferior uses. None have the brilliancy of crown glass. The main difficulty is in the wrinkling. The glass being made in the cylinder form, the inner and outer surfaces are of unequal lengths. In the flattening out, this inequality produces undulations, called cockles, which distort objects seen through the glass. The unevenness also made it very troublesome to polish the surface until the difficulty was overcome by the device of pressing upon each sheet soft leather, which, acting like a boy's "sucker," adheres to the glass by atmospheric pressure. Two plates thus held are laid face to face, and, by the action of machinery, rapidly rubbed together with the intervention of polishing sand and water. By this means a beautiful polish is bestowed.

By these two methods of manufacture most of the glass used in the United States is produced. For the city dwellings of the more wealthy, as well as for the large stores and shops, plate glass is used; but the demand is small compared with the quantities used in the United States for the rapidly multiplying dwellings. Thus the average number of square feet of glass for a dwelling may be placed at 100. The number of houses in the United States in 1850 was 3,363,427, which would require, in round numbers, 336,000,000 feet. In 1860 the number of dwellings was about 4,700,000, requiring 470,000,000 feet of glass, or an increase of 134,000,000 feet for new dwellings alone, without taking into account breakage, rebuilding, churches, hot-houses, public buildings, etc. The value of the new glass required would be about $4,500,000. On account of this large demand, the imports continue considerable, and were in 1858, 19,734,439 square feet, at a value of $626,747. In the same year the export of domestic glass was $214,608.

Various causes affect the combination and the qualities of the compounds. The alkali in window glass, powdered and moistened, is detected by its action upon turmeric paper, and may be dissolved out by boiling water. Atmospheric agents sometimes remove it in part from window panes, leaving a film of silicate of lime. The glass of stable windows is liable to change its appearance and assume prismatic colors from the action of the ammoniacal vapors upon the silica. When moderately heated, glass is readily broken in any direction by the sudden contraction produced by the prompt application of a cold body to its surface. It is divided, when cold, by breaking it along lines cut to a slight depth by a diamond or some other extremely hard-pointed body. It may be bored with a steel drill kept slightly moistened with water, which forms a paste with the powder produced. Copper tubes, fed with emery, also serve to bore holes in glass.

As very large panes of glass could be made by neither of the above methods, the large plate glass used for mirrors and for shop windows is cast. The mixtures employed do not vary much from those used in sheet glass. A larger proportion of soda is used; but this pushed to excess gives a greenish tinge. The greatest care is taken in the selection of the materials. When the glass is melted in the pots, it is ladled into cisterns or *cuvettes* placed in the fire by the side of the pots. Some manufacturers allow the metal to remain fluid in the pots 16 hours, and an equal time in the *cuvettes;* and in some cases, in order to allow the soda to volatilize and the air bubbles to escape, the time is prolonged to 48 hours. When nearly ready, the temperature of the glass is allowed to fall in order that the material may assume a pasty consistency. Meantime, the casting plate is prepared. This is usually a cast-iron plate, perhaps 7 inches thick, 11 feet broad, and 20 feet long. It has raised edges to prevent the glass from flowing off, of a depth proportioned to the proposed thickness of the glass plate. On a level with this table, and arranged along its side, are the annealing ovens. Each of these is 16 feet wide and 40 feet deep. Hot coals are heaped upon the plate to bring it to a proper temperature. The cistern swung on a crane is then approached to the table, which is thoroughly cleaned, and the melted glass carefully skimmed with a copper blade. By canting the cistern, the glass is then poured upon the table. A copper cylinder 3 feet in diameter extends across the table, resting on the raised edges. This, being rolled forward, sweeps before it the excess of glass, spreading the whole uniformly of a thickness governed by the raised edges of the table. The effect of the passage of the copper roller upon the brilliant surface of the glass is very beautiful, leaving, as it does, a splendid play of colors. The superfluous glass being then trimmed from the edges, the plate is thrust forward into the annealing oven previously raised to a red heat. Successive plates are thus cast until the annealing oven is full, when it is closed up and left 5 days to cool. When taken from the oven the plates are examined for defects, and the mode of cutting decided upon is then done with a diamond.

There are many modes of grinding and polishing, but in this, as in most other arts, the latest improvement is an American invention, which, highly successful here, was introduced into England in 1856. A circular plate of cast iron, 10 feet in diameter and

2 inches thick, is secured upon the upper end of a vertical shaft, so as to revolve with it. Above the table, frames are arranged to hold the plates of glass, which are laid in a bed of plaster of Paris, with the face to be polished resting upon the revolving table. The frames are so arranged that the friction of the table upon the glass causes them to revolve so as to present every portion of the glass surface to an equal amount of rubbing. When sand is required to grind down the glass, it is fed in from a box above the frame. This is found to be the best mode; but sometimes the surfaces of the plates are ground together. After grinding, they are smoothed with emery powders of successive fineness until they are ready for polishing. This, in the American machinery, is performed by rings coated with felt and screwed to the surface of the iron table. Oxide of iron or rouge is applied to the felt as a polishing agency. When this is completed they are ready for silvering.

In the process of silvering, a large stone table is prepared so as to be canted, by means of a screw beneath it, on one side. Around the edges of the table is a groove, in which quicksilver may flow, and drop from one corner into bowls placed to receive it. The table, being made perfectly horizontal, is covered with tin foil carefully laid over it. A strip of glass is placed along each of three sides of the foil to prevent the mercury from flowing off. The metal is then with ladles poured upon the foil until it is a quarter of an inch deep, and its tendency to flow is checked by its affinity for the tin foil. The plate of glass, well cleaned, is dexterously slidden on from the open side. Its advancing edge is carefully kept in the quicksilver, so that no air or any impurities can get between the metal and the glass. When exactly in its place it is held until one edge of the table is raised 10 or 15 degrees, and the superfluous metal has run off. Heavy weights are then placed on the glass, and it is so left several hours. It is then turned over, and placed upon a frame, the metal uppermost, which becomes hard in the course of several weeks. Patents have been taken out for precipitating silver upon the glass, but this process is not so successful as the old.

When these plates are used for shop windows, some of them require to be bent in various manners. This is a separate branch of business, and is carried on at Newark, N. J., extensively. The bed is made of suitable material, on the floor of the furnace, and made in the required form. The sheet of glass is laid upon this, and as it softens in the heat, it assumes the form of the bed on which it is laid.

The manufacture of flint glass for domestic purposes requires great care in the selection of the materials. It possesses the properties of great transparency and high refractive power. Its brilliancy and density are in some degree due to the introduction of oxide of lead. Oxide of zinc has also been found effective for the same purpose. In order to protect the glass from effects of smoke or other elements which might discolor it, it is melted in a covered pot, with an opening in a short neck on one side. The heat is made very intense that the fusion may be rapid. The moment fusion and fining have thoroughly taken place, the heat is reduced, to prevent the deleterious action of the materials of the vessel upon the glass. In the United States, when the metal is taken out by the workmen, it is shaped in the required form by pressing into a die. For this purpose, when the article is large, considerable pressure is required. The experience and skill of the workman are put to the test in taking up just the quantity of metal required to fill the mould, which is kept at a red heat. The objects, being formed, go through the cutting process, as it is called, but really the grinding process. Circular stones or metallic disks are made to revolve, being fed with sand and water for coarse grinding, and emery for finer work. The marks left in the coarse grinding are removed by application to wooden revolving wheels, fed with pumice or rotten-stone, and finally with putty powder, a preparation of tin and lead. The fine polishing of chandelier drops, and similar ornaments, is effected by a lead wheel, supplied with rotten-stone and water. Globes and lamp shades are polished on the inside by filling them with sand, and placing them in a drum, which revolves rapidly for a length of time.

The glass most important in the arts is certainly that used for optical instruments. Flint and crown glass are both used for that purpose, but both have their defects. Those of the former arise from the difficulty of effecting uniform fusion, and crown glass is seldom possessed of the requisite uniformity of texture. These difficulties were so great that, until the early part of the present century lenses larger than three and a half inches could not be made. At that time a Swiss clockmaker, Guinand, produced them as large as nine inches, of the greatest perfection. The secret remained with him for a long time, but was finally, by one of his sons, imparted to M. Bontemps, who in 1828 produced lenses of twelve to fourteen inches. The secret was in keeping the mixture actively stirred when liquid, and then suffering it to cool and anneal in the pot. Lenses are now made of flint glass twenty-nine inches in diameter, and weighing two cwt.

The production of vessels of colored glass is conducted in a very ingenious manner. The coloring matters are various. Blue transparent glass is made with 2 lbs. oxide of cobalt; azure blue, 4 lbs. oxide of copper; ruby red, 4 ozs. oxide of gold; other colors by various combinations. Sometimes the color is incorporated merely with the outer portion of the glass. This is effected in the blowing by dipping the lump of clear glass, when shaped upon the marver, into the pot of melted colored glass, and then blowing it to the shape required, and flashing out, if desired to convert it into panes. The color may afterward be reduced in depth by grinding, and clear spots reached by grinding through the color. In the process of "casing," a portion of partially blown flint glass is inserted into a thin shell of colored glass, and then blown until it fills the shell, with which it becomes incorporated by heating and further blowing; casings of different colors may be thus applied. In painting, the color, mixed with a flux that will fuse at a lower temperature than the glass, and with boiled oil, is laid on with a brush as in ordinary painting, or by blocks as in calico printing. The glass is then heated, when the flux melts, and sinks into the body. The painting of glass for church windows was formerly carried to a high degree of excellence, that moderns have not been able to equal. Although the receipts have been preserved in ancient treatises, the process has been lost.

Enamelled glass has of late been much used. The glass of the New York Crystal Palace is an illustration. In this process the enamel substance is ground to an impalpable powder, and then laid with a brush, in a pasty state, upon the glass. After the paste is dried, the ornament is etched out either by hand or by machinery. The glass being then softened in the intense heat of the furnace, the enamel becomes vitrified and incorporated with it. It then passes to the annealing furnace. This process was invented by Mr. William Cooper, of the firm of Cooper & Belcher, New York, whose extensive works at Newark, N. J., supplied 60,000 feet for the New York Crystal Palace. Another variety, the flocked, has now come more into use. The process is nearly the same, except that a smooth opaque surface is given to the glass before the enamel is applied.

Soluble glass has been made of later years of equal parts silica and caustic potash. This is soluble in boiling water, and is used extensively for making buildings and all combustible bodies fire-proof.

In the manufacture of bottles, the metal, on being withdrawn from the melting pot on the end of the blowing tube, is, if for common black bottles, shaped in concavities that are made in the edge of the marver. Fine bottles of flint glass are shaped in moulds of brass or iron, which are made in two parts hinged together, so that they may be opened and shut with the foot. Bottles for champagne, soda water, etc., are made of extraordinary strength, and tested before using by hydraulic pressure. They ought to support, for this purpose, a pressure of 40 atmospheres, or 600 lbs. on the square inch. Notwithstanding the great strength with which they are usually made, the breakage in the manufacture of champagne is rated at 30 per cent.

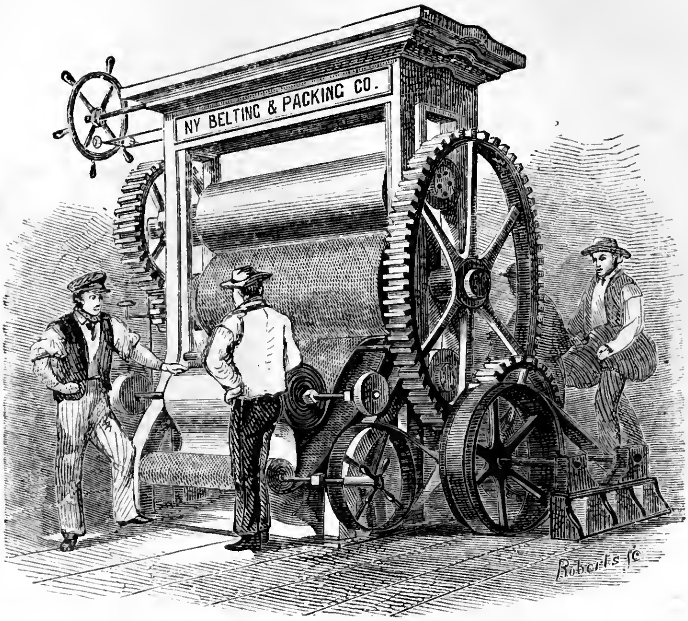
The glass is drawn out into tubes in a manner that illustrates the curious manipulations of the metal. The workman, with his blowing tube, accumulates a certain quantity by successive dips into the melting pot. This is then blown into a globe. Another workman then takes hold with a pontil, at a point exactly opposite the blowing tube. The two men then separate, and the globe contracts in the middle, which being drawn out to the size of the tube desired, cools, and the hotter portions successively yield to the drawing, until a tube of 100 feet or more hangs between the workmen. The diameter of the bore retains its proportion to the thickness of the glass; hence thin tubes must be drawn from globes blown to a large size. These tubes of colored glass may be converted into beads. Beads have always been a great element in the trade with the North American Indians, being highly prized by them.

INDIA-RUBBER AND ITS MANUFACTURE.

One of the most remarkable American discoveries of the present century is, undoubtedly, the mode of manufacturing and applying the article known to commerce as "India-rubber," but which, among the people of South America, is called "caoutchouc." The article in question is a gum procured from a peculiar tree in the hottest regions of the equator. The tree which yields this gum in the East Indies is somewhat different from that which produces it in the equatorial regions of South America. The former ("ficus elastica") is represented in an engraving on another page. Although the gum was used in a rude fashion since many ages by the inhabitants of the countries which produce it (and it had been known to commerce for a long time, having been discovered by a French philosopher in 1736), it is only within 20 years that its value has been appreciated. In that time, under the genius of American manufacturers, it has risen to a rank equal, perhaps, to that of iron and glass among the materials that administer to the necessities and comforts of man.

In the forests of equatorial South America the "siphonia elastica" grows to a height of 60 or 70 feet, and is covered with a scaly bark. It bears a fruit, which encloses a white almond highly esteemed by the natives. A slight wound on this tree causes the sap to flow freely, thick, white, and unctuous, like the sap of the milk-weed. On being exposed to the air, this soon becomes solid. This sap is collected by the natives, who make a longitudinal cut in the centre of the tree, and lateral cuts leading diagonally into it. At the bottom of the perpendicular cut a banana leaf is placed to conduct the sap, as it flows, into a vessel placed to receive it. The sap is used for the formation of bottles, boots, shoes, and various articles. The process is to form the figure of the thing desired in clay, and cover it on the outside with many coats of the gum, exposing it to fire to dry. When the desired thickness is obtained, the mould is soaked out in water, and the article is ready for use. Clumsy shoes, rudely fashioned in this manner, were long an article of importation from Para into the United States, and extensively sold down to within 20 years. There was little other use made of the article except to erase pencil marks, and for which purpose was charged 50 cents for ½ a cubic inch. The nature of the gum did not, however, long fail to become an object of research. The learned decided that it was neither gum nor resin, but of a peculiar nature analogous to resin, from which it differed in not being soluble in alcohol. Many attempts to make it useful in the arts were made, and finally it was found that by dissolving it in volatile oil there was obtained a sort of varnish very useful in making certain tissues and fabrics water-proof. A thin coat, placed between two sheets of stuff, caused them to adhere closely and made them impervious as well to water as to air. This application of it was made in the manufacture of mattresses, cushions, pillows, boots, bottles, etc. A solution in linseed oil is called an excellent varnish for making leather water-tight. The best solvents are said, however, to be oil of turpentine, coal, naphtha, and benzole. Alcohol will not dissolve it, but will precipitate it from ether. Another solvent is of rubber itself, called caoutchoucin. It is produced by exposing rubber to a heat of 600°, when it goes off in a vapor, which, being condensed, produces the solvent. All these applications, however, utilized only one of the distinguishing properties of rubber, viz., its imperviousness to water. An inventor, however, by the aid of a new solvent, found means to spin threads of the rubber of various degrees of fineness and strength. These threads, covered with textile fabrics—silk, wool, cotton, or linen—became light and supple tissues of extraordinary elasticity. This opened the way to an immense number of employments.

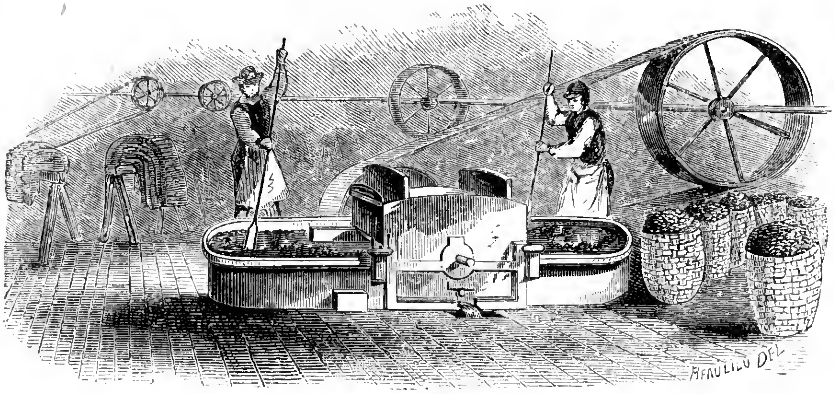
In some machines the rubber is kneaded, and compressed in various ways, and finally a number of the balls thus treated are brought together and powerfully squeezed by a screw press in cast-iron moulds, in which, being firmly secured, the mass is left several days. This process is somewhat modified in different establishments. In some, the cleaned shreds are rolled into sheets, from which threads and thin rubber are sliced by the application of suitable knives, worked by machines, and kept wet. The sheets are at once ready for the purpose to which this form is applied, or, by machinery of great ingenuity, they are cut into long threads of any desired degree of fineness. If then required to be joined, a clean oblique cut is made, with a pair of scissors, and the parts being brought together, readily and perfectly unite by the pressure of the fingers. As



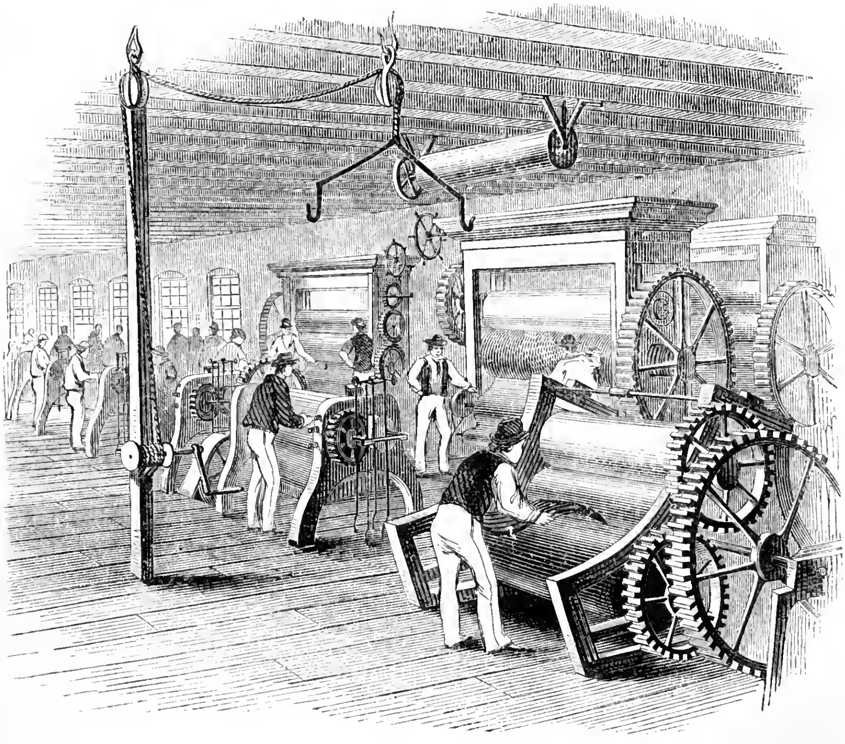
THE GREAT CALENDER MACHINE.

FICUS ELASTICA, FROM THE EAST INDIES.

CUTTING RUBBER INTO SLABS FOR THE WASHING MACHINES.



MACHINE FOR WASHING INDIA-RUBBER.



INDIA-RUBBER GRINDING MILL.

the threads are reeled off, they are elongated about eight times their original length by passing through the hands of a boy, and by the same operation they are deprived of their elasticity. After remaining on the reel some days, they are wound upon bobbins, and are then ready for weaving and braiding. The threads are of different fineness. A pound of caoutchouc can, by one machine, be made into 8000 yards of thread. This may, by another, be divided by 4, making 32,000 yards. Elastic braids are these threads covered with silk and other material. In woven fabrics, caoutchouc thread makes the warp, alternately with threads of stuff to receive the extreme strain that would destroy the rubber, and the other materials form the weft, or cross-threads. When woven, a hot iron is passed over the stuff, and this causes the rubber to regain its elasticity. Another mode of forming the threads perfectly round and smooth, is to convert the caoutchouc into a soft paste. This is done by macerating it for some hours with about twice its weight of sulphuret of carbon, adding 5 per cent. of alcohol. The paste is well kneaded by compressing it through diaphragms of wire gauze, placed in cylinders, and is then forced through a line of small holes at the bottom of another cylinder. The threads, as they issue, are taken on a web of velvet, from which they pass to another of common cloth, and are carried slowly along for 600 to 700 feet, when becoming dry and hard by the evaporation of the solvent, they are received in a little cup. The threads produced of vulcanized rubber retain their elasticity, and are, when woven, kept stretched by weights. On releasing them, the material woven with them is drawn back, producing shirred or corrugated fabrics.

Caoutchouc supplanted the metal elastics for many purposes, since it would not corrode in moisture. It was at once in demand for suspenders, garters, corsets, and numberless appurtenances of apparel.

It came to be used for water-proofing cloths, surgical instruments of all kinds, elastic bands, in the arts and trades. Bookbinders have used it for securing the leaves in books, imparting flexibility and freedom to the opening volumes. In thin sheets, it has been used for taking impressions of engravings. In this form, also, it is an excellent material for covering the mouths of bottles, and similar applications requiring the exclusion of air and moisture. Prepared with other ingredients, it forms a marine glue unsurpassed in adhesiveness when applied to wood. A pound of fine rubber is dissolved in four gallons of rectified coal-tar naphtha and well mixed. In ten or twelve days this will attain the consistency of cream, when an equal weight of shellac is added. It is then heated in an iron vessel having a discharge pipe at the bottom. As it melts, it is kept well stirred, and the liquid flowing out is obtained in the form of thin sheets. When it is applied, it is heated to 248° and applied with a brush, and retained soft until the jointing is made, by passing heated rollers over the surface. This has been, it is said, applied to masts of vessels, which have been so firmly spliced that fractures take place in the new wood sooner than to separate the glued portion; and it has been held that parts of vessels may be, by these means, so firmly put together that iron bolts would be unnecessary.

Rubber has been made use of for paving stables, lobbies, and halls, here, as well as in England, where Windsor Castle carriage-way is so paved. There are a multitude of uses for the material, such as baths, dishes for photograph and chemical purposes, telegraph wire covers, boots, shoes, toys, life-preservers, clothing, furniture covers, travelling bags, tents, beds, water pails. It is being constantly applied to new uses, as the chemical modes of treating the article develop new properties.

The uses of the article were, however, still comparatively limited. The water-proof qualities were, to some extent, availed of, and its elasticity was ingeniously applied in many minor directions. The native article itself was still an impracticable object in the manufacture. It had baffled the philosopher, the chemist, and the artisan in investigating its nature and in controlling its properties. Repeated attempts were made to transport the pure juice or gum to Europe, there to be operated upon, but without success, since it was found that it rapidly degenerated. A method of doing this was finally devised by Mr. Lee Norris, of New York. The liquor is first filtered and mixed with ⅓ its own weight of ammonia. On being poured out on any smooth surface, and exposed to a temperature of 70° or 100° of heat, the ammonia, which had preserved it from the action of the atmosphere, is evaporated, and leaves the gum in the form of the object which holds it. Its intractable nature was finally, however, conquered by Charles Goodyear, who controlled it, apparently, as Rarey does horses, viz., by producing the result without any one being able to explain the phenomenon. Mr. Goodyear spent 20 years of the most unremitting toil in experimenting upon India-rubber, and finally discovered that a mixture of sulphur, white lead, and caoutchouc, exposed to regulated temperature from 8 to 12 hours, becomes "vulcanized," or an entire new substance unlike any other. The native rubber, being exposed to the extremes of heat and cold, is destroyed; but those agencies have no effect on the same article vulcanized. The liquids which dissolve the pure rubber do not influence the new article, which, however, acquires a far higher degree of elasticity — becomes, in fact, an "elastic metal." The article, when put into the heaters, is a tough, sticky, unelastic dough. It comes out endowed with a high degree of elasticity, insensible to heat, or cold, or solvents, and applicable to almost every want of life. It has been since discovered that the white lead contributes but little to the change undergone in the heaters, the cause or manner of which has baffled the skill of the most scientific chemists in this country or Europe. In mixing the proportions of the compounds, reference has always been made to the nature of the objects to be manufactured. The form and adaptation of the articles are perfected before the "vulcanizing." The general mode of preparing the rubber is the same. The rubber imported from the East Indies is said to be of a stronger fibre than that of South America, and the gum is selected in accordance with the manufacture proposed. It is imported in rude masses, in which sticks, leaves, and dirt are thickly mingled. These are about 2 feet long and 1 foot thick. The first process that the gum undergoes is the expensive and laborious one of cleaning, by which the mass loses about $\frac{1}{5}$ of its weight. A large vat is filled with hot water, and in this the rubber remains until the exterior is sufficiently softened to allow of the removal of the coarse basket-work that covers and adheres closely to it. When this is done, the lumps are, by means of a circular knife of a diameter of 4 feet, revolving with great speed under the influence of powerful machinery, cut into slabs about 1 inch thick. The engraving will give a good idea of the operation. These slabs are then carried to the "cracker," of which an illustration will be found on another page. This is formed of two large cylinders grooved longitudinally, and revolving slowly but irresistibly. Between these the slabs, as they are passed, are elongated and twisted, by which operation much of the dirt and bark works out. The stretched slabs are then taken to the washing machine, where numerous sharp knives, revolving under the water, cut it into small pieces, as seen in the baskets on the right of the illustration, which, at the same time, are kneaded and washed until they are thoroughly cleansed. They are then ready for the grinding machine. This consists of large hollow cylinders, made of cast iron, and revolving in opposite directions. The small pieces that come from the washing machine, being fed in, are kneaded by the cylinders again into thick sheets or mats. With this process the preparation is suspended for several months in order to allow the mats to be thoroughly dried and cured by the action of the air. This involves the necessity of keeping on hand a large stock of rubber.

When the rubber is quite cured, it is taken to the mixing machines, where it is to be combined with the various metals and substances to which the metallic rubber owes its peculiar properties. The mixing machines, like most of those used in the manufacture, are hollow revolving cylinders. The mixing cylinders are of great size and strength, and acquire the necessary heat to work the rubber from the steam let in at the ends. These, revolving toward each other, knead the rubber like dough. In the process, a constant series of explosions, like pistol-shots, is caused by the air confined in the folds of the substance being forced out by the action of the cylinders. This, on a grand scale, repeats the boy's amusement of chewing rubber soft in order to explode on his fist the air-bubbles created in it. As the rubber softens under this action, the workman slowly mixes in the various substances required. These consist mostly of sulphur, to which are added the oxides of various metals, zinc, lead, iron, etc. Here the greatest skill of the manufacturer is brought into requisition. Every quality of rubber requires a different compound, and every difference in the compound requires a different treatment in the subsequent stages of the manufacture. Thus prepared, the substance is ready to be moulded and shaped into the various forms in which it is to be finally perfected and used. The modes of preparation are various, according to the ultimate object—whether that may be for it to assume the form of the hard, unelastic comb, a door spring, a steam valve, a carpet, or any of the thousand shapes it is made to take.

It may be here remarked that the discovery, great as it was, was but the first step in the great series of improvements that has resulted from it. After 18 years of incessant labor, Mr. Goodyear had perfected a raw material—but a raw material for what? It was necessary to know to what articles it could be applied before there could be any demand for it; until then it was of no marketable value. It was necessary to invent or discover all the uses to which it might be applied. The shoe business was the first to make it available; but since then, vast as has been the number of manufactures based on it, discoveries are being daily made to extend it.

The manufacture of "belting" and "hose" is a very large business. The belts are used for driving machinery, and are superior to every other means. They are stronger than the best sole leather, and adhere to the drum or pulley with a tenacity that prevents slipping. This manufacture is a peculiar process. Cotton duck, similar to that of which sails are made, is woven in a mode to give double the usual strength longitudinally. This duck is impregnated with the rubber, under the influence of powerful machinery, which drives the substance through and through its meshes. It is then taken to the calender machine, seen in the engraving. The large cylinders of which it is composed have a perfectly polished surface. The rubber having gone through the mixing process, is in the shape of sticky, slate-colored dough, and passing through the calenders, is rolled out into a perfectly even sheet, upon the prepared duck. When this is completed, the "bolts" are taken to the belt-room, spread out upon tables 100 feet long, and cut into the strips desired for the various kinds of belting. For one of great strength, several of the strips are placed one upon the other, and then pressed together with immense power, by rolling-machines; thus giving them the strength of metal, with the peculiar friction surface found only in rubber. The belts are now ready for the heaters. These are long steam boilers, the door of which being opened, there is drawn out a long railway carriage. On this are placed the goods, which are then rolled in, the boiler closed, and steam admitted. In from 8 to 12 hours, the singular transformation known as vulcanizing, takes place.

The manufacture of "Croton hose" is similar. A long iron tube, of the proper diameter (and hose is made from $\frac{1}{4}$ inch to 12 inches) is covered with a sheet of carefully-prepared rubber. This, however, intended to be pliable, would not of itself be of sufficient strength to sustain a strong head of water, hence it is covered with webs of cloth prepared in the manner of the belting duck. When a sufficient number of folds have been applied to give the required strength, an outside covering of pure rubber is applied. A heater of immense length then receives the pipes, with the hose on them, to be cured by the same process as the belts. The hose is then drawn off the pipe to be subjected to proof. This hose will withstand a pressure that will burst the most powerful leather hose.

One of the most useful applications of vulcanized India-rubber, is steam packing. The vulcanized rubber is the only material that will preserve its elasticity and counteract the expansion and contraction of metals exposed to the heat of steam, thus making a joint perfectly steam-tight. It is used to pack round piston rods in steam machines; to place between the iron plates of steam pipes, wherever a joint is required; for gaskets, valves, and rings. Some ocean steamers have huge rubber valves, five feet in diameter, which play up and down in the vast cylinder, opening and shutting like the valves of a colossal artery. The use of rubber is now so great a necessity, wherever steam is used, that the mind wonders how it could ever have been dispensed with. It is not only steam, however, but every branch of mechanics that demands its presence, in the shape of sheets, plates, rings, hollow ellipses, of all imaginable forms and sizes, of which none but a mechanic can conceive the number applicable to his own art.

The use of rubber for car-springs has become almost universal. The high degree of elasticity which the sulphur imparts, makes that application an admirable one, and the more so that it does not lose the elasticity by prolonged use.

The "elastic metal" supplants the rigid one in numberless uses. House-sinks, instead of cast iron, are now formed of rubber, without joint or seam; and these are far less fatal to the china washed in them, than were the metal ones. Springs for doors, from this material, supplant all others. These, for churches, are so arranged that the door may be closed, or held open to a desired distance. For bed-springs, it has become the most desirable, durable, and luxurious material. Carpets and mats for halls, stairways, and public rooms, are formed of it, of infinite variety and usefulness. The mixture of lead in the compound was found to make it more compact and heavy, but the peculiar properties are apparently attained as well without the use of the lead. The combination with sulphur has been effected by exposing the material to the action of sulphurous fluids, as the sulphuret of carbon and the chloride of sulphur. An immersion of one or two minutes, in a mixture composed of 40 parts of sulphuret of carbon to 1 of chloride of sulphur, kept at the usual high heat, will produce the vulcanization; and pressed into moulds while at the high heat, the form becomes permanent when cold. For the purpose of imparting that hardness which is manifest in combs, fancy boxes, canes, buttons, knife-handles, and all those forms in which it has supplanted bone, shell, and ivory, magnesia is introduced. It is stated that sulphur, in the proportion of one to three, will impart the hardness if the high temperature is sustained for a sufficient length of time. The magnesia gives a lighter color to the articles in which it is compounded. In the manufacture, articles to be heated are buried in pulverized soapstone, by the introduction of highly heated steam. The ingenuity of chemists and mechanics is still actively stimulated to produce new compositions and new results, not only in the properties that result from new compounds and varied proportions, but in the applications of which they are susceptible. Vast as are the resources that rubber opens to the arts and to trade, it may be said yet to be in its infancy. The effect upon the commerce of the country is seen in the following table. The largest proportion of caoutchouc used in the world comes from South America.

Years.	Rubber imported.	Shoes exported. Pairs.	Value.	Other rubber goods.	Total value.
1856..	$1,143,372	625,220	$427,936	$665,602	$1,093,538
1857..	1,012,643	537,238	331,125	312,387	643,512
1858..	755,828	247,380	115,931	197,448	313,379

There have been great vicissitudes in the manufacture of goods under Goodyear's patents. Numbers of companies have been formed in Connecticut, New York, Newark, New Brunswick, Millstone, N. J., and elsewhere. Some of these have been highly successful, and others have sunk their capitals. These companies now have a common agency for the sale of their goods, under certain regulations and restrictions, by which the ruinous effects of competition are abolished. The progress of the manufacture has been very rapid. In 1850, the value of the rubber goods made in the United States was $3,024,335. In 1860, it amounted to $5,642,700, an increase of 86·6 per cent. The number of establishments had diminished, but they employed a larger capital, used more raw material, and made a much larger quantity of goods. Since 1860 the manufacture has nearly or quite doubled. The hard rubber, or vulcanite, is used for jewelry, buttons, dress ornaments, pencils, canes, &c.

Gutta percha is used extensively for similar purposes as the caoutchouc, and is prepared in the same manner by Goodyear's process. It is a gum found in the trees of the Malay peninsula, and procured in the same manner as caoutchouc. European attention was first called to it in 1842, and it began to be imported in 1844. Its chemical composition is identical with that of India-rubber, except that it contains oxygen, which rubber does not. It has a number of qualities that make it preferable for certain uses. It is a bad conductor, and is therefore very applicable as a covering for telegraph wires, and its peculiar acoustic properties make it valuable for speaking-tubes in public houses and large establishments. The application of gutta percha to the coating of telegraph wires is claimed by Mr. Samuel J. Armstrong, of New York, who for that purpose modified the machinery for gutta percha tubing. The first machinery built for that purpose was in 1848, and the first wire so coated was laid across the Hudson river, at Fort Lee, in August, 1849, for the Morse Telegraph Company. This machinery was furtively carried to England, and there used for the Atlantic Telegraph. The articles made of gutta percha alone, or mixed with other substances, are of very great variety—ornaments, vessels, articles of clothing, fancy articles, surgical articles, dentists' and numerous other articles. Vessels have also been made of it, and its uses are being daily multiplied.

PAST.

PRESENT.

SEWING MACHINES.

The description of labor which is the most general is, probably, that of sewing, since all women take part in it more or less, and they are aided in the heavier work by men. All human clothing, bedding, upholstery, &c., require more or less sewing in their manufacture, and during the present century the amount required has, from various causes, been greatly increased. To the flax, wool, &c., previously used as materials in the manufacture of cloth, cotton has been added; and by the aid of machinery, cloth, from all these materials, has been produced in greater abundance and at diminished cost; while the increase of individual wealth among the people has given them the means of using a greater variety and amount of clothing, all of which was required to be made up with the hand needle. The condition of sewing women became a matter of public sympathy; and much sentiment was exercised over those thus compelled to waste their lives in

> "Sewing at once, with a double thread,
> A shroud as well as a shirt."

When the inventive genius of the age was directed to the means of facilitating all labors, it is not to be supposed that this important field could be neglected. The first attempt, so far as we can learn, to accomplish sewing by machinery, was made by John Knowles, of Monkton, Vermont; who, as early as the year 1819, invented and constructed a sewing machine, which is said to have made a good seam, and to have been, so far as the capacity of forming the stitch is concerned, a decided success. It used but one thread, and made a stitch identical with the ordinary "back-stitch" made in hand sewing, and by a process substantially the same. The needle, however, was differently constructed, having a point at each end, with the eye in the middle; and it was passed back and forth through the cloth without changing its ends. His machine was furnished with a device for feeding along the work, automatically, in concert with the action of the needle; a device similar in principle to the "basterplate of Howe, noticed hereafter; it was, however, defective, as it would move the work only in a direction straight forward, and hence it could be used only to sew upon straight seams. After much unsuccessful effort to correct this defect, so as to adapt his machine to the general purposes of sewing, Mr. Knowles abandoned his invention. And yet it appears that his machine embraced nearly all the essential features of a practical sewing machine; approaching more nearly to the results reached in the first machine of Mr. Howe, than did any other invention between the two. Mr. Knowles did not apply for a patent, and never made but the one machine.

During the next twenty-five years, many attempts in the same direction were made, both in this country and in Europe. In May, 1829, a patent was granted, in England, to Henry Bock, for a "tambouring machine," the needle having two points and an eye; but *tambouring* is not *sewing*. July 17, 1830, a patent was granted in France, to M. Thimonier, for a crocheting machine, adapted to sewing purposes; but this machine had no feeding apparatus whatever, and the material to be sewed had to be moved along by hand. It had a crochet or hooked needle, and a device called an "accroucheur," to lay the thread on the hook, after it had passed through the cloth. It used but one thread, and made the single-tambour stitch. An attempt was made to introduce it in the manufacture of army clothing, but the attempt proved a failure, as did the machine.

The first patent issued in this country for a sewing machine was granted February 21, 1842, to J. J. Greenough, of Washington City. This machine used a needle having two points and one eye, and made the "through-and-through," or shoemaker's stitch. Whatever may have been its merits, it proved of no value to the public, as no machine except the model was ever built. A machine for making the "running" or "basting" stitch was patented March 4, 1843, by B. W. Bean, of New York City; but we believe that no machines were ever built for sale. A patent was granted, December 27, 1843, to Geo. R. Corlies, of Greenwich, N. Y., for a machine similar to Greenough's; but no machines were ever made for use.

The first really practical sewing machine invented was that of Elias Howe, Jr., of Cambridge, Mass., invented in 1845, and patented September 10, 1846. His patent covered, broadly, the formation of a seam for uniting pieces of cloth, by the combined action of an eye-pointed needle and a shuttle, or their equivalent, interlocking two threads. His machine, as originally introduced, combined a grooved and curved, eye-pointed needle, a peculiar shuttle, holding and feeding devices, thread carrier and guide, &c. In its operation, a loop of thread being thrust through the fabric by the needle, the shuttle, carrying the lower thread upon a small bobbin within it, passed through the loop, leaving in it a line of thread, which, being thus interlocked, was drawn into the fabric. The pieces of cloth to be sewed were suspended upon points of a "baster-plate," with proper "holding surfaces," which was moved forward, and the length of the stitch regulated by a "ratchet wheel." When a "reach" of the seam had been sewed the length of the baster-plate, the cloth was detached, the plate run back, the cloth re-attached to the points, and another reach of seam sewed. This constituted the *feeding* apparatus. In his later machines, however, the method of holding and feeding the cloth is entirely changed. The baster-plate is no longer used, the fabric to be sewed being laid upon the horizontal plate or table of the machine, and passed under a straight needle which acts vertically, instead of horizontally as in the original machine. Few mechanical inventions are introduced in a state of absolute perfection; and this, as we have seen, constitutes no exception to the general rule.

The first patent for an improvement upon Howe's machine was issued to John Bradshaw, of Lowell, Mass., for a device to regulate the *tension* of the thread, and was dated, Nov. 23, 1848. On the 6th of February, 1849, J. B. Johnson and Charles Morey, of Boston, Mass., obtained a patent for a machine, having a *circular* or *continuous* baster-plate, which was an improvement upon the *straight* baster-plate of Howe; but other and more valuable improvements for the same purpose soon succeeded this. May 8, 1849, John Batchelder, of Boston, Mass., obtained a patent for an improvement to regulate the feeding of the cloth, automatically, by the machine. And about the same time a patent was also granted to J. S. Conant, of Dracut, Mass., for an improvement designed to accomplish the same purpose, by a different arrangement. October 2, 1849, Blodgett & Lerow, of Boston, obtained a patent for a machine to make the shuttle-stitch, by a method different from that of Howe, the shuttle describing a *circle*, instead of moving *back and forth*. The introduction of this machine, though it was clearly an infringement of Howe's patent, proved a decided advantage to him; as a

WHEELER & WILSON'S SEWING MACHINE.

Fig. 1.—View of the Machine ready for work.

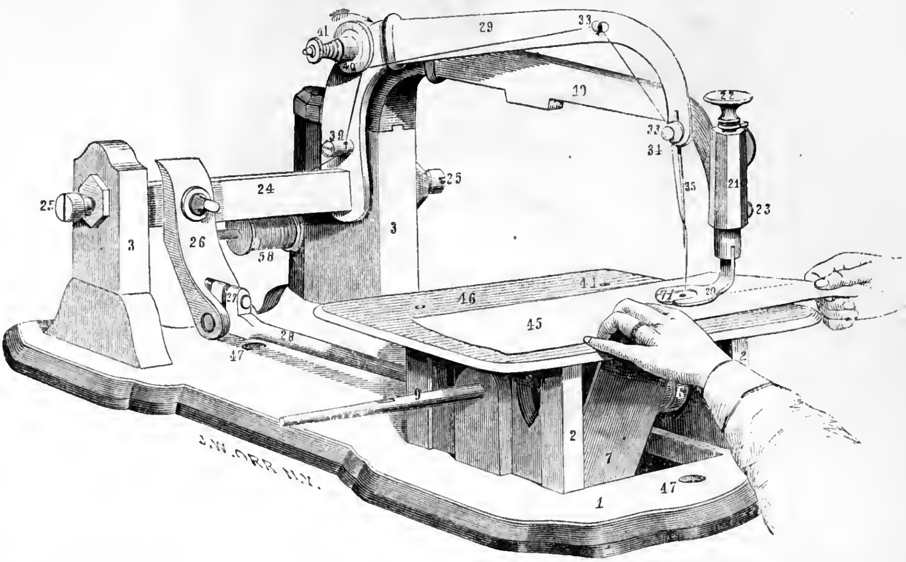


Fig. 3.—Front view of Fig. 2.

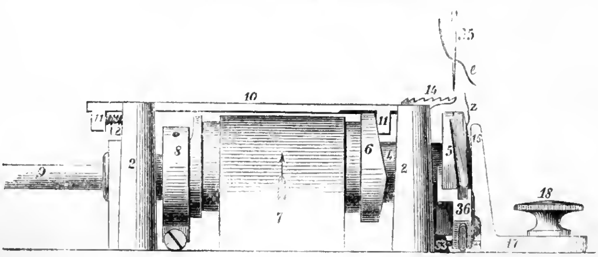


Fig. 2.—View of the Machine with the Cloth Plate removed.

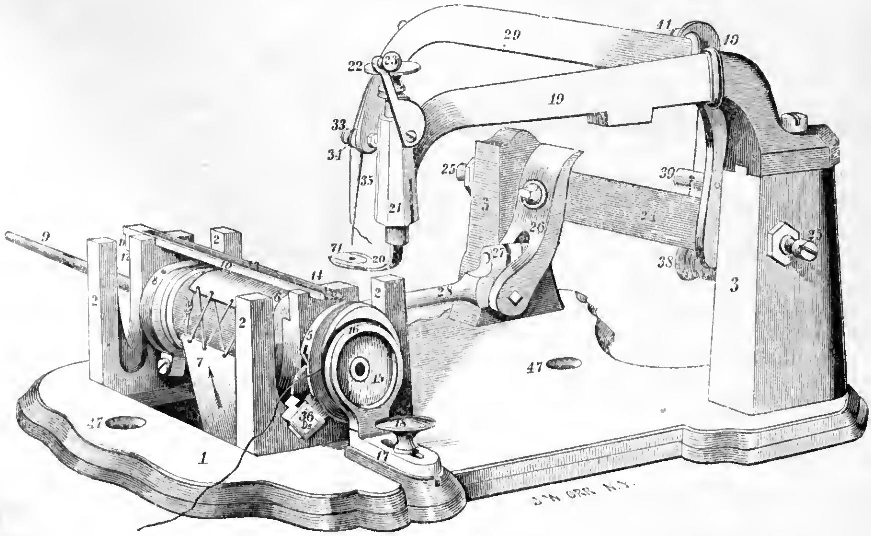


Fig. 4.

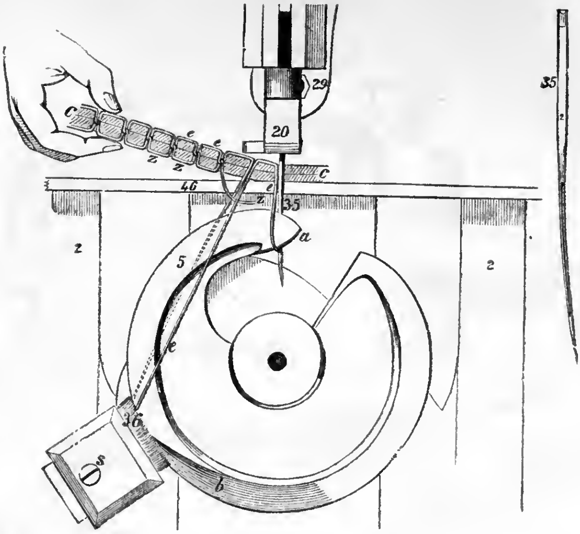


Fig. 5.

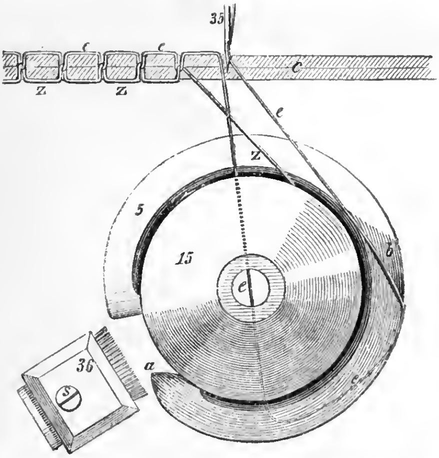


Fig. 6.

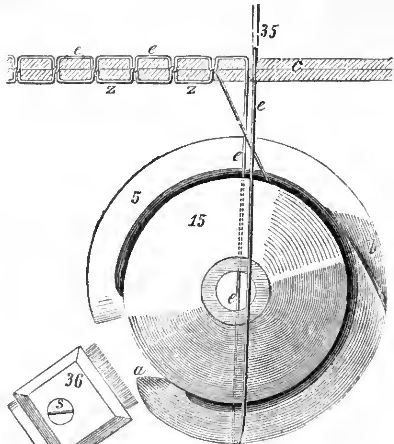


Fig. 7.—Cloth Plate reversed.

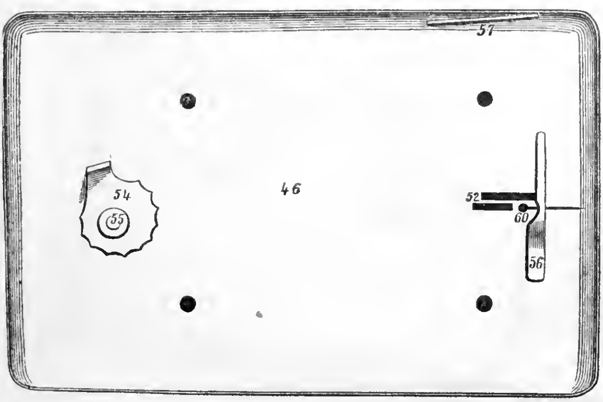


Fig. 9.—Hemmer.

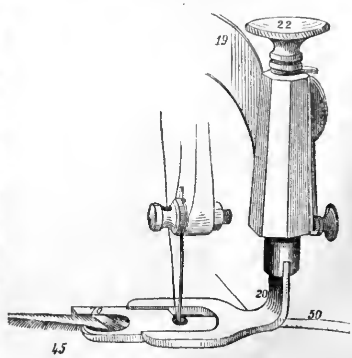
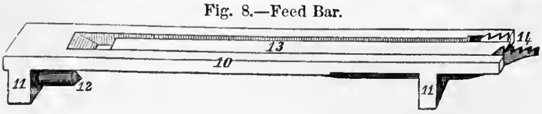
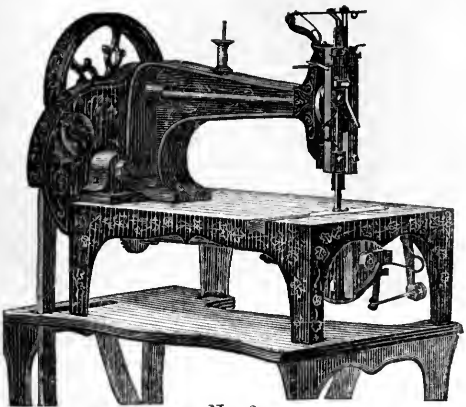


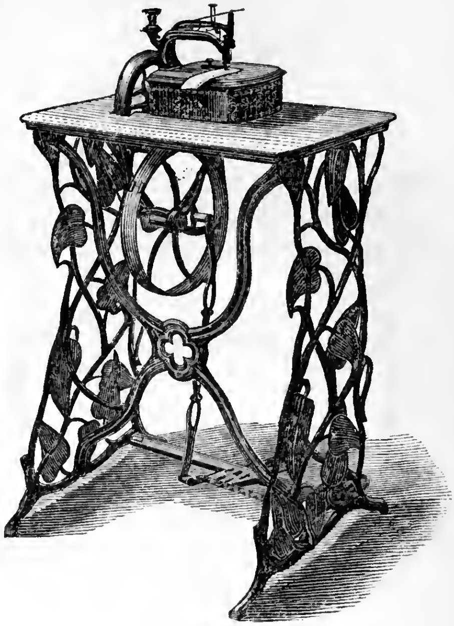
Fig. 8.—Feed Bar.



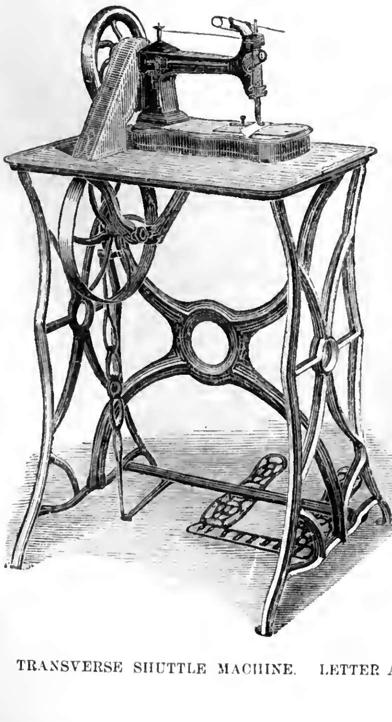
I. M. SINGER'S SEWING MACHINES.



No. 2.



FAMILY MACHINE.



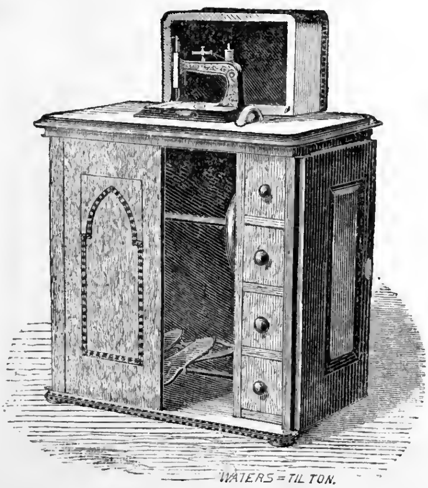
TRANSVERSE SHUTTLE MACHINE. LETTER A

LETTER A MACHINE IN CABINET CASE.

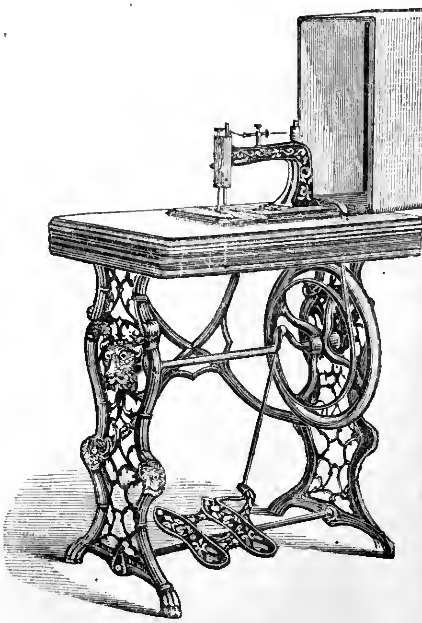
FINKLE & LYON SEWING MACHINE CO.

No. 4. LARGE MANUFACTURING MACHINE.

No longer is wrought the *gusset and band*
With ceaseless stitch and wearied hand:
For sewing is *pleasure* by magic art,
Since curious machines well play their part.



No. 2. FAMILY MACHINE.



No. 3. MEDIUM MACHINE.

considerable number of the machines were made and sold, and their operation, though far from perfect, did much toward convincing the public that sewing *could* be done by machinery. Several other improvements were also introduced, but those above mentioned were the most important that appeared during the first four years succeeding the date of Howe's patent; and none of these can be said to have accomplished any marked results. During the fifth year, however, improvements were multiplied more rapidly; and from this period may be dated the first decided success in the practical application of Howe's invention.

On the 12th of November, 1850, a patent was issued to Allen B. Wilson, of Pittsfield, Mass., covering two improvements: one, a new device for feeding the cloth, termed the "two-motion feed," afterwards changed by a further improvement to the "four-motion feed"—which has proved the best feed arrangement for general purposes yet invented; the other, a shuttle, pointed at each end, which made a stitch at *each movement*, while in Howe's machine the shuttle had to *go and return* at every stitch. This improvement was, however, superseded by another, styled the "rotating hook," which was the subject of a patent dated August 12, 1851, and which served as a complete substitute for the shuttle of Howe. This improvement constitutes the leading or characteristic feature of the Wheeler & Wilson machine.

On the 11th of February, 1851, a patent was granted to Grover & Baker, of Boston, for a machine invented by William O. Grover, of that firm, the distinguishing feature of which consisted in a device called the "circular needle," which also served as a substitute for the shuttle. In the summer of 1851, Mr. Grover, without knowledge of what Wilson had done, invented a feed device, substantially similar to Wilson's, for which a patent was issued to Grover & Baker, June 22, 1852. This double invention of the same device gave rise to some difficulty between the two companies; but this was compromised, and the same feeding arrangement has since been used in both machines.

In September, 1850, Isaac M. Singer, of New York City, completed a machine, for which a patent was issued to I. M. Singer & Co., on the 12th of August, 1851. This machine, though it contained several improvements on that of Howe, bore a closer resemblance to it, in its general construction, than either of the two last named. Copying so nearly from Howe, Singer & Co. had less to do in getting out their machine, and were the first in market, but the others followed soon after; and thus, with a nearly even start, those three companies commenced the manufacture and sale of their respective machines; Singer & Co. taking the lead for the first two years, Grover & Baker for the two next, and since that the Wheeler & Wilson. With such energy was the business prosecuted by each of those companies, and so great was their success, that before the expiration of Howe's original patent, in 1860, the aggregate number of machines made and sold by them had exceeded 130,000; of which about 55,000 were turned out by Wheeler & Wilson, 40,000 by Singer & Co., and 35,000 by Grover & Baker. At that date less than 2,000 machines of *Howe's* patent had been manufactured, and these were made by a brother of the inventor, Mr. A. B. Howe, of New York. While, therefore, the highest honor is due to Mr. Elias Howe, Jr.—as the *original* inventor of the sewing machine—the public is largely indebted, for its improvement and successful introduction, to the inventive genius of Wilson, Grover, and Singer, and the enterprise of their respective companies. And here it may be remarked, that the infancy of the sewing machine, like that of many other important inventions, was beset with difficulties. By the time that Mr. Howe had completed his experiments, built his model, and secured his patent, he had exhausted his means. He could not embark in the manufacture of machines without capital; and he could not obtain the capital he so much needed until the utility of his invention had been demonstrated by practical use. Failing in his effort to enlist the aid of capitalists in this country, he went to Europe. In England a patent was secured for his invention, but he allowed it to be taken in the name of another party residing there, who, losing confidence in the invention, never did much with it, and Howe never realized any thing from it. Failing of any success abroad, he decided to return, and try his luck once more here. But to such poverty was he now reduced, that he was obliged to pawn his effects to pay his wife's passage, and to work, as an ordinary deck hand, for his own. Arriving penniless, but not disheartened, confident that some day his invention would be appreciated, he resumed his old employment as a journeyman mechanic, for a livelihood. At length the tide of circumstances turned in his favor. The infringement of his patent, by the three companies above referred to, and by other parties of less note, in a short time accomplished what he had never been able to do himself; as great numbers of machines, of various makers, were thus distributed, by means of which the utility of the sewing machine was soon demonstrated. These infringements furnished also the occasion for legal proceedings, in the course of which the validity of his patent was established by judicial decisions. Of the suits brought by him against those three companies, one resulted in a judgment, in his favor, and the other two were *settled*, before decisions had been reached. At this time, or soon after, an arrangement was entered into between Mr. Howe, Wheeler & Wilson, I. M. Singer & Co., and Grover & Baker, by which each of those three companies was licensed to manufacture its own machines, under the protection of Howe's patent, during the remainder of the term for which it had been granted, at a patent rent, or royalty, of *ten dollars* on each machine made and sold, until a certain number had been produced, and at a less rent afterward. The contract by which that arrangement was perfected was dated October 10, 1856, and is known as the "Albany Agreement." By its provisions, those four parties were constituted a *combination*, for the mutual protection of their several patents, against outside infringement—a combination which has exercised an important influence upon the general sewing machine interests of the country.

While these inventions were being introduced, there were other difficulties to be overcome—difficulties affecting not Mr. Howe only, but also the combination—among which were, the incredulity of the public; the trouble of teaching operatives; the indisposition of manufacturers to adopt new modes of doing business; the disinclination of tailors and seamstresses to welcome the sewing machine; and, last but not least, the introduction of an inferior class of machines, which, being sold at lower prices, met for a time a ready sale, and which, by their general failure, did much to impair the confidence of the public in the utility of the sewing machine. Yet this experiment served one good purpose, as by it the public became satisfied of the worthless character of cheaply made machines; and hence the result was, on the whole, advantageous rather than otherwise, to those interested in the manufacture and sale of good ones.

From 1852 to 1857, no new machine, of any marked excellence, was introduced, the efforts of all inventors, outside of the aforesaid combination, being directed not so much to the *improvement* of the sewing machine, as to the production of a *cheaper class*. The next invention, which possessed any claim to special merit as an improvement upon those already noticed, was a machine invented by James E. A. Gibbs, of Millpoint, Va., for which a patent was issued June 2, 1857. The leading idea of Mr. Gibbs, and the object claimed to have been accomplished in his machine, was—the attainment of greater *simplicity*, in order more perfectly to adapt the sewing machine to the capacities of all. Mr. Gibbs, who was a natural, but uneducated mechanic, had never seen a sewing machine of any kind until he had completed the model of his own. His machine, therefore, though containing principles which had been previously invented and patented, was with him entirely an original invention. He had seen in some newspaper or magazine a notice of a "sewing machine"—which was described as using "two threads"—and the thought immediately occurred to him, that if a *reliable* seam could be made with *one* thread, instead of *two*, less machinery would be required, and thus greater simplicity would be secured; a result which, to him, appeared to be one of great importance, especially in an instrument for general family use. He at once set himself to work, and soon invented a *new kind of stitch*, requiring the use of but one thread, yet possessing, as claimed, at least equal merit, for general use, to any made with two threads. After Mr. Gibbs had obtained his patent, James Willcox, then of Philadelphia, secured the control of it; and on the 18th of February, 1859, obtained a license from the aforesaid combination, and commenced the manufacture of the machines, under the name of the Willcox & Gibbs Sewing Machine. The peculiarities of the stitch, and the construction and operation of this machine will be more fully described hereafter.

On the expiration of Howe's original patent, and its extension for the further term of seven years from the 10th day of September, 1860, a more liberal policy was adopted. The "combination" was continued; but an agreement was made between Mr. Howe and the other parties constituting it, which provided for the granting of licenses, by the combination, to other parties not members of it, in numbers sufficient to secure to the public a "full supply of *good* sewing machines at *reasonable* prices."

The patent rent exacted of licensees, under this new arrangement, is fixed at *seven* dollars for each machine using two threads, which is manufactured and sold to be used in the United States, and *four* dollars each for all exported, to be used in foreign countries. Of this rent, Mr. Howe receives one dollar on each machine made and sold, and the balance goes to the other three parties; who are required to defray all the expenses of protecting his patents, jointly with their own; besides paying him a license rent of one dollar each on all machines made by them. Mr. Howe has therefore a *net* income of *one* dollar for every sewing machine made and sold in the United States—an income which amounts to a fortune every year. The amount thus received by Mr. Howe during the year 1866, as appears by the license returns, was upwards of $155,000. During the same period, the three companies received from the same source about $213,000; making a total of over $368,000, received by the combination.

The progress of invention has brought into use *three classes* of sewing machines, viz.:

1st. Those making the double-thread, "shuttle" or "lock-stitch." Of this class are the Howe, Wheeler & Wilson, Singer, Weed, Etna, Elliptic, Florence, Empire, Finkle & Lyon, and Leavitt Machines.

2d. Those making the "double-loop," or "Grover & Baker stitch." The only machine of any importance, which makes this kind of stitch, is the Grover & Baker.

3d. Those making the single-thread, "twisted-loop" or "Willcox & Gibbs stitch." The only machines of this class are those manufactured by the Willcox & Gibbs Sewing Machine Company.

In all sewing machines, the formation of a stitch requires two distinct operations, the first of which is performed on the upper surface, and the second on the under surface of the goods. The first process is accomplished in every machine by means of an eye-pointed, reciprocating *needle*, with a vertical movement, acting in concert with the *feed*; the office of the needle being to take the thread from the spool, and, carrying it downward, perforate the fabric and pass a loop of the thread down through it, to a point where the stitch-forming mechanism underneath will reach it, while the feed, by an alternate movement, carries the goods forward for another stitch. The second process is accomplished by means of special mechanism, the office of which is to connect and fasten, with a separate under thread or with a portion of the upper one (according to the kind of stitch made, whether a double or a single thread one), the successive loops of the upper thread as they are passed down through the fabric by the needle. Thus, as the sewing proceeds, two continuous rows or lines of thread are produced, one on the upper, and the other on the under surface of the goods, inclosing between them the pieces of fabric united by the seam; the upper line being always a single thread, while the under one is either *single,* as in the "lock-stitch," *two-corded,* as in the "twisted-loop stitch," or *three-corded,* as in the "double-loop stitch." These two lines of thread, it will be perceived, are united or linked together by the loop of the upper thread passing through the fabric at the end of every stitch; and this coupling, or locking of the two lines of thread, when properly drawn up by the tensions, completes the formation of the stitch. A continuous row or chain of these united stitches, thus inclosing the fabric sewed, constitutes a *seam.*

The first of these operations is substantially the same in *all* machines; but the second operation, or under process, is different in the different machines, and the variations are as numerous as the different kinds of stitches made. It is in this feature only, that the distinguishing characteristics of the several kinds of sewing machine stitches consist. Thus in all lock-stitch machines, whether using a reciprocating shuttle like Howe's, or a rotating one like Wilson's, a separate thread is used underneath; and the entire length of this thread is carried, by the shuttle, through each successive loop of the upper thread; thus leaving, when the seam is completed, only a single line of thread on the under surface of the fabric, as well as on the upper one.

In forming the double-loop stitch, a separate thread is also used underneath; but this thread, instead of being re-wound, and carried by a shuttle, is manipulated by an eye-pointed, non-perforating, horizontal needle, which takes the thread directly from the spool, and instead of passing the entire length of the under thread through the loop of the upper one, as in the lock-stitch, it passes only a *loop* of it through; and this loop in its turn is fastened by the next loop of the upper thread. Hence, when a seam of this class is completed, instead of there being a single line of thread on the under side, there is a series of compound loops, forming a ridge or chain, of the "double-tambour" character, which is always more or less prominent, according to the size of the thread used.

In the formation of the twisted-loop stitch, the connecting and fastening of the stitches on the under side of the fabric are also effected by means of *loops* instead of a single line of thread. But as there is no under thread used, this fastening is done with a portion of the upper thread, after it has been passed down through the fabric. In other words, the lower, or fastening loop is simply the upper loop extended. On its reaching the under side of the fabric, each loop is first carried through the last preceding one; and then extended—twisted—and held open—ready to receive, and be in its turn fastened by the next succeeding loop from above. With these few observations on the elementary principles of machine sewing, we proceed to describe these several stitches; in the illustration of which it will be necessary to describe also the construction and operation of one or more of the leading, or representative machines in each class. The

First Class—includes those making the *lock-stitch;* to illustrate the character and formation of this stitch—which is precisely the same, made by one machine as another—we select the Wheeler & Wilson machine.

Among the first improvers of the sewing machine, as we have already stated, was Mr. A. B. Wilson, of the Wheeler & Wilson Sewing Machine Company. In his hands the sewing machine underwent radical changes, and his results embody mechanical conceptions that place the sewing machine among the most ingenious and effective pieces of modern machinery.

Mr. Wilson, like Mr. Howe, approved of the *lock-stitch* only, but his *method of making* it, the *holding and feeding mechanism*, and the *tension* of the threads, are radically different. Instead of passing a bobbin with the lower thread through a loop of the upper, he puts a loop of the upper around a stationary bobbin containing the lower thread, and feeds the fabric to sew an endless seam.

For carrying the loop of the upper thread around the bobbin containing the lower thread, Mr. Wilson employs a rotating hook of peculiar construction, marked 5 (fig. 4). It is formed by cutting away a portion of the periphery of the circular concave disk. *a* (fig. 4) is the point of the hook. From *a* is a diagonal groove across the periphery of the hook to the point *b*, where the edge is beveled off. The hook thus constitutes a portion of the thread of a screw. 46 is the cloth-plate, 35 the needle, with the eye near the point threaded with *e*, a loop of which has just been entered by the point of the hook *a*. The lower thread is carried in a double convex metallic bobbin 15, to lie in the cavity of the hook, and held in its position by a concave ring 16 (fig. 2), between which and the concave surface of the disk it lies. No axis supports it, so that a loop of thread can pass around it as the girl passes the skipping rope under her feet.

Fig. 5 represents the hook as having made about two thirds of a revolution, and the lower thread, *z*, extending from the lower surface of the fabric to the bobbin in the concavity of the hook. The upper thread, *e*, extends through the fabric from a previous stitch into the concavity of the hook behind the bobbin, diagonally around the hook at the point *b*, thence diagonally along the groove to the needle 35.

As the hook further revolves to the position indicated in fig. 6, both lines of the loop *e* are upon the same side of the disk. The line of thread that extended in fig. 5 along the groove of the hook by *b*, has slipped off at the termination of this groove, and fallen in front of the bobbin, so that the loop of the thread *e* extends behind the bobbin, around the point of the hook *a*, and across the front of the bobbin to the needle 35, thus surrounding the bobbin, and inclosing the lower thread *z*.

As the hook further revolves, the loop is held by the check 36, until the point of the hook enters the succeeding loop as seen in fig. 4, when the loop *e* is freed from the check, and being drawn up by the enlargement of the succeeding loop, interlocks with the lower thread *z* in the fabric and forms a stitch.

In this connection we will explain the "*tension.*" In the "*lock-stitch,*" when properly formed, the interlocking of the two threads is in the centre of the fabric sewed, as seen in the following diagram:

The lower thread is re-wound upon the metal spool or bobbin 15, of such size as to hold 50 or 60 yards of No. 80 cotton. This re-winding is effected by the machine itself. The bobbin with the lower thread is placed in the concavity of the hook, and held in place by the ring 16 (fig. 2), with the thread flowing from the top toward the front of the machine, in which direction it revolves slowly. The hook 5 revolves rapidly in the opposite direction, and the friction between these surfaces renders the strain or tension upon the lower thread sufficiently great to keep it straight.

The upper thread is fed from the original spool 38 (fig. 1), through the guide 39, passes once around the tension pulley 40, and thence through the eyelets 33, 33, and the needle 35 near its point. Its flow is regulated by the thumb-screw and volute-spring 41 pressing against the side of this pulley. Should the thread be drawn too easily from spool 38, the hook will draw thread from that instead of drawing up the preceding loop (fig. 4). The proper pressure, however, being upon the pulley 40, the hook draws up the previous loop to the proper position of interlocking in the fabric, before it draws any from spool 38.

The feeding mechanism of Mr. Wilson's invention consists of a feed-bar 10 (fig. 8), slotted nearly its entire length, in which is pivoted near the left end the feed-tongue 13, armed with two rows of feed-points, 14. This feed-bar works in grooves in the standards 2, 2 (fig. 3), and lies just beneath the cloth-plate 46 (fig. 1), so that the points 14 may be raised through the slots 52 (fig. 7), with its left end against the feed-stop 54. The feed is worked by a cam 6 (fig. 3), which rotates with the arbor 4. As this cam revolves, the swell of its periphery strikes the under surface of the feed-tongue 13, and raises the feed-points 14, through the slots 52, while the swell upon the right side of the cam 6 presses upon the right ear 11 of the feed-bar, and throws it forward. The cam further revolving, brings a point of depression both in its top and its side next to the feed-bar ear, when the points drop below the surface of the cloth plate and the feed-spring 12 (fig. 3), working between the left standard 2, and the left ear 11 of the feed-bar, throws the bar back to the left against the feed-stop 54 (fig. 7), and the next revolution of the cam throws it forward. It should be remarked that while the needle penetrates the cloth, the feed-points are below the surface of the cloth-plate, and intermit their action upon the cloth; hence the needle constitutes a pivot upon which the fabric may be turned to sew a curved seam of any radius.

The feed-points rising and penetrating the cloth at each stitch, their movement forward determines the length of the stitch, which is graduated by regulating the play of the feed-bar. The play of this bar is limited to the difference between the widest and the narrowest parts of the feed-cam 6, which is about one fourth of an inch, and may be graduated to any length within those limits, by the feed-stop 54, against which the feed-bar is thrown by the feed-spring 12. As the widest or the narrowest part of this eccentric stop is turned toward the feed-bar, greater or less play is permitted, and longer or shorter stitches are made.

The machine is mounted upon a neat work-table, as seen in the cut at the head of this article, and driven by sandal treadles and band 7 (fig. 1). Motion is thus communicated to the hook 5 (fig. 2), and by the eccentric 8 through the connecting-rod 28 to the rocker 24, pivoted at 25, 25, and gives motion to the needle-arm 29, which holds the needle 35. The needle vibrates through a small hole, 60, in the cloth-plate. The threads being adjusted, the machine is touched into motion by a gentle pressure of the foot upon the sandals. The cloth moves forward from left to right, and the sewing is accomplished in the manner described.

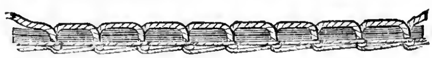
Various appliances are furnished for regulating the width of hems, etc., until the hand and eye have become trained to dispense with them. Another appliance is the hemmer (fig. 9). It is slipped into a slot of the cloth-presser 20, and is so convoluted, that as the edge of the cloth passes through to be sewed, it is turned down as in ordinary hems, and stitched. In addition to their regular machines, the Wheeler & Wilson Co. also manufacture the Elliptic Machine, and a Button-hole Machine.

As before remarked, the lock-stitch is always the same, on whatever machine it is made. In forming this stitch upon either the Howe, or the Singer machine, the details of operation do not differ essentially from those above described, with the exception, that the shuttle movement in both these machines is reciprocal, instead of being rotary as in the Wheeler & Wilson machine; and the feed movement is rotary, instead of "four-motioned." Each of these several movements has its advantages for certain purposes; the reciprocating shuttle being the best adapted for heavy work, and the rotary one for light work, particularly for such as requires a high rate of speed; while the rotary or wheel-feed is preferred for leather, and for some kinds of heavy cloth work,—and the four-motion feed for family use, and for light manufacturing purposes generally.

The Howe and Singer machines so nearly resemble each other in construction and action, that a description of the operation of one would be substantially correct for the other. It should here be stated that the "wheel-feed," as now used in these and several other shuttle machines, projecting upward through the table, was first applied in the Singer machine; and also the "arm," for supporting the working apparatus over the table. The "New Family Machine" of the Singer Co., a style brought out during the past year (1866), is furnished, however, with the "four-motion" feed. This machine is less noisy, simpler in construction, and in other respects superior to their old family machine, now superseded by this.

Of the "licensed" machines making the lock-stitch, there are several which possess greater or less merit; but none of these, we believe, contains any valuable feature which is not to be found in one or more of the machines already noticed.

We come now to the Second Class;—of which the Grover & Baker machine is at once the original type, and the only representative at present in the market. In this machine, a circular, eye-pointed needle takes the place of the shuttle. This needle is attached, in a horizontal position, upon the upper end of a vertical shaft, which is operated in such manner as to give to the needle an oscillating movement, similar to that of the balance-wheel in a watch, and the circular needle makes two movements, one forward and the other back, at every stitch. The under needle, as well as the upper one, takes the thread directly from the spool, thus saving the trouble of re-winding the under thread. In sewing, the upper thread is carried by the perforating needle down through the fabric, where a loop is thrown out as the needle rises, and this loop is entered at the right moment by the circular needle carrying the under thread, which, in its turn, throws out a loop also as the needle is withdrawn; and this loop is entered by the upper needle as it comes down again with another loop from above. Thus, the "under process" of sewing, in this machine, consists in putting, first, a loop of the under thread through a loop of the upper thread, and then a loop of the upper thread through a loop of the under thread; and so on to the end of the seam, each loop being drawn up by the tensions as the sewing proceeds. A seam of this kind, when finished, appears as in the following diagram:



which gives a side view of the seam, with the fabric cut away so as to exhibit the course of the threads in the formation of the stitch. This stitch, it has been stated, was introduced as an *improvement* of the lock-stitch; and the reader will naturally inquire, what has been the result of experience on this point? The answer is found in the following facts:—These two classes of machines have been on public trial about the same length of time, or about sixteeg years. Owing to various causes, Grover & Baker did not get fairly under way in manufacturing their machines as early as Wheeler & Wilson, or the Singer Company. But so favorably was their machine at first received, that, as soon as they were prepared to meet the demand, they took the lead, and, in 1854, Grover & Baker sold more machines than both the other companies. The license returns for 1866, however, show that, during the past year, the Wheeler & Wilson Company alone sold nearly twice as many machines as the Grover & Baker Company; these returns also show that more than four-fifths of all the *double-thread* sewing machines made and sold during the past year were of the *lock-stitch* class.

Among the advantages claimed, for the "double-loop" stitch over the lock-stitch are,—greater elasticity of seam,—the fact that there is no necessity for re-winding the under thread,—the non-liability of the seam to ravel when broken,—and the capacity for making a certain kind of embroidery, which cannot be made on machines of the lock-stitch class. It is also claimed that the double-loop stitch is free from certain defects of the lock-stitch, one of which is, that in *thin* goods, where the diameter of the thread must necessarily be nearly or quite equal to the thickness of the fabric, the lock cannot be made in the *center*, although it *may* be so made on *thicker* goods; but that it will be made on one of the surfaces, thus leaving the thread on that side *straight*, and the seam without any elasticity. It is also claimed, that in *thicker* goods, in consequence of variations in the tension, caused by the unequal thickness of the thread in its different parts, the position of the lock is constantly varying, from the center of the fabric to one side or the other, as exhibited in the following diagram:

and it is claimed that a large proportion of the sewing done in families, upon lock-stitch machines, is of this description. On the other hand, it is objected to the double-loop stitch, that it requires a great deal more thread. In reply it is claimed that in using lock-stitch machines, there is much waste of thread, at the ends of the seams; and that in the ordinary sewing of a family, where the majority of the seams are short, this *waste* of thread is fully equal to the extra amount used in making the double-loop stitch seam. Widely differing estimates of the relative amounts of thread, thus wasted, or used, by these two classes of machines, have been published, as the results of actual experiments. These apparent contradictions have doubtless arisen from the use of different materials, and different lengths of stitches in making those several experiments; since a thin material, with a long stitch, would show a far greater difference, in the *ratio* of thread used, than a thick material with a short stitch. All such experiments are therefore unreliable; nor are they necessary, for the actual difference between two seams of equal length, made on the same goods with the same thread and length of stitch, would plainly be just equal to twice the length of the seam. It is also objected to the double-loop stitch, that it leaves an unsightly ridge on the under side. To this it is replied that if the under thread is of the proper size (half that of the upper one), no ridge of any consequence will be formed. Of the correctness or incorrectness of this explanation, the reader can judge from the above diagram of this stitch—which is an enlarged side view of a seam made on common shirting muslin, with a Grover & Baker machine, using No. 70 thread above, and No. 140 underneath—these being the proper sizes for such goods. By many persons this ridge is considered an objection to the stitch. Yet there can be no doubt of the value of this class of machines for certain purposes; especially for all kinds of work where great elasticity of seam is required. Thus far we have described only machines using two threads. It now remains to notice those of the

Third Class;—which, as we have already stated, use only a single thread, and make the "twisted-loop stitch." The fact that this stitch requires but one thread has, doubtless, led some to suppose it identical with the old "chain-stitch," long since rejected as unsuitable for sewing purposes. They are, however, distinct—as much so as any two stitches made. In forming the twisted-loop stitch, each loop is twisted, and its opposite sides crossed, as illustrated in the following diagram, No. 1; while the chain-stitch loop is never twisted, but is

always in the position shown at No. 2. In the formation of the twisted-loop stitch, the "upper process," or that which is performed by the needle, is substantially the same as in the machines already described. The feeding apparatus is the "four-motion feed," which is operated by an eccentric on the end of the driving shaft. This shaft operates also the needle and the "hook." The "under process," or connecting and fastening of the stitches on the under side of the fabric, is wholly unlike that of any other machine, the entire process being performed by a novel and ingenious stitch-forming device, called the "rotating hook." As the needle begins to rise, after having carried the thread down through the fabric, a loop of the thread is thrown out, just in time for the point of the hook, as it passes the needle, to enter the loop. As the hook continues to revolve, it passes further and further into the loop, enlarging and twisting it as it proceeds; until, having made an entire revolution, the point of the hook arrives again at the needle, which, in the mean time, has brought down a fresh loop; this new loop is now caught by the hook and carried through the former loop, which still remains upon the hook, spread open in the right position to receive it. As the hook proceeds to make another revolution, it soon passes out of the old loop, and leaves it to be drawn up, by the tightening of the stitch, into the seam. This tightening is effected, partly by the lifting of the needle-bar as it rises for another stitch (the other end of the thread being held by the tension), but chiefly by the peculiar action of the hook, as it enlarges the new loop. But it is the *twist* given to the loop during the process of opening it, as above described, which is claimed to constitute the distinguishing feature of this stitch. And this lock, or twist, being drawn in below the surface of the fabric, the seam is left as smooth on its under surface as its upper one; the only difference being, that while there is but a single line of thread above, there is a double one below, the two being so closely imbedded in the surface of the goods, as to present, except on a close inspection, the appearance of a single line. The following diagram exhibits a section of a Willcox & Gibbs seam,

as it appears when completed; the edge of the goods being cut away to the stitching, to show the course of the thread in the formation of the seam. It has been objected to the twisted-loop-stitch, that it is not so *reliable* as one made with two threads. On the other hand, it is claimed that this stitch is, even in this respect, an *improvement* on both the lock-stitch, and the double-loop stitch; that the effect of the twist in the loop is to produce a mutual friction or bind of the two opposite sides of the loop on each other, which actually makes the seam stronger and more difficult to rip, when cut and pulled open, than any stitch made with two threads. At the great trial at Island Park, in 1855, this stitch was subjected to a thorough practical test, with the lock-stitch, before a jury of sewing machine experts. Their decision was, that in every kind of work, they found "the twisted-loop stitch stronger, and less liable to rip, than the lock-stitch." It can, however, be readily taken out if desired, after unlocking it; a capacity which is claimed to be an advantage in making over old garments, and in removing seams that have been placed amiss.

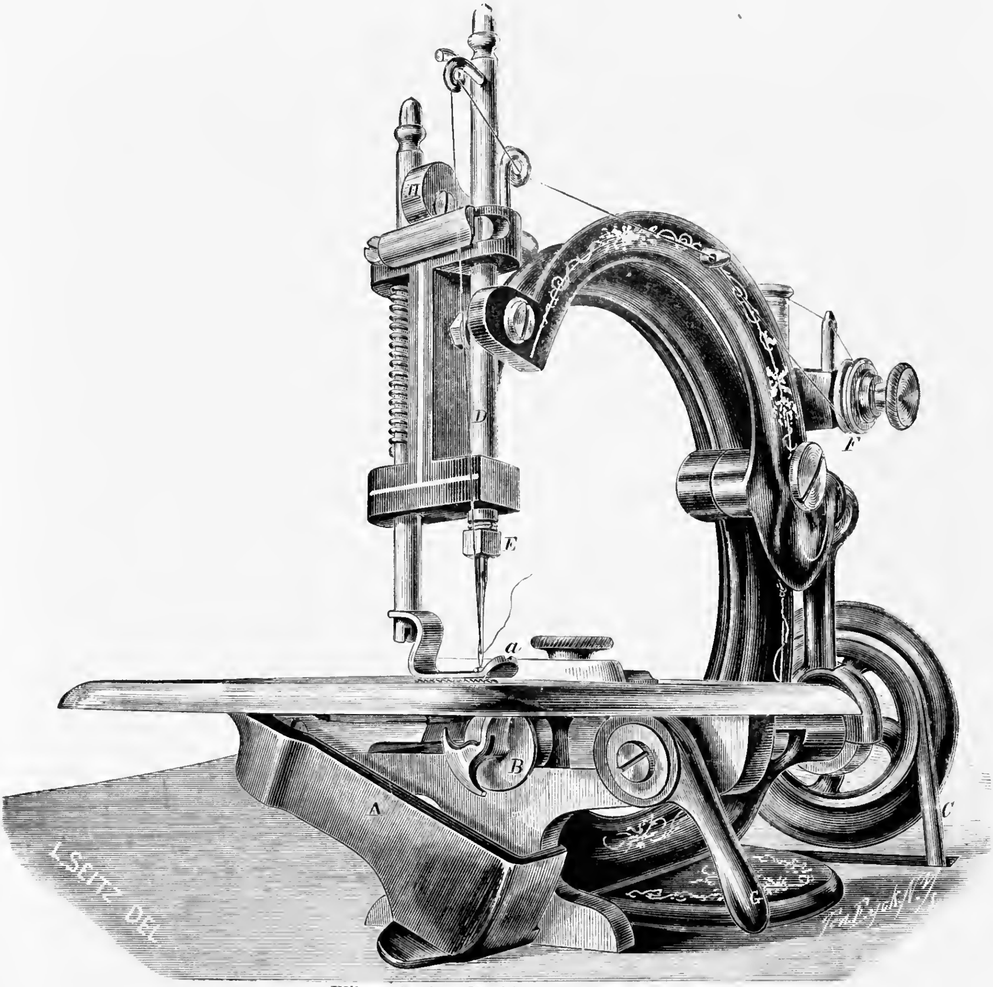
Another valuable quality claimed for the rotating hook is, the certainty with which it performs its work. This is said to be such, that unless the machine is out of order, the missing of a stitch cannot occur.

The rotating hook has also the peculiar capacity of fastening off the seam, automatically, whenever the work is removed from the machine, or the thread is cut or broken. But, perhaps the most remarkable feature of the hook is, its own *simplicity.* While it performs all the various offices accomplished in two-threaded machines, by the "bobbin"—the "shuttle"—the "concave ring"—the "shuttle-race"—the "spooler"—the "circular-needle"—the "spiral"—the "driver"—the "under-spool"—the "spool-holder"—the "under-tension," &c.—it is itself only a single piece. In fact it does not add so much as a unit to the number of the working parts in the machine; for as it is permanently attached to the end of the driving shaft, and revolves with it, it is, practically, a part of the shaft itself.

The following description, and the corresponding cuts in the plates, at pages 417 and 418, will give the reader a general idea of the construction of this machine:

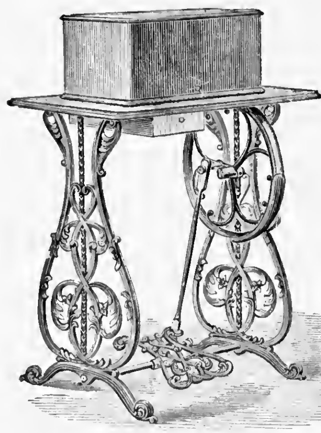
The perspective view (fig. 1) exhibits the machine itself, separated from its table or stand. All the working parts, underneath the cloth-plate, are but two in number—the "*rotating-hook*," B, and the "*feed*" apparatus, which is situated just behind it; these parts are covered, when the machine is in use, by the hinged *cap*, A, which, in the cut, is turned down to expose the hook and feed, The length of the stitch is regulated by the *lever*, G; and the *cloth-presser*, *a*, is raised from the plate by the *cam*, H. The machine is fastened upon the *table* (fig. 2) by a *thumb-screw* from the under side. It is driven by a round, leather *belt*, C. The *tension* on the thread is produced by passing it between two polished, glass *washers*, F, which are fitted on a screw spindle, and pressed together by a spring, the pressure of which is regulated by turning the screw. The balance-wheel is prevented from turning in the wrong direction, or wearing the dress of the operator, by a patented improvement, shown in fig. 2; in which A is the *wheel*, C the *dress guard*, B a part of the stand, or table frame to which the guard is fastened, and D a *rubber ball*, which fits loosely in a

WILLCOX & GIBBS SEWING MACHINE.



Willcox & Gibbs Machine, without Table.

No. 2 Machine.



No. 4.—Half-Case Machine, closed.

Fig. 2

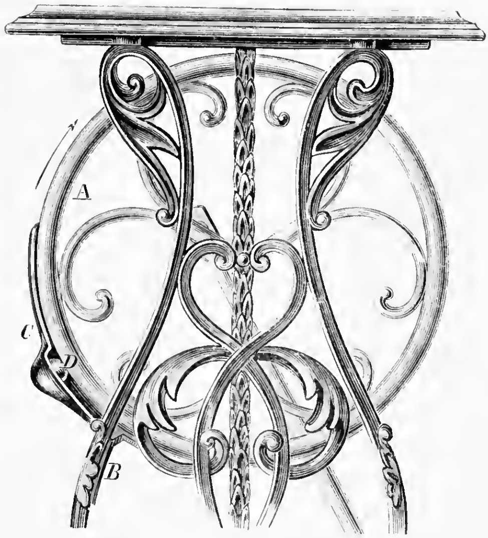


Fig. 5

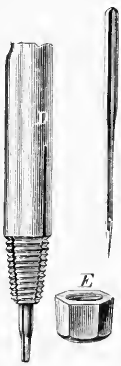


Fig. 3

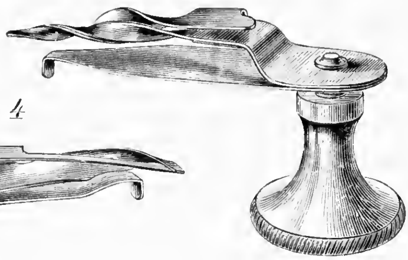
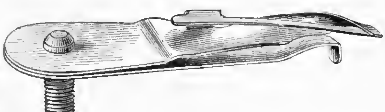


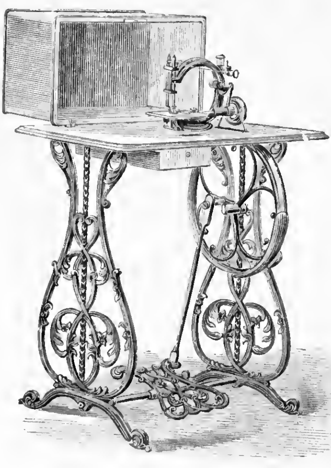
Fig. 4



Needle-bar and Needle.

Feller.

Hemmer.



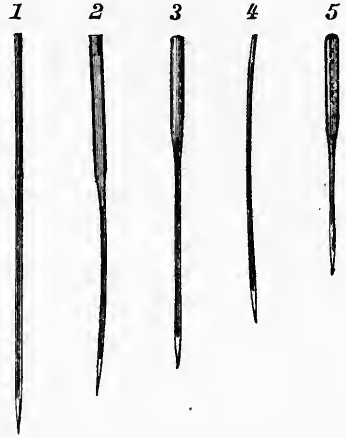
Nos. 5 & 6.
Half-Case Machine, open.

No. 7.—Cabinet Machine, open.

recess in the guard, and is kept, by its own gravity, in contact with the rim of the wheel, between which and the recess it wedges when any attempt is made to turn the wheel backward. The *needle* (fig. 5), which, with the manner of setting it, is patented, is made *self-adjusting*, by means of a *groove* in its shank, which matches with a *spline*, or steel rib, situated within the tubular cavity or hole in the lower end of the *needle-bar*, D; so that it is impossible to set the needle in any but the right position; and as the needles are all of precisely the same length, when it is pushed to the upper extremity of the hole and secured by the *nut*, E, it is sure to be adjusted properly.

This improvement, in the manner of setting and fastening the needle, is one of much practical importance, especially in a sewing machine for general family use. In all other machines the needle is fastened by means of a *set-screw* (or other device producing the same result), which presses against the shank of the needle only at a single point, while the bearing against the back side of the shank is equal to its entire length. In this mode of fastening, which is represented in the following cut, the needle is

liable, when first set, to stand *aslant*, as indicated by the dotted lines, *b* and *c;* in which case it is necessary for the operator to spring or bend the needle, until it stands in its proper position, as seen at *a*. This is a difficult process, and often occasions much trouble, especially with beginners. But in the Willcox & Gibbs machine, this trouble is avoided; since, in fastening its needle, the shank is compressed by means of the *concentric* nut, *on all sides alike;* and consequently, the point of the needle, when fastened, is certain to be in its proper place—as seen at *a*. The Willcox & Gibbs needle is also unlike any other, in having a much shorter blade—as seen in the cut above, which exhibits a needle of each of the five leading machines; each needle being of the size ordinarily used for common muslin,—and the illustration being in each case *exact*, in size and form. Of these, No. 1 is the Singer needle; No. 2, Wheeler & Wilson; No. 3, Howe; No. 4, Grover & Baker; and No. 5, Willcox & Gibbs.



The *hemmer* (fig. 3), and *feller* (fig. 4), which are also patented, turn the hem or fell to the under side, so that the stitch is on the right side of the goods—which is not the case in the hemming or felling done on other machines. They are also self-adjusting; are easily operated; make the hem or fell of any desired width; and do their work in a very perfect manner.

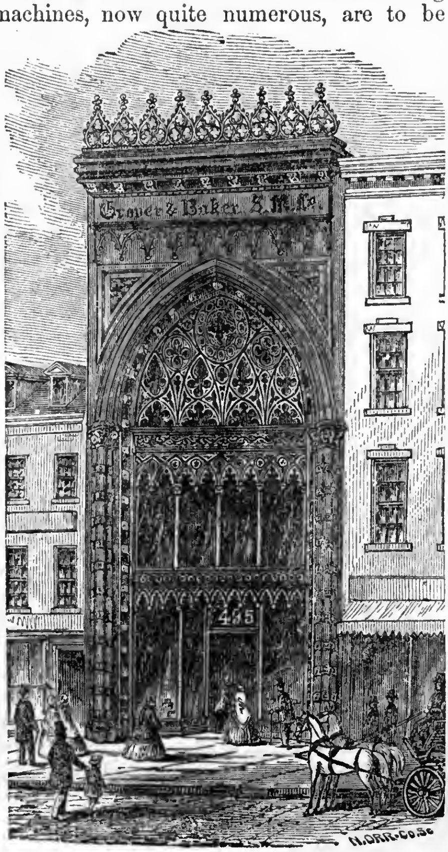
The groove in the cloth-presser, at *a*, is the *braider*, by means of which braiding is done of any desired pattern; and the braider, being a part of the machine, is always adjusted, and ready for use. This machine has also several other adjuncts which are not represented in the plate; as the quilter, corder, and tucker,—all of which are patented improvements, of recent introduction.

The machine runs very easily, is almost entirely noiseless, and all its movements being rotary and positive, it runs faster, and is said to wear longer and cost less for repairs, than any other yet introduced. The Elm City Company of New Haven have run a large number of these machines by steam power, in the manufacture of stitched ruffling, working double time (20 hours a day), at a speed of more than 3,000 stitches per minute.

Although the Willcox & Gibbs is offered only as a *family* machine, and no effort has been made to introduce it for manufacturing purposes, it has already found its way into manufacturing establishments, in the various departments of industry—especially in the manufacture of shirts and collars, and other descriptions of ladies' and gents' furnishing goods; in hat and cap trimming, finishing hosiery work, &c.

The success of this machine, commercially, affords evidence of the appreciation of its merits by the public. In the number of machines already made and sold, the Willcox & Gibbs is second only to the Wheeler & Wilson, Singer, and Grover & Baker. Although it is, comparatively, a new machine, having been in the market scarcely eight years—and not prominently so more than four or five—upwards of 55,000 of the machines have already been made and sold; a number nearly twice as large as any other company sold in the same number of its earliest years. Till recently this machine was manufactured by Jas. Willcox, then sole proprietor; but the business has now passed into the hands of the Willcox & Gibbs Sewing Machine Company—a new stock company of half a million dollars capital, organized within the past year—of which Mr. Willcox is President. The principal office and salesroom of this company is at No. 508 Broadway, New York.

The warehouses for the sale of sewing machines, now quite numerous, are to be found principally on Broadway. Several of these are constructed in the newest style of warehouse splendor, and combine, in an eminent degree, ornament with convenience. That of the Wheeler & Wilson Co., at No. 625 Broadway, is the largest and most costly structure of the kind in the world. The Singer establishment, on the corner of Broadway and Grand Street, and that of the Howe Co., at No. 699 Broadway, are also capacious and elegant structures. The preceding cut represents a front view of the salesrooms of the Grover & Baker Co., at No. 495 Broadway. The depth of the lower room is nearly 100 feet, and the front is almost entirely of glass. On this long floor, richly carpeted, the machines are displayed, and inspected by the purchaser, to whom instruction is given in the inner rooms.



It is conceivable that, when the fact came to be clearly established that machines would do good and strong sewing, and with a speed so much greater than hand sewing, every branch of industry in which the needle is used began to introduce and adapt the machines to its own exigencies. It was soon found that some machines were better adapted than others to particular labors. The clothing business, which has become so important as a new branch of industry in the last 25 years, found a powerful auxiliary in the sewing machine, and great numbers are used in it, mostly Singer's. For shirt and collar making, and most other light manufacturing purposes, Wheeler & Wilson's is used much more extensively than any other. For bag-making, seaming knit fabrics, and other work where great elasticity of seam is necessary, the Grover & Baker is chiefly used; although the Willcox & Gibbs is also much used for this purpose. The Howe machine, as now made, takes the lead for light leather work, and competes strongly with Singer's in tailoring and leather work of the heavier grades. For family use, nearly every kind has been recommended, and, to greater or less extent, sold; the most popular for this purpose, until recently, being the Wheeler & Wilson, and next, the Grover & Baker; but of late the Willcox & Gibbs—on account of its greater simplicity, ease of working and management, and non-liability to get out of order, adapting it more perfectly to all kinds of work and to all capacities—though a later invention, is taking the lead for domestic use.

The activity which has been imparted to the use of sewing machines may be inferred from the fact that the number of machines made and sold under Howe's patent, up to and inclusive of 1866, is over 700,000, the proportions being, in round numbers, as follows:—

Wheeler & Wilson Co.	250,000
Singer Co.	160,000
Grover & Baker Co.	140,000
Willcox & Gibbs Co. (since May, 1859)	55,000
Howe	40,000
All others	65,000
	710,000

The number of sewing machines made and sold under Howe's patent, during the year 1866, and during the last quarter of said year, as appears from the license returns, was as follows:—

	Last quarter.	Year 1866.
Wheeler & Wilson Co.*	13,579	47,125
Singer Co	14,164	36,235
Grover & Baker Co.	8,776	28,186
Willcox & Gibbs Co.	5,180	15,028
Howe	2,820	10,251
All others	7,680	27,673
	52,199	164,498

Sales have also been made of a great number of infringing machines, of inferior character and imperfectly made, that would not do the work promised. The number of these now made is, however, very small; and the manner in which all sewing machines are now got up is much more perfect than formerly. Great preparations have been made by the leading firms to meet the growing demand. One manufactory, that of the Wheeler & Wilson Co., at Bridgeport, Conn., is said to contain *four acres* of flooring; and another company boasts of its ability to supply 170,000 machines annually. Since the extension of his patent in 1860, Mr. Howe has erected at Bridgeport a very extensive and complete establishment, for the manufacture of his machines. The Grover & Baker Company have an establishment nearly as large, at Boston, Mass.; and the Singer Manufacturing Company have theirs in New York. The manufactory of the Willcox & Gibbs Company, at Providence, R. I., though not as extensive as those above named, is capable of turning out a very large number of machines. This establishment is distinguished for the completeness and perfection of its machinery, and the superior character of the work sent out. These several establishments so nearly resemble each other in character and general arrangements, and in the process of building the machines, that a description of one will serve for all. The following is a sketch of the Singer establishment:

* Wheeler & Wilson's returns include the Elliptic machine.

The main building is of iron and brick, six stories high above ground, with a cellar and sub-cellar underneath. The length of the front is 100 feet, with an extension of about 60 feet at the south end. The depth of the main building is 60 feet, but an addition to the rear causes the premises used as a foundry to reach through to Elizabeth Street. The main edifice is now extended to Broome Street, making its entire length 250 feet. The floors are of wood; but the pillars, beams, girders, and stairs are of iron; while the ceiling to each floor is arched with brick, making the whole concern fire-proof.

Entering by the front door, we find a neat business office to the left, beyond which is the stock room, occuping nearly all the first floor.

In the adjoining wing is the blacksmith-shop, with its forges, drop-hammers, trip-hammers, &c. This apartment, well ventilated and lighted, has from twenty to twenty-five men constantly at work. Here are fabricated the shuttles, feed-hammers, and other light parts of the machine, made of the best bar steel. The shuttle is a little canoe-shaped vessel, from one to three inches long, as bright and smooth as a new pin. A die of the proper size and shape is placed on the block under the drop-press, which is made to fall with a blow of 250 pounds upon the heated steel, when the shuttle is substantially formed, requiring only to be polished with the file to be ready for use. The next process is *annealing* the articles turned out from the forges, in order to soften the metal sufficiently to bear hammering and filing. For this purpose they are packed between layers of charcoal in a strong iron box, which is shut up in the annealing furnace for about two days. This done, they are passed through the trimming-press, an instrument which cuts off all flanges or excrescences that may have been made under the drop-press. Some pieces require to be dressed on the planing-machine; others to be turned in the lathes, or filed in the vices.

Passing down one flight of stairs, we enter the foundry, which not only extends all the way under the main building, but has offshoots in two other directions, its entire area being nearly half an acre. So much crowded, however, was this department that a separate foundry had to be established up town, where a portion of the work is now turned out. The engine, having a capacity of eighty-horse power, occupies a separate apartment in the basement.

The sub-cellar is devoted to cleaning the castings, which is done by the ordinary mode of immersing them in diluted sulphuric acid, and afterward scraping off, or by placing them in a large cylinder, with several hundred weight of metal stars. The cylinder is then made to revolve rapidly, exposing every part of the surface of each casting to a constant attrition from the stars, by which it comes out in time smooth and shining, as if it had been filed. In the foundry about eighty employés are at work. The average weekly wages of journeymen, including some over-time, is between $20 and $22.

On the second floor, the machine properly takes its rise. Here its heavy parts are planed, bored, grooved, and otherwise prepared for the adjusting room. About one hundred machines, planers, lathes, milling, slotting, grooving, screwing, &c.—are running—while the hundred workers behind them are so actively engaged that they have no time to bestow upon the stranger. In every sewing machine are nearly one hundred pieces, independent of the wood-work, some of the pieces having ten or a dozen faces. It is essential that part shall fit part so accurately as to occasion neither jolt nor jar afterward, or delay in adjusting, when the whole instrument is put together. Hundreds of openings of all sizes have to be drilled and reamed out; yet so nicely that none shall vary a hair's-breadth from the true line. Grooves have to be excavated—often one below another. Bolts, nuts, turnscrews, have to be turned and milled, in many cases undergoing half a dozen operations at the hands of a single workman.

The third floor differs little in appearance or use from the second, except that it is appropriated to the smaller parts of the instrument, the infinitesimal screws and bolts, the needle-bars, &c. In this apartment are fifty milling machines, twenty lathes, and eight gear cutters; the number of men and boys at work is about sixty. The scale of wages ranges from $4.50 for boys, to $25 per week for the best mechanics.

Room number four is the *adjusting* or finishing room, into which all the parts are brought to be put together. The instrument, however, is recognized as a machine, after the table and arm have been bolted together, which is done on the second floor. The quantity of machinery there is inconsiderable, as compared with the lower apartments, the work being mostly of a kind that must be done by hand. The number of employés is about 85.

Room number five is the *japanning* room, and shows the effects of the operations carried on, the roof being in places a rich amber color, which deepens into a dark or brownish green. Japanning is an art of comparatively recent introduction into this country; but it has already attained a high degree of excellence. A coating of it becomes apparently as hard as the metal on which it is laid. We can describe it only in brief. The liquid, composed of oil, turpentine, and gum asphaltum, is applied by a brush to the metal, and the article is then put into a kiln or furnace, a fire-proof building, heated to a temperature 350 degrees Fahrenheit. After baking about eight hours, it becomes smooth and hard, and is taken out. But previous to this operation, if the machine is to be a fancy one for family use, is that of *pearling*, for which purpose the delicate green snail shells are sawn into thin layers, and, by means of a punch and dies, cut into any desirable sizes or figures. These are applied by hand to the margin and center of the table, making a border and center of flowers, which are laid on before entering the kiln.

Plain machines receive three coatings and bakings, after which the black surface is rubbed smooth and light with pumice or rotten stone. The pearl machines, after being baked, are scraped along their margins and centers, so as to expose the face of the pearl, which is then even with the surrounding surface. The operation next in order is to apply gold-leaf, for which purpose a line of asphaltum is traced on the table with a pencil, of any required design. Gold-leaf is applied to the entire surface, and afterward rubbed off with wet cotton waste. To the line traced as above described, the gold adheres. The cotton, thus saturated with "the king of metals," is carefully preserved and made to yield up its treasure. On the plainer instruments, gold is not applied, but a substance known as "German metal." In this department are 32 finishers and laborers. First-class ornamentors can readily command $30 per week.

The sixth floor, which is next the roof, is the department for making and fitting a variety of small work, namely, the springs, gauges, needle-bars, &c. The number of employés there is eighty. There are several screwing machines, with revolving heads, at work. The close, delicate-fitting work is done here; though the body of the machine is put together on the fourth floor. In an adjoining room the emery wheels are hard at work, emitting their streams of fire, and imparting an exquisite polish to various parts of the machine. The number of steel springs made and polished every week is about 12,000. The number of employés in all departments is 783. The amount of a week's pay-roll was $9,700.

Two kinds of machines are made, "the Standard," or "Manufacturing," and the "Family Machine;" also a Machine for making button-holes.

The Spring Street branch comprises two floors in a large building, both being used in making *needles*. Hence, it is sometimes termed "the needle department." The number of hands employed is about seventy, who turn out, on the average, 50,000 needles every week. About twenty-five of the employés are women and girls. The needles are made of the best quality of steel wire, some of it costing $4 or $5 per pound. The first operation is to straighten it by removing all twists or kinks. The apparatus used had to be invented for the purpose. After cutting the wire into lengths, the needles are grooved on both sides by means of a revolving circular saw, the fine teeth of which gnaw into the side of the needle as it moves forward. Of course, it is a delicate piece of work; but there is hardly ever an instance of failure. One man is able to attend half a dozen of the saws, each cutting 2,500 per day.

The needle is next taken to the *eyeing machine*, where the eye is punched by means of a lever worked by hand. The attendant, if excelling, will punch 8,000 in a single day. After punching, the eye is *drilled out* by another delicate device. The speed here attained is less than at punching, a good day's work being 2,500. The needles are then tempered and pointed in rows of six at a time, the grinding being done on a wet stone. From this they pass to the polishing-roll, a round revolving bar, overlaid with a composition, in which grooves have been sunk corresponding to the sizes of needles. This done, they are put up into bundles and sent off to their destination.

MILLS.

The universal dependence of the human family upon bread as food, has no doubt caused that article to be aptly designated as the "staff of life." It has been made of many substances, but in the American colonies, from the earliest times, Indian corn, wheat, and rye have been the leading if not the only materials. The laborers of Europe have only since comparatively recent dates used grain commonly for bread. The peasants of the south of France for long ages used only chestnuts and similar fruits for the purpose. In Germany, rye forms the native "black bread" made of the grain ground but unbolted. The Scotch use oatmeal and barley for bread. The English use wheat commonly, as is the case now mostly in America. Here, however, the variety and abundance of animal and other food is so great that wheaten bread enters less into the daily diet of the masses than would otherwise be the case. Whatever the grain used, however, milling is the first necessity, and the number and capacity of the mills must always be proportioned to the numbers of the people. In a country like this, where they multiply so fast, the investments in mill property must keep pace with the swelling numbers of the people. We find, therefore, in the returns of the manufacturing industry of the Union for 1850, published by order of Congress, that of the whole value produced, $1,019,106,616, by far the largest item was the products of flour and grist mills. This amounted to $136,056,736, or rather more than 13 per cent. Next to this industry, the highest production was of cottons, the most general material for clothing, and that product reached $65,501,687. The largest mill interest was in the state of New York, where the product was $33,037,021. The census of 1840 gave the number of flour mills in the Union for that year, and if we compare the population and crop of wheat as reported, with the number of flour mills, the results are as follows:—

	Population.	Wheat raised. Bush.	No. of Flour Mills.
1840	17,069,453	84,833,272	4,364
1850	23,191,877	100,485,944	11,891
1860	31,443,322	170,176,027	13,868

In order to get the quantity of wheat floured, it is necessary to deduct from this production the quantity reserved for seed, and the quantity exported as grain.

From the earliest settlement of the country, flour has been an important article of export, and New York wheat early gained a reputation as well abroad as at home. During the wars of Napoleon, the valley of the Hudson furnished large supplies of flour, and milling was a very profitable business. Water-power was generally used. Mills concentrated where this was to be had advantageously in the neighborhood of good supplies of wheat. The mills of Rochester, New York, where the famous Genesee wheat is floured, are a grand example of well-applied water power. The Baltimore and Richmond city mills acquired great reputation, and of late years the settlement of the western country has caused St. Louis to become the central point of a vast region, and magnificent mills are there constructed. The mills at Louisville are also on a grand scale. One of those mills, as an illustration, erected at a cost of $85,000, has four run of stones of a capacity of 1500 bushels of wheat daily. The mill is situated at the falls of the Ohio, just where they dash through the Indiana chute. The mill-race, excavated in the solid limestone, involved a large expenditure of time and money. The wheels are constructed on a new principle, being similar to the submerged propellers used in war steamers, and working an immense upright shaft, the base of which is sunk fifteen feet in the solid rock. This shaft drives the entire machinery of the mill with irresistible power and the regularity of clock-work. Almost every state abounds in valuable mill sites that furnish the power for flouring the grain of the several districts for local use. Steam plays, however, an important part as a motor for supplying flour for export. The ordinary operation of grinding has been by two millstones of some 4 to 6 inches in diameter, average weight 14 cwt. The surfaces are dressed, and the lower one fixed, the upper one revolving with an immense velocity, generally 120 revolutions per minute. The wheat being fed in through an aperture, is ground between the revolving and fixed surfaces of the stones. It is obvious that the great weight of the revolving stone, the speed at which it moves, and the friction caused by the interposition of so glutinous a substance as wheat, involves the expenditure of vast power to sustain the action. A single pair of stones requires a four-horse power to keep up the required motion. In this mode of grinding between such extended surfaces, the flour does not escape so readily as desirable, and becomes somewhat deteriorated by continuous retrituration. There have been many improvements introduced in the form of mills. One of the most successful seems to have been to give the stones a conical form. In this improvement, the weight of the running stone is reduced from 14 cwt. to 1½ cwt., and it is placed beneath the fixed stone; the size of both is reduced to one-third, and they have the form of a frustum of a cone. It is obvious that a mass of 14 cwt., revolving over a surface, is not susceptible of the same delicacy of adjustment as one of 1½ cwt. revolving under the fixed surface, and the miller has a much easier and more effective control over the most important portion of his operations. The conical form facilitates the discharge of the flour, and obviates the clogging and overheating of the flat stones. By a judicious combination of this mill with the dressing machine, a perfect separation of the flour from the bran is effected at the moment the grist escapes from the stones. The bran still remains in the mill, and falls by its own gravity to a second pair of stones in all respects like the first pair. Both pairs, being mounted on the same spindle, are impelled by the same gearing. The lower pair complete the process, and leave nothing unconverted into flour that will add either to the weight or the quality of the loaf.

The capital invested in flour mills in the whole country was in 1860 given at $84,585,004, and the production $248,580,365. The quantity of flour exported in 1860 was somewhat over three millions of barrels. To supply this, and the wants of a population amounting to fully 32,000,000, the quantity floured was about 35,500,000 barrels.

MUSICAL INSTRUMENTS.

Passing over the class of band instruments, the violin and its congeners, the flute, guitar and harp, all of which, though manufactured here, are substantially the same as European instruments, and none of them have been materially improved, we have only space to speak of the piano and the class of reed instruments. The church organ might indeed challenge our attention, but this has only kept pace with the foreign instrument in its improvements.

The piano has been improved in compass, tone and ability to imitate the musical sounds of the human voice, during the past eighty years, more than any other musical instrument; and most of these improvements have originated in the United States. The instrument in its earliest form, dates back only to 1757, and as late as 1823 was still a very imperfect, wiry-toned affair, tolerated but not admired. Considerable numbers of the English and French pianos were imported in the early part of this century, though attempts were made at manufacturing pianos here, by Osborn, by J. Thurston, and by Stodart, from the London house of that name. In 1823, Jonas Chickering, a young mechanic from New Hampshire, commenced their manufacture in Boston, and possessing mechanical ingenuity as well as musical skill, he soon began to improve the instrument. He made the entire frame of iron, in order to enable it to resist the better the immense strain of the tense strings, and at the same time to increase the resonance and purity of its tones. He also devised the "circular scale" with the "arch-wrest planks" or "tuning blocks;" both these improvements were speedily adopted by other manufacturers in Europe and America. He also made numerous improvements in minor details, which resulted in rendering his instruments equal to any in the world. Other manufacturers have also made important improvements, within the last 20 or 25 years, in the instrument. Among these have been the Æolian attachment of Obed Coleman; the adoption by several manufacturers of the over-strung bass in square pianos; the bedding or insulation of the iron frame by Mr. F. C. Lighte: the use of soft elastic washers to soften the tone, by the same manufacturer; the double sounding-board of Mr. S. B. Driggs, intended to increase the volume and sweetness of the tones of the instrument; the patent combination sounding-board of Messrs. Raven & Bacon, and the cycloid form of the piano of Messrs. Lindemann & Sons, having the same purpose. Messrs. Steinway & Sons have applied the patent Agraffe arrangement directly to the full iron frame, and have also obviated the difficulties which had been experienced in the construction of the upright piano, by their patent resonator, and double iron frame. Their instruments took the highest premium over the competing pianos of the best manufacturers of Europe, at the International Exhibition in London, in 1862. Both their instruments and Chickerings have a very high reputation in Europe, and are largely exported thither, while the importation of pianos has ceased. The Chickerings have made over 30,000 pianos, a larger number than any other manufacturers. The entire production of these instruments is probably not far from 25,000 per annum.

REED INSTRUMENTS.

These are all the inventions of the present century. The first use of metallic reeds (vibrating tongues of metal), for musical purposes, in Europe or America, was the *Eolodicon* of Eschenberg, of Bohemia, invented about 60 years ago. This was followed, in 1821, by the accordeon, which, whether of small or large size, was little more than a musical toy. The rocking melodeon, as at first constructed, was only an amplification of this, and as in the English and French melodeons, the air was forced outward through the reeds, in order to produce musical sounds. The reeds, moved by this forced current, frequently caught, or did not vibrate promptly, especially the highest and lowest notes. About the year 1840, some of the rocking or lap melodeons, constructed by several manufacturers on an improved plan, gained considerable reputation. The reeds of these were fastened to, and vibrated in, a small square metallic pipe, which was inserted through the top of the wind-chest, with the points of the reeds downward, the rear ends of the keys resting on the open ends of the metallic pipes, and thus forming the valves. About 1840, another improvement was adopted in the lap melodeons, which gave them a better character of tone, and contributed to their introduction as accompaniments to church music. The reeds were riveted upon a piece of brass swedged or bent so as to form three sides of a square, the edges of which were then inserted in grooves made for them upon the upper side of the wind-chest, directly over the valve mortice; and, in order to bring the point of the reed to vibrate on the inside, the reeds were made to pass through their sockets to the under side, and thus naturally took the form of a double curve, somewhat resembling the letter S. This curving the reeds improved the tone, and on this account was adopted by most of the American manufacturers, though liable to the objection of retarding the promptness of the response of the reeds.

In 1846, Mr. Jeremiah Carhart secured a patent for a certain construction of bellows, with other combinations, to operate the reeds by suction or drawing in, instead of forcing out the air, since known as "the exhaust plan." This invention gave to these instruments an improved quality of tone, greater durability, more simplicity of construction, increased promptness of utterance, uniformity of tones, and an equal distribution of power through the entire scale. The melodeons made on this plan by Carhart, and subsequently by Prince & Co., were at first small, of only one size, having but four octaves of reeds, and extremely plain in style. After two or three years, they were increased in size, extended to 4½ and 5 octaves, and had two sets of reeds. This was about the utmost compass possible for the melodeon. Another improvement, made about 1849, was the change of form of the bellows, the exhauster being placed on the upper side of the reed-board, instead of underneath the bellows; this enabled the performer to operate the bellows more easily. The tones of the instrument still lacked softness and sweetness. This difficulty was remedied, in 1849, by a discovery made by Mr. Emmons Hamlin, now of Mason & Hamlin, but then with Prince & Co. He found that, by slightly twisting each of the already curved reeds, this harshness was overcome, and the tones rendered soft and musical.

In 1855, the firm of Mason & Hamlin, formed the previous year, offered to the public their "*Organ Harmonium*," an instrument having 4 sets of reeds and two manuals of keys. The reeds extended from ccc in the "bourdon" to c''''' in alt, or seven octaves. Two blow-pedals were also attached to it, which enabled the performer to produce effects not hitherto attained by any reed instrument in this country. In 1861, after numerous experiments, Messrs. Mason & Hamlin succeeded in perfecting their "*School Harmonium*," simplifying the construction, but retaining all the good features of the larger instrument. In this instrument, the bellows was first placed vertically. This and the other improvements were soon after adapted to the organ harmonium, which thenceforward became capable of receiving a more elegant form, and, in 1862, was brought out in its present shape, as the "*Cabinet Organ.*" Its history since that time has been one of constant improvement, by which its compass, variety and sweetness of tone have been enhanced, while its rapidity of action enables it to render secular music with fine effect, and to become a formidable rival of the piano. Of these improvements, the chief are, the *Double Bellows;* the improved *Self-adjusting Reed Valves;* the *Automatic Bellows Swell,* an addition of great practical value; the *Sounding* and *Tube Boards,* which increase the resonance of its tones; the *Noiseless Safety Valves,* regulating the pressure and escape of the wind; and the *Improved Combination Register,* which facilitates the drawing and closing of the stops.

The *Cabinet Organ* is the most perfect of the reed-instruments, but the melodeons, harmoniums, and Cottage, Gem and Monitor organs, which have preceded it, or are now made by other manufacturers, though inferior to it in sweetness of tone, resonance, variety and rapidity of execution, are yet much superior to the English, French or German instruments, none of which are constructed on the "exhaust plan." During the year ending November 1, 1866, the internal revenue taxes paid by the manufacturers of reed instruments in the United States, on their sales, were a little more than $80,000, indicating a manufacture of the value of $1,600,000. Of this $80,000, Mason & Hamlin paid about $21,000.

HUMANITARIAN AND CORRECTIVE INSTITUTIONS.

CHAPTER I.

PRISONS AND PRISON DISCIPLINE.

The idea of imprisonment, as a punishment for crime, though less than a hundred years old in this country, seems to have occurred to our law-makers sooner than to those of most of the states of Europe. In the early history of the colonies, however, the prison was seldom used, except as a place of detention for debtors, for those arrested but not yet tried, and for criminals awaiting the infliction of the death penalty. Death, under the code of most of the colonies, which was based upon that of Great Britain, was the penalty of a great number of offences, not less than a hundred and fifteen in one of the states; while for minor crimes and misdemeanors, the pillory, the stocks, whipping at the whipping-post, branding, cropping, slitting the nostrils, wearing the halter, and banishment, were the usual punishments.

Very soon after the Revolution, however, the penal code was revised in a spirit of humanity in most of the states, the number of capital offences greatly diminished, the indignities to the person either abolished or (with the exception of one or two states) greatly mitigated, and imprisonment substituted for the death penalty, as well as in a milder form for various punishments of a personal character, and for heavy fines.

The prison was not at this time by any means a model institution. The worst criminals were often herded together, and fighting, blasphemy, drunkenness, and obscenity made their dens (for really they were nothing more) perfectly hideous. Often, too, young and innocent persons, unjustly accused of crime or detained as witnesses, were compelled to endure the society of the most depraved wretches, and the young man or young woman who entered the prison with no evil habits, after a few weeks' stay there emerged with tainted morals and thoroughly educated for a life of crime. In one state (Connecticut) an old abandoned copper mine was fitted up as a convict prison, and in its dark, damp shafts and galleries, into which the light of day never penetrated, criminals were confined till in many cases its poisonous air and the dampness of its walls put an end to their existence.

Pennsylvania having been the first state in the Union to ameliorate her penal code, was also the first to attempt an improvement in her convict prisons. In 1786, the Walnut Street Prison was erected on the *solitary plan*, with thirty cells. The convicts were confined in a cell larger than that generally in use in prisons, and here they remained without work or books, or the opportunity of seeing a human face or hearing a human voice. The men who advised the adoption of this plan were really humane men, who had from motives of philanthropy urged and effected the abolition of the death penalty for many of the crimes for which it had hitherto been inflicted, but they did not understand how terrible a system of torture they were establishing, in inaugurating this *solitary plan*. To have no occupation, no recreation or relief, nothing to do but to think, think, year after year; to be deprived, too, of all communication with friends, of all religious instruction, of all opportunity of reading the Bible, or any other book, was a torture so refined and dreadful that it was deserving of being ranked with the rack, the boot, and the thumbscrew of the Inquisition.

The effects of this system of punishment in producing insanity and fatuity, though obviously to us inherent in the system itself, were attributed at first by its advocates to the limited scale on which it was tried, and certain defects in the methods of construction and arrangement; and it was insisted that if tried on a larger scale and with the modifications suggested by experience, it would be found the best plan for a prison. The citizens of Pennsylvania have been wont to deliberate for some time on the best plan for conducting public institutions, whether corrective or humane, but when their minds have once become settled in regard to them, they have never hesitated on the ground of the expense of the measures they deemed necessary. It was so in this case. Two convict prisons were needed in the state, one to take the place of the miserably arranged and managed one at Philadelphia, the other to accommodate the convict population of the rapidly growing western counties. The latter, since known as the Western Penitentiary of Pennsylvania, was first completed. It was located at Pittsburg, and was finished and occupied in 1826. The Eastern Penitentiary, located at Cherry Hill, near Philadelphia, was not completed till 1829. Meantime, the experiment of the solitary plan had been tried, though under very unfavorable circumstances, in several other states. A narrow and miserable economy had prevented such a construction of the cells as was tolerable; and the plan of strictly solitary confinement, bad enough at the best, became utterly unendurable and was abandoned.

In Maine, one of the states which tried the experiment, the cells were in the form of pits, entered through a trap door, made of an open grate of iron, about two feet square—serving the double purpose of a door and a window. The only ventilation was through a crooked orifice in the side wall, one and a half by five inches, and all the heat they had, in a stern northern winter, was by the admission of warm air through a hole in the bottom of the cell about one inch in diameter. The cells or pits were entered by raising the trap door, putting down a ladder for the convict to descend, and then drawing up the ladder and fastening the door upon him.

The Auburn (New York) State Prison, also commenced on this system, carried it out with great rigor, in small, inadequate, and ill ventilated cells, and, as was to be expected, produced the most disastrous effects on the health and reason of the convicts subjected to it, and in 1821 it was definitively abandoned.

The New Jersey Prison, though constructed on the same plan, was better arranged, and the rigor of its régime was soon modified. At the time of erecting the two Pennsylvania penitentiaries, opportunity for observation had been afforded, and the intelligent and thoughtful friends of prison reform in the state, though not disposed to give up the idea of separating convicts from any association with each other, yet saw the necessity of some modifications of the solitary system. The changes they initiated justified the change of name they applied to the system, and both in England and this country it has since been known as the *separate* system. The expenditure for perfecting the penitentiary buildings for the purpose designed was liberal, almost lavish. Each prisoner has a cell, seven feet by seventeen, or thereabouts, of good height, and well warmed and ventilated, and supplied with water for washing, a water closet, a good bed, books, and the implements of some kind of labor. There is also an arrangement, by means of which, in case of sickness, neglect, or the want of any article, he can call his keeper to his cell. These cells are so arranged as to prevent the possibility of communication between one convict and another, or the sight of one convict by another. The convict is visited by the warden, the keeper, and the moral instructor, and is allowed to receive the visits of those who are interested in his moral and religious welfare. On the Sabbath, religious worship is conducted in the corridor, and all who have cells on that corridor can listen to it, and, if they please, join in the hymns or prayers.

The revulsion of feeling caused by the cruelty of the *solitary* system, led many of the states, and prominently among them New York and the New England states, to adopt a widely different system, first employed in this country at Auburn in 1821 (though it had previously been tried in Holland), and hence often called the *Auburn plan;* a more appropriate name would be either the *congregated* or the *silent* system, as expressive of its peculiar features.

Prisons constructed on this system have small cells, usually five by eight feet in size, with iron grated doors, arranged in tiers over each other, in which the prisoners are confined at night, at meal times, and on the Sabbath, except during short religious exercises in the chapel. Attached to the prison and within its enclosure are extensive workshops, to and from which the men are marched three times a day, keeping the lock-step, and in which they are employed during the day, their services being usually let to contractors at so much per head a day, the contractor furnishing tools and machinery, and the state, rooms, power, and the board and clothing of the convict. The prisoner is prohibited from looking up from his work, or speaking to a fellow-convict, or to his instructor (the contractor's agent) except about his work; nor is the instructor or the keeper allowed to converse with him. There is usually a sermon, and perhaps also a Sabbath School on the Sabbath, and the chaplain or moral instructor is also allowed intercourse with the prisoners during the week; and in some prisons there are libraries, and the chaplain selects and exchanges the books for the prisoners.

On one or the other of these plans, the *separate* or the *silent*, or on some attempted combination of the two, all the convict prisons of this country are organized. Neither plan is free from objections, while both have also their advantages.

The *separate* system individualizes the convict; prevents his recognition by or communication with other evil disposed persons who may be in prison at the same time; renders a large armed force of guards unnecessary, since combinations and conspiracies are impossible; makes his reformation more practicable, since he is only in communication with the good and virtuous, and is left for the most part to his own thoughts, unprompted to evil by the sight of, or association with the vicious; and he is not liable, except under extraordinary circumstances, to those severe personal punishments, by the lash, the bolt-shower-bath, bucking, etc., which are regarded as indispensable in the silent system, and consequently escapes their degrading effect. It was for many years claimed that the *separate* system induced insanity and materially shortened life; but the statistics of the Pennsylvania prisons, for a considerable term of years, as compared with the best *congregated* prisons in this country, demonstrated the error of this opinion. Insanity is much less frequent than in the Auburn or the Connecticut prisons, which have been reckoned the most favorable examples of the latter, and the percentage of deaths is also smaller.

The objections to the separate system are, the much greater cost of the prison buildings, the comparative unproductiveness of the labor of the prisoners (the result of their working alone), and the general weakening of the character of the convict, making him after his discharge rather dependent upon others for guidance than independent and self-reliant in his conduct.

The *silent* system demands a much less costly structure for its inmates, and while the *per capita* cost of their maintenance and safe keeping, owing to the greater expenditure for guards and watchmen, is about the same, the labor when well (*i. e.* economically) managed, is considerably more productive. No *separate* prison has ever yet paid its way, while some of the *congregated* prisons have done so, for a time, at least.

This fact has exerted an unwarrantable influence over the legislatures of the different states, who seem to have forgotten, or never to have realized, that the design of imprisonment was to reform as well as to punish, and only to have inquired which system would *pay* the most immediate profit to the state, without reference to its effect upon the prisoner.

The objections to the silent system are, that it deals with the men in the mass, rather than as individuals; that it is impossible under it to prevent the convicts from communicating with each other, and that from their knowledge of each other they are less likely to be reformed, inasmuch as, after their discharge, the more hardened will exert an evil influence over those who desire to reform; that conspiracies and combinations are not infrequent; that extreme severity on the part of the wardens and keepers is rendered almost inevitable, and degrading punishments are frequent; that the almost unlimited and irresponsible power, necessarily reposed in the officers, is very liable to abuse; and that the constant irritation of mind under which many of the prisoners labor, stimulated, as it often is, by their overseers or companions, is very unfavorable to reformation.

When we add, that in nearly all of the states the pardoning power is exercised with very little discretion, and often with great injustice, and that the appointment of the officers of the prisons is generally among the prizes of the successful political party, and that party services, not eminent qualifications, are the ground on which the posts are claimed, it will be evident that the system is not usually so well administered as it might be.

There are, indeed, in nearly all the states, state prison directors, or inspectors, whose duty it is to investigate the condition of the prisons and the management of the officers, and redress any wrongs or grievances of the prisoners; but in the nature of the case they can learn but little except what the officers are disposed to have them know, and in many cases cruel and inhuman beatings, and the use of the bolt-shower-bath, one of the most terrible instruments of torture ever invented, the yoke, and other punishments worthy only of the Inquisition, fall to the lot of the unhappy prisoner, often at the mere caprice of the keeper.

In Massachusetts, and perhaps in one or two other states, the plan has recently been adopted of *commutation*, or of throwing off a certain number of days, proportioned to the length of the sentence, from its term, for each month of good conduct on the part of the prisoner. Thus a prisoner sentenced for ten years, commutes five days for each month of good behavior, and may shorten his sentence almost two years, if his conduct is uniformly good. The intention of the measure is good, but there are two serious objections to it: one, that as a reformatory measure it is of little avail, since it is often the case that the sly, cunning rogue, who is constantly on his guard, is more likely to conform to the rules, in the hope of the sooner resuming his career of wickedness, than the man who, though earnestly desirous of reformation, is passionate and sensitive to harsh treatment; and the other, that the personal prejudices or spites of the keepers will often make this an engine of punishment, to the unhappy wretch who has incurred their displeasure.

A better plan, in every respect, is that adopted in Ireland, of *intermediate prisons*. The ordinary prisons of Ireland are on the separate plan, and the prisoner sentenced to one of them for, say ten years, earns the privilege, if he will, by continuous good conduct, of being transferred at the end of six years to an intermediate prison, usually connected with some government works, where the men work in gangs; and if his conduct continues exemplary there, he is discharged at the end of a year and a half, by a *ticket of license*, allowing him to be at large, he reporting himself to the constabulary station nearest him, and being there registered, the constabulary being notified also of his having received a ticket of license, by the prison authorities. During the remainder of his sentence he is under the surveillance of the constabulary force; and if guilty of any offence against the laws, can be taken at once and remanded without trial to his first prison, to serve out the remainder of his sentence. The plan works admirably there, and would, we think, do so here if the difficulty in regard to police supervision could be obviated.

Great Britain and Germany are greatly in advance of us in the matter of prison discipline. Eminent men are devoting their whole thoughts and time to the work of devising the best means of combining punishment most effectually with reformation, and the government, wisely deeming the men worth reforming at any cost, spares no expense to carry into effect the best methods. In both countries, too, every officer, even down to the lowest subordinate, is trained for his work, and is selected for his moral worth and executive ability, and not as a reward of partisan service.

Besides the convict prison, already described, of which there is one in each state, and in the larger two or three, there is in each county (with a few exceptions where several small counties have united in supporting a district prison) a county jail, to which persons arrested on a charge of crime are committed previous to trial, in which witnesses who would be liable to abscond are detained, and persons convicted of habitual intemperance and vagrancy, petty larceny, and other crimes of a venial character, are confined. To these county jails are also committed prisoners convicted in the United States courts, in many cases, and juvenile delinquents awaiting trial or transportation to a reformatory. In most cases, there are one or more apartments destined for the confinement of those arrested on civil process, and known as the debtors' prison.

These jails, when located in the large towns, or in populous and wealthy counties, especially if recently erected, are usually built substantially on the plan of the *silent* convict prisons, but the rule of silence is not so strictly adhered to. Each prisoner has a cell to himself, but the able-bodied are employed in the day time in the workshops connected with the prison, or in other work, under the direction of the jailer or his deputy. The sentences being in the majority of cases short, and the prisoners in many instances confirmed drunkards, or otherwise physically infirm, the labor is seldom or never sufficient to defray the cost of the prisoner's maintenance.

The greater part of the jails throughout the country are, however, inferior to these, and are rather calculated to demoralize than to reform their inmates. Unseemly and ill-constructed buildings, often erected originally for some other purpose, and at all events poorly adapted to this, ill ventilated and frequently filthy, congregating the prisoners, whether convicted for crime, awaiting trial, or detained as witnesses, in one or two rooms, where they remain night and day, the vicious polluting the minds and depraving the tastes of the innocent, by their blasphemy and obscenity, and their boasting over the crimes they have committed; drunkenness and pilfering practised unchecked, or at least with but partial restraint; and in many cases, the jailer, a rapacious, greedy cormorant, selected in consequence of party service, and without any qualifications of humanity or moral principle for his post; all these together constitute a scene so forbidding, that it is wonderful that it should be tolerated in an intelligent and enlightened community. It is certainly desirable that in counties where the population is so sparse and the number of criminals so small as to make the burden of erecting and maintaining a good and well-regulated county jail too heavy for a single county, several adjacent counties should unite and establish a district prison, where those improvements can be adopted which shall prevent it from becoming a source of moral corruption, and over which a man thoroughly qualified for his position may be placed.

In the large cities there are other prisons deserving of notice. The large number of offenders, as well as the different authorities by which they are committed, render a classification of the prisons necessary. There are, then, in most of the large cities, *penitentiaries*, or prisons to which persons guilty of minor crimes are sentenced for periods from one month to two years, and where they are usually employed in labor during their period of imprisonment. In these, there are usually separate buildings for male and female prisoners. There are also *city* or *police prisons*, to which parties arrested by the police are committed for safe keeping till tried, and in which, if their offence is trivial, they pass their brief term of imprisonment. To these prisons are also committed prisoners convicted of capital offences, and awaiting execution, or those who having been convicted of state prison offences, are not yet sent to the convict prisons; or having appealed, await the result of their appeal. United States prisoners are also confined here. Besides these, there are prisons for persons arrested on civil process, generally known as *debtors' prisons*, though debtors are not imprisoned in most of the states, except on the charge of fraudulent conduct; there are also *houses of detention*, for witnesses; and *workhouses*, or *houses of correction*, for able-bodied vagrants. Under the general head of education, we have spoken of the *houses of reformation* for juvenile delinquents, which partake somewhat of a penal character, though having for their main object the reformation of the youthful offender.

The condition of many of these institutions is very far from what it should be, though the sums expended upon them by the city authorities have been amply sufficient to make them model institutions, if money alone could accomplish that end. Many of them are of bad construction, but the great want in most of them is of capable, upright, humane, judicious keepers—a want never to be fully remedied till the appointments are made on the ground of competency for the position, alone, without reference to political opinions.

There are, however, a few of the penitentiaries, and prominent among them the Albany (New York) Penitentiary, where the prison has been constructed under the supervision and direction of men of large experience on the subject of prison discipline, and where the officers employed have been selected solely on the ground of their adaptation to their several positions. In these institutions, the prisoners have been treated as human beings, and not being deprived of all hope or self-respect, a large proportion of them have thoroughly reformed, and on their restoration to society have proved themselves good citizens.

The improvements in the construction of prisons, as well as in their discipline and management, are due in a great degree to the unwearied labors of the late "Boston Prison Discipline Society," founded in 1826, the "Philadelphia Society for alleviating the miseries of Public Prisons," founded in 1787, and the "New York Prison

Association," founded in 1846. These societies, though the first two were engaged for years in a most acrimonious discussion of the comparative merits of the separate and silent systems, have yet diffused much valuable information on the subject of prison management. For fifteen years past the Philadelphia society has published a quarterly *Journal of Prison Discipline*, containing articles of great value and importance. The Philadelphia association has a visiting committee who visit regularly and frequently the prisoners of the Eastern Penitentiary and of the city prisons, and instruct and encourage them in their efforts to reform. Efforts are also made to protect those who are unjustly accused, and to save from prison the young who are novices in crime or dupes of the designing. This work was originated and successfully carried on in that city for many years by the late Isaac T. Hopper, a member of the Society of Friends, who subsequently removed to New York, and there was the means of organizing the New York Prison Association. The reports of this association are very valuable and interesting, and throw much light on the causes of crime and the most effectual means of repressing it, as well as on the statistics of crime both in the state of New York and in other states and countries. The association has authority from the legislature to visit, inspect, and report upon the condition of the convict and county prisons throughout the state, and by its reports has aided greatly in improving the condition and construction of the latter. It employs a general agent, who visits the city prisons, and procures the release of the innocent and friendless, and the suspension of judgment and discharge of those who, having committed trivial offences, give evidence of sincere repentance, and a determination to do better in future. The same agent also aids discharged prisoners who are desirous of leading correct lives, furnishing them, where necessary, with clothing and a small sum of money, and finding them employment.

There is also a Women's Prison Association in New York, formerly connected with the New York Prison Association, which now maintains, at 191 Tenth avenue, a refuge for discharged female prisoners, called the "Isaac T. Hopper Home." Here 121 females were received last year, on their discharge from prison, and 53 provided with good situations, 15 discharged, and the remainder retained at the Home. The effect of this institution in reforming this class of women has been excellent. Similar institutions exist in Boston, Baltimore, and other cities. In Boston, a philanthropic gentleman, Rev. Mr. Spear, has established a monthly journal, called the *Prisoner's Friend*, for the benefit of this unhappy class, and the promotion of measures for their improvement.

CHAPTER II.

HOSPITALS FOR THE INSANE.

THE condition of the insane in all civilized countries has become, within the last seventy years, an object of deep solicitude to the humane. Hospitals for their treatment, or rather for their confinement, have existed in Europe for five or six hundred years; but the suffering endured, previous to the close of the last century, in these places of torment, by the hapless creatures deprived of reason, exceeds the powers of human description. The vilest galley-slave, or the most depraved heretic in the power of the pitiless officers of the Inquisition, was not subjected to such tortures as were inflicted on those who had "lost their wits," and who were so unfortunate as to be known as *lunatics.* Confinement in close, dark, damp cells, without fire, without sufficient clothing, in the most pestilential filth, loaded with chains, often cruelly beaten either at the will of their brutal keepers or as the only curative treatment, their limbs often sloughing off from the combined irritation of their chains and frost, till death, most earnestly longed for, yet sometimes so long delayed as to excite our astonishment, ended a life of inconceivable wretchedness: such was the terrible fate that awaited the insane, even in Christian lands, but eighty years ago. Nor was it those deprived of reason alone, who were consigned to a doom so terrible. The private establishments for the treatment of lunatics, and even some of the public ones, offered ready facilities for putting out of the way persons whose existence in society interfered with the covetousness, malice, or hatred of relatives or others, and whom it was not prudent to remove by poison or the assassin's knife; and many a helpless victim was consigned to a private or public "bedlam," whose fault was not insanity, but the possession of property or affection coveted by another.

The first step for the amelioration of the condition of the insane was taken by Philip Pinel, at the Bicêtre in Paris, in 1792. He took off their chains, brought them out to the light of day, and sought to win them back to reason by kindness instead of barbarity. Humane reforms are seldom rapid in their progress, and this was no exception to the general rule. Twenty-one years later, the first movement to substitute kindness for chains, and the system of non-restraint for one of cruelty and brutality, was made in England by William Tuke, a member of the Society of Friends, at the Retreat, near York, England. Three years later the first permanent lunacy commission was appointed in England, and its reports revealed such atrocities in the treatment of these poor wretches, that reform became imperative; but in England and on the continent of Europe it is only within the last thirty years that the proper construction of insane hospitals and the truly scientific treatment of insanity may be said to have been initiated. In both particulars our country has fully kept pace with the most advanced of the European states.

At the close of the Revolution there were but two insane hospitals in the country, and of these one was a branch of a general hospital. These were the "Insane Department of the Pennsylvania Hospital," at Philadelphia, founded in 1755, and the "Virginia Lunatic Asylum," at Williamsburg, Virginia, founded in 1773. The two had less than two hundred patients. In their treatment they were probably on a par with the best institutions of the time in Europe, which is no very high encomium; chains, straps, strong, dark rooms, the strait-jacket, and very likely occasional whippings and beatings were among the remedial means employed; but this was the universal treatment of the insane. No other insane hospital was established in this country till 1817, though the number of the insane, at the commencement of the century, could hardly have fallen short of 5000 persons. These were kept in private houses, under restraint if violent, or at liberty if deemed harmless; if paupers, they were confined in jails and poor-houses, or let out to the lowest bidder, who managed, if possible, to make their services of some value, or if not, often kept them confined in pens or sheds, under circumstances of the most revolting filth and exposure. A warm room in the winter was considered entirely unnecessary for the insane, partly, doubtless, from the apprehension that they would injure themselves or others by means of the fire, and partly from an absurd notion that the feverish heat attendant upon their disease rendered them insensible to cold.

In 1817, members of the Society of Friends in Pennsylvania, moved by the success which had attended the experiment of Mr. Tuke, at his Retreat in the vicinity of York, Eng., established at Frankford, Penn., the "Asylum for Persons deprived of their Reason," a small, but, from the first, an admirably managed institution, and which has the honor of being the first in which the system of non-restraint was adopted in this country. In 1818, the McLean Asylum at Somerville, Mass., the first of the New England insane hospitals, was established. The Bloomingdale Asylum, a branch of the New York General Hospital in New York city, was founded in 1821; the South Carolina Insane Hospital at Columbia, in 1822; the Retreat for the Insane, at Hartford, Conn., in 1824; and the Kentucky Asylum at Lexington, the same year.

Up to 1840, there were fourteen insane hospitals in existence in the United States. Of these five were in the southern states, four in New England, two in New York, two in Pennsylvania, and one in Ohio. The construction of many of these was very faulty in respect to ventilation, warming, and convenience of classification of patients. Many of them were also over-crowded for their accommodations. Their management was, however, decidedly in advance of the views which had obtained in the early part of the century, and their construction, in most instances, admitted of such modifications as would make them, if not perfect, yet measurably well adapted to the comfort and welfare of their inmates. But at this time a new era commenced in the care and treatment of the insane. This was due to several causes. The managers of the Pennsylvania Hospital for the Insane, which for many years had occupied a site in the city, at the corner of Eighth and Pine streets, finding its location surrounded on all sides by a dense population, sold its property in the city, and purchased a farm of one hundred and thirteen acres in the suburbs, in 1836, and proceeded to erect upon it a hospital for the accommodation of about two hundred patients. Having ample funds at command, and a judicious board of managers, it was resolved to introduce into the hospital all the improvements in construction which were to be found in the best insane hospitals in Europe and America. The present eminent superintendent of the hospital, Dr. Kirkbride, was elected to the post early in the progress of the work, and contributed greatly to the completeness and perfection of its arrangements. This hospital was not opened till the beginning of 1841, and its improved construction exerted a decided influence on those states which were contemplating the erection of hospitals for the insane.

A still more powerful agency in stimulating action in behalf of the insane, and leading to the erection of new and improved hospitals for them, was found in the efforts of Miss Dorothea L. Dix. Highly educated, and occupying a social position which left nothing to be desired, this heroic and noble-hearted woman, touched with the condition and sufferings of the insane, devoted herself to the work of promoting their welfare by personally investigating their condition in each state, and urging upon the legislatures the erection and maintenance of hospitals for their treatment and cure. Her memorials to the different legislatures, and subsequently to Congress, are replete with terrible facts, showing the cruel abuses to which they were subject where their care devolved upon relatives or upon the towns; and the eloquence of her appeals was almost invariably irresistible. The twenty years which have passed have increased the public hospitals for the insane to more than fifty, besides a considerable number of private asylums. Of these public hospitals, most have accommodations for 250 patients, and some of them for a much larger number. In their construction there has been jealous care exercised to introduce whatever improvements had been fairly tested, either in Europe or America; and the result is that in convenience and healthfulness, and in all the particulars of construction and management, the American insane hospitals are surpassed by those of no country in the world.* To these ends the Annual Convention of Superintendents of Insane Hospitals, first organized in 1845, and the *American Journal of Insanity*, established in 1844, have materially contributed. At the time of the commencement of the latter, not more than five or six works on insanity, including translations and reprints, had been published in this country. The number of such works is now very large. Many of the superintendents of insane hospitals have visited the European institutions, and some of them, Drs. Earle, Bell, and Ray among the number, have given to the public very full descriptions of the best institutions there. The Convention of Superintendents have agreed upon certain principles in regard to construction, number of patients, and minimum extent of grounds, desirable in the erection of hospitals; these, with other suggestions of great value and importance, have been embodied in a treatise on the construction and management of hospitals for the insane, by Dr. T. S. Kirkbride of the Pennsylvania Hospital. Drs. Beck and Ray have, in their works on medical jurisprudence, laid down with great clearness and force the principles which should govern all legal investigations concerning insanity. Dr. Macdonald gave the first public course of lectures to medical students on insanity, in 1842.

The careful investigations made by most of the superintendents into the different forms of insanity, and their comparative effect on the general health of the patient, have led to many discoveries of great importance to the community at large as well as to the medical profession. It has been fully demonstrated that early treatment at a hospital greatly increases the probability of cure; that insanity often exists long before its presence is suspected; that crimes are many times committed under an insane impulse; and that mental aberration may exist, to an extent which renders the subject irresponsible, where there is no hallucination,

* The most complete and perfect of the American hospitals for the insane, not only in its construction but in all its equipments and appliances, is the "New Pennsylvania Hospital for the Insane," near Philadelphia, opened in 1859, intended for male patients only, but in the immediate vicinity of the female department, which was opened in 1841; both being under the general supervision and management of Dr. Thomas S. Kirkbride. It is intended for 250 patients, and cost, with its complete equipment, about $350,000. It was planned by Dr. Kirkbride, and, for its size and purpose, is unsurpassed either in Europe or America. The hospitals recently erected at Northampton, Mass., and Kalamazoo, Mich., are also admirably arranged.

and no maniacal excitement, or melancholic depression. Painful evidence has been adduced that in many instances persons have perished upon the gallows whose crimes have been committed under the influence of insanity, and who should have been committed to the care of the superintendent of an insane hospital rather than to the hangman.

Within the past two or three years, insane hospitals have been established for those who have committed serious offences against the laws under the influence of insanity, and for convicts who have become insane during their imprisonment. The largest of these is at Auburn, opened in February, 1859, and which has received sixty-nine patients, fifty-five of whom are still in the hospital.

Among the improvements introduced in the treatment of the insane within the past ten or twelve years are horticulture and floriculture for those patients who can be induced to take an interest in them; libraries and reading-rooms; gymnasiums well provided with apparatus; the introduction of paintings and engravings, not only into the halls, but into the patients' rooms; games like chess, checkers, backgammon, tivoli, and dominoes, as well as those of a more active character; school exercises for a portion of the patients; parties, lectures, tableaux, readings and recitations, and other measures for diverting the mind, and recalling it from the trains of thought to which it is accustomed to revert. The success which has crowned these measures has been most gratifying. The percentage of recoveries in recent cases has been constantly on the increase, and even among those regarded heretofore as incurable, there have been many instances of recovery under the stimulus to new trains of thought thus induced.

There is still needed provision in all the states for cases of long standing, the chances of whose recovery are very slight, inasmuch as in many cases they have fallen into a condition of hopeless imbecility, or are most of the time stupid and depressed, with occasional alternations of violent mania. The safety of the community, as well as their own comfort, require that they should be in a hospital; yet most of the insane hospitals are so pressed with applications for the admission of recent cases, generally of a far more hopeful character, that they are reluctant to retain these incurables, and far more reluctant to receive them, when brought to them after years of insanity. In England, and generally in Europe, hospitals specially for incurables have been established; but this plan has its objections, as, except in cases of fatuity, it is almost impossible to pronounce positively on the curability of a given case, and the association with those whose recovery is more probable often exerts a beneficial influence upon those who have long been insane. Some measures should be adopted soon for the relief of this large class of the insane.

The fifty public insane hospitals in the country have cost on the average somewhat more than $250,000 each, or an aggregate of not less than $13,000,000. In conjunction with private asylums, they afford accommodations for a little more than ten thousand patients. According to the estimate of Miss Dix, recently published, the whole number of persons in the United States, who at some time in their lives are afflicted with insanity, is about 62,000. This would indicate an alarming deficiency of hospital accommodations for this unfortunate class. That there is a great deficiency is undoubtedly true, but it is not quite so large as these figures would indicate. The population of the hospitals is a constantly changing one, and the discharges in any one year will amount to very nearly one half of the number in the hospital. It is safe therefore to conclude that the present hospital accommodations are sufficient for nearly or quite one half the insane. They are, however, unequally distributed. Massachusetts has five public and several private hospitals, furnishing accommodations for nearly 1500 insane; Connecticut, with nearly one half the population, has but one public institution, having accommodations for 250, and one small private asylum. New York has but five public, and several private hospitals, the public hospitals affording accommodations for not more than 1600 patients; while Pennsylvania, with a considerably smaller population, has seven public hospitals, with accommodations for about 1800 patients.

The newer states are not, as yet, fully provided with hospital accommodations for the insane, though most of them have commenced their erection.

The character of our population, active, restless, eager, and impulsive, is such as to make insanity more prevalent than in most other countries; and it is of a different

STATISTICS OF INSANE HOSPITALS IN THE UNITED STATES, 1860.

Name of Hospital.	Location.	Date of opening.	Patients at beginning of year.	Admitted durin. year.	Discharged.	Remaining at end of the year.	Discharged cured.	Discharged not cured.	Died.	Percent. of recoveries.	Percentage of deaths	Percentage of recoveries on admis'ns.	Superintendents.	Receipts.	Expenditures.
State Insane Asylum	Augusta, Me.	1840	208	149	120	237	58	45	17	26.12	7.65	38.92	Dr. Harlow	$32,421	$32,726
" " "	Concord, N. H.	1843	165	85	66	184	38	28	17	21.71	9.71	44.70	Dr. Bancroft	31,855	31,227
Insane Asylum	Brattleboro', Vt.	1836	431	143	138	436	58	43	37	13.39	8.54	40.55	Dr. Rockwell	59,270	57,810
McLean Asylum	Somerville, Mass.	1818	186	131	142	175	61	53	28	39.60	13.70	46.45	Dr. Tyler	64,115	61,627
State Lunatic Hospital	Worcester, "	1833	301	200	184	317	89	65	30	28.80	9.70	44.50	Dr. Bemis	60,451	60,220
" " "	Taunton, "	1854	301	231	149	341	..	..	42	..	13.08	..	Dr. Choate	63,666	61,452
" " "	Northampton, "	1858	220	93	61	233	33	28	19	14.60	8.40	35.48	Dr. Prince	47,577	46,145
Boston Lunatic Hospital	Boston "	1839	123	96	80	139	39	20	21	29.77	16.03	40.62	Dr. Walker	29,782	29,782
Butler Hospital for the Insane	Providence, R. I.	1848	135	42	42	135	14	18	10	10.37	7.40	33.33	Dr. Ray	30,696	31,090
Insane Retreat	Hartford, Conn.	1824	215	168	156	227	70	66	20	31.67	9.05	41.66	Dr. Butler	45,816	40,653
State Lunatic Asylum	Utica, N. Y.	1843	502	312	295	519	114	146	35	22.30	6.85	36.53	Dr. Gray	118,545	109,465
City " "	New York, "	1838	655	389	247	711	148	99	86	21.67	12.59	38.05	Dr. Ranney	49,615	50,318
Bloomingdale Lunatic Asylum	" "	1821	145	138	131	152	55	58	18	36.91	12.08	39.85	Dr. Brown	49,149	40,205
King's County " "	Flatbush "	1845	290	180	162	308	87	49	26	29.10	8.69	48.33	Dr. Chapin	..	..
Criminal Insane Asylum	Auburn	1859	51	18	14	55	12	1	1	22.64	1.88	..	Dr. Hall	..	..
Pennsylvania Hospital for the Insane	Philadelphia, Penn.	1841	254	211	191	274	98	67	26	37.12	9.84	46.44	Dr. Kirkbride	84,144	86,407
City Lunatic Asylum	" "	..	406	376	366	416	115	140	111	27.97	27.00	30.59	Dr. Smith	..	..
Asylum for persons deprived of their reason (Friends' Asylum)	Frankford "	1817	62	25	29	58	10	15	4	16.66	6.66	40.00	Dr. Worthington	..	..
State Lunatic Hospital	Harrisburg, "	1854	267	143	136	274	31	82	25	11.48	8.59	21.67	Dr. Curwen	59,079	58,997
Western Pennsylvania Insane Hospital	Pittsburg, "	1856	74	83	67	90	34	19	12	41.46	14.60	40.96	Dr. Reid	24,000	23,734
State Lunatic Hospital	Trenton, N. J.	1848	293	186	173	306	76	71	26	28.00	8.66	40.86	Dr. Buttolph	51,525	51,523
State Lunatic Asylum	Baltimore, Md.	1834	108	97	101	110	69	19	13	63.30	11.92	71.13	Dr. Fonerden	..	..
Mount Hope Institution for the Insane	Mount Hope, "	1842	144	135	102	177	39	47	16	24.37	10.00	28.88	Dr. Stokes	..	..
Eastern Virginia Insane Asylum	Williamsburg, Va.	1773	257	167	121	300	33	31	59	11.82	21.14	19.76	Dr. Galt	66,518	55,458
Western " " "	Staunton, "	1828	389	102	119	372	62	17	40	16.31	10.52	60.78	Dr. Stribling	..	..
United States Insane Hospital	Washington, D. C.	1857	110	43	36	117	18	5	13	15.80	11.40	41.86	Dr. Nichols	24,500	24,500
Insane Asylum	Raleigh, N. C.	1856	138	57	49	146	24	16	9	16.90	6.34	42.10	Dr. Fisher	30,000	30,000
" "	Columbia, S. C.	1822	184	63	53	194	25	9	19	13.23	10.05	39.68	Dr. Parker	47,142	45,087
" " *	Midway, Georgia	1840	..	..	..	..	..	..	..	..	..	..	..	35,630	35,000
" Hospital*	Tuscaloosa, Ala.	1855	..	..	..	..	..	..	..	..	..	..	..	..	..
" Asylum	Jackson, Miss.	1854	105	47	48	106	14	17	19	13.53	18.69	29.78	Dr. Kells	30,065	35,315
" "	Jackson, La.	1855	137	97	77	157	34	6	37	21.29	25.17	35.05	Dr. Barkdull	31,167	31,129
Tennessee Asylum	Nashville, Tenn.	1852	105	122	69	158	28	22	19	21.21	14.39	22.19	Dr. Cheatham	52,426	48,000
Eastern Kentucky Asylum	Lexington, Ky.	1824	226	45	43	228	19	15	9	8.37	3.96	42.22	Dr. Chipley	..	..
Western " "	Hopkinsville, "	1846	87	95	74	108	38	18	18	38.77	18.36	40.00	Dr. Montgomery	..	..
Missouri Asylum	Fulton, Mo.	1853	135	122	86	171	45	19	22	29.41	14.37	36.88	Dr. Smith	..	38,920
Northern Ohio Lunatic Asylum	Newburg, O.	1855	141	140	133	148	75	54	4	52.08	2.80	53.57	Dr. Kendrick }		
Central " " "	Columbus, "	1838	259	175	179	255	101	59	19	39.84	7.39	57.71	Dr. Hills }	..	93,423
Southern " " "	Dayton, "	1855	161	116	117	160	73	27	17	45.60	10.60	62.93	Dr. McIlhenny }		
Hamilton County Insane Asylum	Cincinnati "	1852	179	158	107	230	46	49	12	22.55	5.88	29.11	Dr. Mount	..	..
†Michigan Insane Hospital	Kalamazoo, Mich.	1859	111	..	..	..	..	..	..	..	..	..	Dr. Van Dusen	..	..
Indiana " "	Indianapolis, Ia.	1848	277	203	177	303	95	70	12	32.76	4.11	47.29	Dr. Athon	..	36,196
Illinois " "	Jacksonville, Ill.	1851	214	312	297	229	164	91	42	73.87	19.82	52.50	Dr. McFarland	36,000	36,000
†Wisconsin " "	Madison, Wis.	1860	..	..	..	..	..	..	..	..	..	..	..	..	..
†Iowa " "	Mt. Pleasant, Iowa.	1861	..	..	..	..	..	..	..	..	..	..	..	..	..
California " "	Stockton, Cal.	1853	273	276	124	370	40	35	49	12.38	15.17	14.49	Dr. Aylett	..	..
†Texas " "	Austin, Texas.	1858	..	..	..	..	..	..	..	..	..	..	..	10,000	..

There are also County Hospitals for the insane at Albany, Canandaigua, Troy, and Buffalo, N. Y., an Insane Hospital for Emigrants, just opened, on Ward's Island, N. Y., and private asylums at Dorchester and Pepperell, Mass., Litchfield, Conn., Flushing, etc.

* No report.

† Just opened, or nearly ready for patients.

type, assuming oftener the violent form; while in Europe, the pauper insane, who form the largest portion of those afflicted, have usually become so under the influence of insufficient food and depressing circumstances, and are melancholy and dejected, rather than violent.

The preceding table, prepared with great care, exhibits the condition and success of nearly all the public insane hospitals of the United States, up to January, 1860, though a few of the returns of the remoter institutions are of the previous year.

CHAPTER III.

THE RELIEF OF THE POOR.

In every large community there is, of necessity, a dependent class, to be in some way provided for; their poverty and helplessness may proceed from the loss of their protectors, the husband or parents, at a time when they were unable to provide for themselves; from sickness; from mental or physical incapacity for self-support; from lack of employment; or from intemperance and vicious indulgence.

Whichever of these causes may have induced this state of dependence, it is a recognized duty in all civilized communities to diminish, and so far as possible prevent, extreme suffering on the part of those thus helpless.

The methods of accomplishing this result are of necessity various. All who need, at times, pecuniary aid, are not paupers; and to treat them as such would not only wound and distress them needlessly, but would in the end produce a demoralization and indisposition to exertion which would throw an intolerable burden on the tax-paying class, who would be compelled to support them.

It was the recognition of this truth which led very early to the organization of asylums, dispensaries, and relief societies for the orphan and the widow (especially those of certain classes), the aged and infirm, and the sick. It led also to the administration of private charities, which, although sometimes injudicious, was prompted by the most humane motives. It also led to the distinction between the out-door poor and the pauper, which is commonly established in our large towns.

The methods of providing for the poor, as well as the authorities who take charge of it, vary in different sections of the country. In New England, where the *town* was an older political organization than the county, province, or state, the legal care of the poor has always devolved upon the first town officer, or selectman, as he is usually called. To him all applications for assistance are made, and after the necessary examination into their condition and necessities, relief is furnished, to a limited extent, from the town treasury. Those needing only temporary assistance receive small sums, and are encouraged to struggle on at their homes; those wholly dependent are provided for, in the smaller towns, by contract with some citizen, who for a stipulated sum agrees to provide them with food, clothing, and shelter, employing such of them as are able to perform some labor, in such work as their health or want of skill will permit. In the larger towns, this class are received into almshouses, to which often a farm is attached, much of the lighter labor of which is performed by the paupers. Paupers of foreign birth, who have never gained a residence in any town, as well as vagrants who have no fixed abiding place, are sent to a state almshouse, or placed in charge of a state contractor for the poor.

In the middle and western states, the assistance to the poor and the support of paupers are a *county* charge, and are under the control of supervisors elected by the voters of the county. Those entirely dependent are usually quartered in a county almshouse, and, where practicable, employed in light labor. In the Southern states, with a milder climate and a sparser population, there is less occasion for definite preparation for the wants of a pauper class, especially as a very considerable portion of those who would elsewhere be dependent upon the public are, from the peculiar constitution of their institutions, cared for, when infirm, sick, or disabled, by their masters. Hence, except in the cities and large towns of the South, there has been no well-defined provision for paupers.

At the close of the Revolution, there was a vast amount of poverty and suffering, the result of the prostration of commerce, the ravages of war, the loss of the productive industry of so large a number of able-bodied men for several successive years, and the complete and ruinous depreciation of the continental currency. From this condition, however, under the stimulus of an active and prosperous trade and commerce, the country soon rallied, and though the war of 1812 brought much privation and loss of property, yet the constant westward emigration, and the enterprise of the people, kept the pauper population within narrow limits. The poor were mostly natives of the country, and the ties of kindred were strong enough to prevent the burden of their support from pressing heavily on the public treasury.

In the larger towns, and especially in the seaports, where there was the largest influx of persons of foreign birth, and of families reduced to poverty through the vicissitudes of a seafaring life, there were benevolent societies, some of them dating back almost to the revolutionary period, of the different nationalities, which bestowed aid on their own countrymen, and marine societies (that of New York founded as early as 1770) to provide for the widows and orphans of seamen. There were also one or two dispensaries in the larger towns, for providing medical attendance and promoting vaccination among the poor. Between 1800 and 1830, relief societies, some of them connected with particular trades or professions, such as the tailors', house-builders', firemen's, etc., some composed of persons of particular nationalities, as the Germans, Irish, etc., and others of a more general character, like the Masonic, Odd Fellows', and Temperance Lodges, were organized, having for their object the care of the sick, and provision for the widows and orphans of their members. The New York Hospital opened in 1792, the City Hospital at Bellevue, the New York Eye and Ear Infirmary founded in 1820, the City Dispensary founded in 1791, the Northern Dispensary founded in 1827, and the Lying-in Asylum founded in 1824, afforded the necessary medical treatment to those who were without means to pay for the attendance of a physician. Soon after 1830, however, the tide of European emigration began to set westward, and with each successive year, larger and still larger numbers of emigrants, at first mainly from Ireland, but subsequently in quite as large numbers from the German states, began to pour in upon us. Many of these possessed a small amount of money, and others, stout and able-bodied, found ready employment at remunerative wages, and provided well for themselves and families.

No inconsiderable portion, however, had either been paupers at home, or coming here with insufficient means, their manners, customs, and language diverse from ours, and the climate, under their privations, proving far more severe than that of their native country, sunk down into a hopeless and despondent pauperism almost immediately on their arrival. With the intent of obviating this influx of foreign pauperism, stringent laws were passed by the states having extensive commercial relations with Europe, prohibiting the reception, by captains of emigrant ships, of pauper emigrants, and a tax of two dollars per head required of all emigrants arriving at the principal ports, or a bond by the ship-owners to the state that they should not become chargeable to the state within three years. These laws were so constantly evaded, and the pressure of foreign pauperism in consequence became so severe in New York, the great port of entry for emigrant ships, that a modification became necessary, and a board of Commissioners of Emigration was appointed to receive the emigrant tax, which was raised to three dollars, and they were required to establish hospitals, almshouses, etc., and to assume the entire responsibility for the pauperism of emigrants for five years after their arrival.

Measures nearly as stringent were adopted by Massachusetts and Pennsylvania.

Notwithstanding these efforts to restrain within due metes and bounds the influx of foreign pauperism, and prevent its becoming chargeable upon our own citizens, its increase in New York, Massachusetts, and Pennsylvania, has been such as to create no small degree of alarm on the part of the taxpayers. The state of New York alone had, in 1859, above 260,000 paupers, being 7.4 per cent. of her population, or nearly one pauper for every 13 persons. This proportion is about eight times that of Ireland, and more than double that of the United Kingdom of Great Britain and Ireland; and formidable as it is, it does not include any of those under the care of the Commissioners of Emigration. The increase of pauperism has been nearly fifteen times that of the population within the last thirty years. Of this increase more than 75 per cent. are either of foreign birth or the children of foreigners. In New York city the proportion of foreigners exceeds eighty per cent.

These statistics, however, by no means tell the whole story in regard to the dependent poor of the great cities. Large numbers, who are unwilling to be enrolled on

COMPARATIVE STATISTICS OF POOR RELIEF IN ENGLAND, FRANCE, MASSACHUSETTS, AND NEW YORK.

	England. 1859.	France. Average from 1848 to 1852.	France. 1853.	Massachusetts. 1858.	Massachusetts. 1859.	New York. 1858.	New York. 1859.
Number of almshous, poorhouses, or workhouses	749	..	..	212	222	60	60
Land attached to these houses	..	..	..	21,276	21,601	7,208	7,691
Number of persons relieved in almshouses, etc.	107,050	618,207	542,323	11,845	10,369	38,582	36,550
Out-door poor	692,384	982,516	1,022,996	23,071	21,954	333,405	279,717
Cost of support of poor in almshouses	$12,644,906	..	$13,431,379	$435,661	$380,149	$1,121,222	$927,581
Average *weekly* expense of each pauper in almshouses	$2.27	..	$1.13	$1.57	$1.47	cts. 90.5	cts. 71.8
Average *yearly* expense of each pauper in almshouses	$118.12	..	$58.76	$81.64	$76.44	$46.06	$37.34
Expenditure for out-door poor	$14,259,149	..	$3,420,585	$284,963	$356,096	$748,196	$677,680
Average expenditure per head per annum for out-door poor	$20.59	$2.23	$2.33	$12.35	$16.22	$2.24	$2.42
Total expenditure for legal relief of poor	$26,904,055	..	$27,886,554	$720,624	$736,245	$2,123,974	$1,877,908
Population	19,578,000	..	36,012,669	1,231,494	1,231,494	*3,735,607	*3,735,607
Ratio of expenditure for paupers to population	$1.37	..	cts 77.4	cts. 58 5	cts. 59.8	cts. 56.6	cts. 50.2
Whole number of paupers	902,052	1,726,236	1,694,495	58,907	49,137	399,839	344,763
Percentage of paupers to population	4.60	4.79	4.70	4.78	3.99	10.70	9.20
Number of insane paupers	19,487	..	..	1,176	1,142	3,457	4,299
Valuation of property of country or state	..	..	..	..	$897,795,326	..	$1,416,298,837
Percentage of poor-rate to valuation	..	..	..	..	.0008	..	.0013
Percentage of the poor-rate of the whole tax of the country or state	..	..	34.4	..	31.6	..	11.0

* Except Albany County.

the city or county records as paupers, are still dependent for a considerable share of their support, especially during the winter months, on private charity, bestowed either through the churches with which they are connected or some of the societies or associations devoted to the relief of the poor. These organizations have greatly increased within the past twenty years, in all our large cities, and though varied in their specific purposes, they all have the general object of ameliorating the condition of the poor. For the sick poor, hospitals, dispensaries, and infirmaries have been greatly multiplied; for the aged and infirm and for very young children, homes and nurseries have been established; for widows and orphans, widows' societies, assistance societies, and orphan asylums; for the disabled, relief societies; for youthful offenders or the morally endangered, asylums, houses of reformation, houses of industry, children's aid societies, and "missions;" for the intemperate poor, inebriates' homes and Samaritan homes; and for the poor in general, associations for improving the condition of the poor, provident societies, soup houses, etc., etc.

In addition to these, very large sums in the aggregate are bestowed by the benevolent in private charity to the poor and suffering, and sums almost as large in contributions to the importunate mendicant, by those who give from impulse and a naturally generous disposition.

The great increase of mendicancy, and the annoying importunity of the beggars who preferred a living obtained in that way to one acquired by honest toil, led to the formation of a class of organizations now existing in most of the large cities in the country, but originating in the city of New York. In different cities different names for these organizations have been adopted, but their general purpose is the same. "The New York Association for Improving the Condition of the Poor," was not only the first but has been the most efficient in its action. Its purposes, and those of its kindred associations, of which there are now thirteen in as many of our large cities, are, "to discountenance indiscriminate almsgiving and put an end to street begging and vagrancy; to visit the poor at their dwellings, and extend to them appropriate relief; and through the friendly intercourse of visitors to inculcate among them habits of frugality, temperance, industry, and self-dependence." Each city, where one of these associations exists, is divided into districts, which are again divided into sections (New York has almost four hundred of these sections), to each of which a visitor is appointed, who takes upon himself, without compensation, the entire oversight of the poor of his section, visiting them, ascertaining their situation, their resources, if any, their just claims upon any other organization for relief, and where necessary, rendering them such assistance as will enable them to subsist until they can obtain work or aid from quarters where they have a claim for it, or if they need assistance, bestowing it in such a way as not to destroy their desire for self-dependence or injure their self-respect.

To check street begging, every member (and any person contributing to the funds of the association is a member) is furnished with printed cards and a directory showing the residence of the visitors and the section which they have in charge, and when a beggar applies for charity, the member inquires his residence, and instead of giving him money, gives him a card with the address of the visitor upon it, and directs him to call upon that visitor, who will investigate his case, and if proper, render him aid.

These associations have also been active in promoting sanitary reforms, encouraging the erection of well-arranged tenement houses, in preventing truancy, in aiding in the formation of temperance societies, in promoting the establishment of dispensaries and houses of reformation, and in diffusing, by means of tracts and handbills, information among the poor on the subject of cleanliness, ventilation, and household economy.

Ignorance, intemperance, licentious indulgence, the congregation of such large numbers in filthy, ill-arranged, and ill-ventilated tenement houses, and disregard of sanitary laws generally, are the causes of more than four fifths of the pauperism of our great cities, and it is only by removing these causes that any considerable diminution in the number of paupers can be expected. The small dependent class whose poverty is not traceable to either of these, can readily be provided for; but the terrible burden of taxation to maintain those who are paupers from their own fault or that of their parents, renders it certain that there must be, ere long, carefully considered, but stringent legislation to prevent the evils which inflict such a burden on the industry of our people.

CHAPTER IV.

HOSPITALS.

Hospitals for the sick, either general or special, have been in existence in Europe from the early Christian ages, and their endowment has been a favorite form of Christian charity. In this country, the first general hospital was the Pennsylvania, at Philadelphia, opened in 1752. The charter, granted in 1751, contemplated "the reception and relief of lunaticks and other distempered and sick poor in this province," and it has always had a department for the insane, who occupied a portion of the hospital building until 1841, when they were removed to the Pennsylvania Hospital for the Insane, then completed, which we have described under the head of Hospitals for the Insane. This building, now the female department of the insane hospital, was erected mainly from funds resulting from the sale of the hospital land, and the general hospital has, aside from this, a permanent fund of nearly $400,000 invested, the income of which sustains nearly 150 free beds. The average number of inmates is below 200. The medical staff, selected by the managers, serve gratuitously, and are the most eminent members of the profession in the city. There is a library of over 10,000 volumes attached to the hospital. Benjamin West's picture of "Christ Healing the Sick" was painted for this hospital, and its exhibition added $24,000 to its funds.

The New York Hospital, the first in New York, was incorporated in 1771 by the colonial legislature, but was not opened for the reception of patients till 1791. At first it had wards for the insane, like the Pennsylvania Hospital, but in 1818 the governors of the hospital established a separate asylum for the insane at Bloomingdale, with an efficient superintendent and corps of officers, but under their general supervision, and supported in part from their funds. The general hospital has grown up to be a very large and admirably managed institution. It is a close corporation, under the control of 26 governors. All cases of serious accident or emergency are admitted immediately, without regard to payment or recovery; otherwise, persons whose cases appear not to admit of cure or relief, are not received. It has four physicians and six surgeons in regular attendance, besides a house physician and several assistants. The entire medical staff is twenty-four. There are about 500 beds. The cost of each patient is $4.32 per week. The rate of deaths to the whole number of patients is only about $5\frac{1}{2}$ per cent.; being less than that of any hospital in Europe. Connected with the hospital is a library of between 6000 and 7000 volumes.

The Massachusetts General Hospital at Boston, founded in 1817, is an institution of high character and reputation. It has funds to the amount of about $300,000; a medical staff of 20 physicians and assistants, and about 200 beds. It is managed by a board of trustees, and a president, vice president, secretary, and treasurer. It has an out-door department, furnishing medical and surgical aid to over 3000 out-patients. The McLean Insane Asylum, at Somerville, is a branch of the hospital. The annual expenditure is nearly $100,000.

There are now in the city of New York fourteen hospitals, and five other institutions having hospital accommodations. Of these, seven are general, and receive patients of all classes except those with contagious diseases; one is for small pox, one for syphilitic diseases, one for quarantine patients, two exclusively for women, one for children, and one for diseases of the eye. Of the five institutions having hospital accommodations, one is for lying-in women, two for young children, one for aged females, and one for colored persons. There are also hospitals connected with the Orphan Asylums, House of Refuge, and Juvenile Asylum, for the sick inmates of those institutions. The entire capacity of these hospital accommodations exceeds 7000 beds.

Philadelphia has eleven hospitals, four of them general, one naval, one for infectious disease, one a lying-in charity, one for diseases of the eye and limbs, and three for aged and indigent females. The entire number of beds does not exceed 1600.

Boston has eight hospitals, of which five are general, and one for diseases of the eye and ear, one for aged and indigent females, and one a lying-in hospital.

Brooklyn, N. Y., has five, two of them general, one naval, and two for aged women.

Baltimore has three, two of them general, and one for aged women.

Charleston has two hospitals, and Norfolk, Va., two, a naval and city institution.

Cincinnati has three, one a commercial hospital, one a hotel for invalids, and one a widows' and female asylum and hospital.

STATISTICS OF HOSPITALS IN NEW YORK, BOSTON, AND PHILADELPHIA, WITH COMPARATIVE STATISTICS OF PARISIAN HOSPITALS.

Name of hospital.	Date of organization.	Whole number of patients.	Males.	Females.	Cured.	Relieved.	Not relieved.	Died.	Percentage of deaths.	Total receipts.	Total expenditures.	Total expenditure for free patients.	Expenditure for food.	Expenditure for fuel.	Expenditure for medicines, &c.	Expenditure for clothing and bedding.	Expenditure for salaries.	Cost of food per head per week.	Whole cost per head per week.	Charge per week to pay patients.	Whole number of pay patients.	Whole number of free patients.
New York Hospital	1791	3,115	..	..	2,045	384	89	316	10.1	$46,596	$57,706	$29,609	$24,467	$6,193	$5,702	$1,486	$14,695	$1.71	$4.04	$4.00	1,927	1,188
St. Vincent's Hospital	1849	600	277	323	186	236	58	125	20.8	11,074	11,926	3,069	5,752	784	729	620	2,125	1.82	3.70	3.00	396	204
St. Luke's Hospital	1859	468	232	236	320	..	89	59	12.6	16,308	15,715	14,177	6,751	1,492	701	736	3,356	*1.91	4.25	4.00	56	412
The Jews' Hospital	1852	387	180	107	185	48	7	23	7.67	15,817	7,193	6,918	2,443	328	423	204	1,470	1.38	4.07	4.00	..	..
The Woman's Hospital	1855	130	..	130	52	41	4	2	1.54	8,512	8,958	..	..	..	..	..	..	..	..	4.00	..	..
Child's Nursery and Hospital	1854	607	..	..	463	..	22	106	17.46	10,543	8,854	4,331	4,572	1,238	..	489	1,469	0.51	0.98.4	1.20	..	..
Hospital for Women	1853	106	..	106	..	..	..	..	..	5,088	3,718	1,500	1,869	196	..	..	..	..	..	4.00	..	..
Colored Home and Hospital	1840	582	116	466	..	..	..	97	16.6	15,483	12,184	12,184	3,730	758	284	852	1,300	†0.23	†0.75	..	none	all.
Lying-in Hospital	1823	87	..	87	79	2	6	..	..	2,171	2,081	2,081	863	368	60	..	573	..	8.93	..	..	..
Bellevue Hospital	..	11,411	6,819	4,592	..	..	..	1,013	8.88	119,414	119,414	119,414	39,480	12,422	10,168	10,547	14,622	0.80	1.80	..	none	all.
Island Hospital	..	6,125	1,820	4,305	..	..	..	158	2.58	31,426	31,426	31,426	17,407	2,911	2,884	3,148	4,445	0.79	1.43	..	none	all.
Small Pox Hospital	..	339	204	135	..	..	..	36	10.62	3,454	3,454	3,454	1,113	608	364	254	930	0.83	2.67	..	none	all.
Emigrants' Hospital	..	4,729	2,848	1,881	3,014	..	..	226	4.79	58,913	58,913	58,913	26,065	13,372	5,825	2,782	17,035	0.69	1.57	..	none	all.
Nursery Hospital, Randall's Island	..	1,329	..	..	..	924	298	107	8.	20,844	20,844	20,844	..	..	..	..	4,292	..	1.48	..	none	all.
Massachusetts General Hospital	1835	1,394	848	546	698	305	134	121	8.69	45,749	42,578	36,148	16,337	3,397	3,657	1,583	12,451	2.45	6.42	4.50	257	1,137
Pennsylvania Hospital	1752	1,958	1,570	388	1,351	248	167	131	6.79	35,845	35,139	24,623	15,158	2,630	3,677	1,927	7,894	1.69	3.93	4.00	628	1,173
Total for 16 American Hospitals.		34,067						2,520	7.4	$447,237	$440,103								$2.93			
Hospitals of Paris—1858	..	88,237	..	..	78,913	..	..	9,283	11.76	$998,206	$998,206	$998,206	..	..	..	..	..	..	$3.02	..	none	all.

* This is exclusive of large donations of cooked food made to the hospital.

† Exclusive of donated food, and vegetables raised on the extensive grounds of the hospital.

PAUPERISM IN THE CITY AND COUNTY OF NEW YORK, 1860.

Name of Institution or Department rendering assistance.	Number in charge of department, etc., January 1, 1860.	Received during year 1860.	Discharged during year 1860.	Remaining in charge of department, January 1, 1861.	Total in charge of the department throughout the year.	Males, January 1, 1861.	Females.	Children.	Natives.	Foreigners.	Total amount of assistance.	Cost per head per day.	Cost per head per week.	Assistance rendered in clothing.	Assistance rendered in food.	Assistance rendered in fuel, etc.	Assistance rendered in medicine.	Assistance rendered in money.	Number of deaths.	Number of insane, demented, or idiotic.	Number of births.
Almshouse, Blackwell's Island..	1,770	4,129	8,860	2,039	5,899	955	868	216	429	1,610	$79,842	c.35.8	$2.50	$15.864	$42,662	$13,973		....	455	200	..
Bellevue Hospital.	860	10,551	10,485	926	11,411	519	855	52	167	759	119,414	25.7	1.80	10,547	89,480	13,422	$10,168	....	1,013	15	474
City Prison (insane paupers)....	..	..	..	..	..	..	..	..	....	....	...	..	..	....	....	...	....	....	84	859	8
City Lunatic Asylum, B. Island.	711	401	358	754	1,112	801	453	40	199	555	92,361	22.5	1.57	15,899	18,675	14,549	....	....	118	754	..
Randall's Island Nursery..	1,142	1,397	1,360	1,153	2,539	53	101	999	*842	264	43,774	21.2	1.48	15,822	83,823	21,505	....	....	82	..	..
" " " Hospital	256	1,073	1,031	298	1,329		..	298	....	....	20,853	..	.	....	....	....	....	....	107	..	..
Workhouse, Blackwell's Island..	1,387	11,641	11,601	1,427	13,028	675	752	..	....	....	88,961	22.2	1 55	25,607	35,279	18,006	....	. ..	21	..	..
Colored Home	293	568	556	805	861	..	..	..	....	....	17,814	15 6	1.09	1,096	7,781	1,839	984	....	98	..	71
Colored Orphan Asylum........	211	70	66	215	281	..	.	..	....	....	19,735	24.1	1.68	1,796	5,903	1,167	875	....	7	..	..
Island Hospital, Blackwell's Isl..	431	1,175	1,254	852	1,606	96	256	93	93	259	31,426	20.02	1.40	3,148	17.407	2,711	2,884	....	54	..	..
Small Pox Hospital, Blackw's Is.	16	323	296	43	339	26	17	..	6	37	3,454	38.09	2.66	254	1,113	608	364	...	36	..	..
Out-door poor for the year......	7,077	79,780	..	..	79,780	ad'lts. 33,679		46,101	*3,896 †35,818	*29,783 †10,283	107,348	..	..	...	....	82,786	....	$28,535	..	..	..
Totals for municipal relief.....	86,857	111,108	80,367	7,512	118,185	..	..	47,706	41,450	43,530	$624,482	25.0	$1.75	$89,933	$202,073	$120,016	$14,775	$28,535	2,015	1,828	548
COMMISSIONERS OF EMIGRATION.																					
Total assistance afforded.	..	..	..	..	20,715	..	..	..	....	....	$206,064	..	..	....	...	....	....	....	..	..	..
Refuge and Hospital, Ward's Isl..	764	8,965	8,661	1,068	4,729	2848	1881	557	422	4,307	58,913	22.4	$1.57	$26,065	$2,782	$18,378	$18,192	$5,825	226	204	264

If to the municipal relief, $624,482, we add that afforded by the Commissioners of Emigration, $206,064, and that furnished by the voluntary charitable associations of the city, which by careful investigation has been demonstrated to amount to $586.119 for the year 1860, we have a total aggregate of $1,416,665 for the public relief of the poor in the city of New York. The amount bestowed in private charity cannot, of course, be estimated.

* Adults. † Children. A large portion of these are children of foreigners, though themselves born in this country.

Chicago has a marine hospital.

St. Louis has four, one for quarantine, one marine, and two general; one of them under the care of the Sisters of Charity.

New Orleans and Mobile are more amply supplied with hospitals in proportion to their population than most of the cities of the Union, the former having four, one of them a United States naval hospital. The Charity Hospital at New Orleans is the largest in this country, receiving from 13,000 to 20,000 patients a year, and having about 1000 beds. Mobile has three, one marine and two general. All are large, and admirably managed.

Most of the cities of twenty thousand inhabitants and over have one, and some of them more than one hospital, though ordinarily their wards are by no means full.

CHAPTER V.

DISPENSARIES.

Another of the methods of relief and ministration to the wants of the poor has been the establishment of Dispensaries. The idea of such institutions originated, we suppose, in Rome, but was not adopted in other cities till the latter part of the last century. In London, a dispensary was established in 1696. There was none in Paris till 1803. At first, it was simply an apothecary's shop, where medicines were dispensed gratuitously to the poor. After a time, a physician attended at a certain hour to prescribe for patients who might require treatment; then, as the number of patients increased, they were classified, and other physicians volunteered to take charge of the different classes, and a house physician and apothecary were appointed to take the general oversight, keep the records, prepare medicines, arrange the patients for the classes, etc.; then, as it was found that many of the sick poor were unable to come to the dispensary to receive treatment, and some of those who came once or twice were unable to continue to attend, and so suffered for the want of medical care, the plan was adopted of dividing the region appertaining to the dispensary into districts, to each of which a district physician was appointed who visited the sick at their dwellings. Vaccination, from its first introduction, was largely practised at the dispensaries; and nearly all of them now give attention to it, keeping a supply of the vaccine virus constantly on hand, and vaccinating all who apply, and at some seasons of the year calling the attention of the people to the necessity of it. To some of the dispensaries a lying-in department is added.

The first dispensary in this country was the Philadelphia, founded in 1786.

The New York Dispensary, the first in that city, was founded in 1791, and the Boston Dispensary in 1796.

There are now in New York five public dispensaries, covering the whole city below Sixtieth street west of Fifth avenue, and below Fortieth street east of that avenue. The territory of the city below these streets is parcelled out between these dispensaries, in such a way as to give to each a district not excessive either in size or population. Each dispensary employs two or more district physicians, to visit the sick poor at their homes when they are unable to come to the dispensary. The patients who come to the dispensary between the hours of 10 A. M. and 4 P. M., are divided into eight or nine classes, each of which has its room, where the physician in attendance prescribes for the patients belonging to his class. The medicines prescribed are furnished by the institution, and though plainly put up, great care is taken to have them uniformly of the best quality.

Besides these, there are three homœopathic dispensaries in the city, and four other institutions of a dispensary character, intended for special diseases, two of them for diseases of the eye, and two for women and children.

Philadelphia has three dispensaries, two of them with a lying-in department. It has also several institutions which dispense medicine to the poor, and prescribe for them in particular forms of disease, in connection with the hospital or asylum accommodations.

Boston has one central dispensary, which is largely endowed, although its funds are not yet available. This dispensary has two consulting and eight attending physicians, two consulting and four attending surgeons, a medical superintendent and apothecary, and eight district physicians, who divide between them the city territory and visit all the sick poor who apply, and who are unable to attend at the dispensary. The Massachusetts General Hospital also affords medical and surgical relief to out-patients, to a very considerable extent.

LEADING STATISTICS OF THE FIVE NEW YORK DISPENSARIES AND THE BOSTON DISPENSARY FOR THE YEAR ENDING JANUARY 1, 1860.

Name of Dispensary, and date of incorporation.	Sexes and ages of patients.				Grand total of each dispensary.	Patients where treated.		Vaccination.			Results.			Prescriptions, their number, average, and cost.			Financial.			Nativity of patients.	
	Males.	Females.	Adults.	Children under fifteen years of age.		At the Dispensary.	At their dwellings.	Number of primary vaccinations.	Number of revaccinations.	Whole number vaccinated.	Number sent to hospital.	Number of deaths.	Number discharged cured or relieved.	Whole number of prescriptions.	Average No. to each patient.	Average cost of each prescription.	Total expenditure per year.	Average cost of service to each patient.	Average cost of medicine to each patient.	Of American birth.	Of foreign birth.
New York, A. D. 1791..	18,317	25,222	25,525	18,014	43,539	37,140	6,399	1,597	70	1,667	5,428	272	37,839	102,591	2.45	cts. 02.78	$5,706 20	13.1 cts.	6.6 cts.	19,358	24,181
Northern, " 1827..	7,653	11,883	11,129	8,407	19,536	15,033	4,503	1,289	109	1,398	143	95	19,298	30,840	1.7	" 06.22	3,833 02	19.62 "	9.81 "	9,088	10,448
Eastern, " 1832..	12,920	17,132	14,948	15,104	30,052	23,758	6,294	5,116	2,051	7,167	918	157	28,977	55,658	2.28	" 03.9	4,421 16	14.7 "	7.4 "	15,250	14,802
Demilt, " 1851..	11,229	15,387	15,479	11,137	26,616	18,550	8,066	1,772	19	1,791	381	313	25,922	44,458	1.79	" 04.9	4,591 36	17.25 "	8.62 "	11,983	14,633
North-western, " 1852..	6,586	8,089	8,113	6,562	14,675	12,125	2,550	686	8	694	172	88	14,415	28,776	2.0	" 04.95	2,910 95	19.8 "	9.9 "	6,388	8,287
Totals....	56,705	77,713	75,194	59,224	134,418	106,606	27,812	10,460	2,207	12,667	7,042	925	126,451	262,683	2.15	" 04.55	$21,462 96	15.96 "	7.98 "	62,067	72,351
Boston Dispensary, A.D. 1796	Ad'lts 2,805	Ad'lts 5,882	8,687	5,649	14,336	7,094	7,242	..	..	..	218	283	6,764	34,685	2.5	" 05.	$3,888 08	0.27 "	12.5 "	..	..

We subjoin the following general statistics of the New York Dispensaries. Owing to the loss of its early records, those of the Boston Dispensary cannot be ascertained:—

Average number of years in which medical charity has been dispensed to the sick poor of New York by the dispensaries..........	29
Whole number of persons vaccinated in all the dispensaries since 1804..........	218,991
Whole number of persons who have received medicine, and medical, surgical, and vaccine service gratuitously since 1791..........	2,069,804
Aggregate amount of expenditures of the several dispensaries since 1791..........	$361,735 39
General average cost of medicine, and medical, surgical, and vaccine service to each dispensary patient since 1791..........	17.47 cents.
Average number of patients treated annually for the average twenty-nine years that the dispensaries have been organized and in operation.........	71,372
The New York Dispensary alone, in the sixty-nine years of its existence, has prescribed for..........	1,046,404

In Brooklyn there are three city dispensaries, not as yet systematized like those of New York, and having, up to the present time, no district physicians. There is also an eye and ear infirmary, at which persons suffering with diseases of these organs are prescribed for gratuitously, and a homœopathic dispensary.

Baltimore has two dispensaries or infirmaries; Cincinnati, Chicago, St. Louis, New Orleans, and Charleston, as well as some other smaller cities, one or more.

Besides these institutions, there are in connection with nearly all the medical schools in the large cities, *cliniques*, at which, at a given hour, once, twice, or thrice a week, patients are prescribed for gratuitously by the professors, in order to familiarize the students with the practical diagnosis of disease. Some of the medical schools have hospitals, with quite a number of free beds, for the same purpose.

We insert a table showing the annual amount of medical service rendered by the dispensaries of New York and Boston, and the small cost at which so large an amount of good is accomplished.

CHAPTER VI.

NURSERIES AND FOUNDLING HOSPITALS.

There has been a strong prejudice in this country against foundling hospitals, mainly undoubtedly the result of the mismanagement which formerly prevailed, and, to some extent, still prevails in some of the great European hospitals for foundlings. They have been stigmatized as offering a premium for licentiousness, and destroying the barriers against illegitimate births. On the other hand, it has been urged in their favor, that they tend to prevent infanticide and those crimes so prevalent in communities where no such institutions exist. After long deliberation, the public authorities of New York have decided in favor of a foundling hospital, which will be the first in this country.

Provision has been made for many years past for the care of the young children of criminals, and of paupers deceased, or incapable of taking care of them, in all our large cities. The usual method, if they are infants, is to put them out to nurse until they are three or four years of age, the city paying a dollar a week or thereabout to the nurse. In many cases, those who have thus taken charge of them were utterly unfit for their duty, and painful instances of cruelty and maltreatment of these unfortunate children have come to light. Closer scrutiny is now exercised in regard to the character and position of those who apply for employment as nurses, and the abuses are measurably checked. If the children survive the nursing period, they are placed together in a public nursery or farm school, and there receive a good English education, and are then apprenticed or adopted in families in the country, or, in some instances, sent to sea.

The neglect and evil results which in many instances followed from the course pursued in these institutions, as well as the conviction that the infant children of virtuous parents, who were deprived of their parents' care by death or extreme poverty, were entitled to a tenderer watchfulness and supervision, has led in most of the large cities to the establishment of nurseries, infants' homes, and other institutions of a similar character, for children of this class. The "homes for the friendless," a class of institutions we have elsewhere described, have received very considerable numbers of these children, and after carefully rearing them, have provided them with good homes, where they have been adopted by those who received them. There are also in New York, Boston, and Philadelphia, hospitals for infants of legitimate birth. An institution much needed in all our large cities, and which has just been established in Boston, is the *crèche*, now very popular in most of the European cities. It is a large building, with fine, airy, well-ventilated rooms, fitted up with cradles, toys, and every thing necessary for the care and amusement of infants and young children, and provided with a sufficient number of amiable and intelligent nurses, where the poor mother, whose daily toil sustains her little flock, may leave them for the day, certain that they will be well cared for, and receive wholesome food and pure air. For this care she pays a trifling sum, graduated to her ability.

CHAPTER VII.

HOMES AND ASYLUMS FOR THE AGED AND INFIRM.

From the care of children who have been bereft of a parent's tender love, to the provision for those whom the burden of years and infirmity has reduced to an almost childish feebleness, seems a natural transition. For this class, and especially for women who in the time of old age find themselves without those who can minister to their wants, and to whom the almshouse seems almost as terrible as the grave, the large-hearted charity of the philanthropic in most of our cities, has made liberal provision. New York has five institutions for this class, besides several relief societies intended mainly for them; Boston three or four, one of them largely endowed; Philadelphia four; Brooklyn two, one the Graham Home, nobly endowed by one of her citizens; Baltimore two; and the other larger cities one or two each. In Boston and Philadelphia there are also institutions for aged clergymen, merchants, and others. New York has an asylum for infirm seamen, the Sailor's Snug Harbor, located on Staten Island, and founded and amply endowed by the munificence of a retired sea captain, Robert R. Randall.

Provision has been made in most of the Northern cities for children, the aged and infirm, and the sick of the African race, in separate institutions, but with accommodations fully equal to those provided for whites.

INDEX

ACCORDION, the, 433.
Adriatic, the (steamer), picture of, 237.
Aged and infirm, houses and asylums for the, 454.
Agricultural books, 98.
Agricultural exhibitions, the first, 25; benefits of, 26; fruit culture increased by, 84.
Agricultural implements in old times, 20, 24, 26; improvements in, 30–37; manufacture of in Illinois, 76.
Agricultural literature, progress of, 97.
Agricultural newspaper, the first, 25.
Agricultural periodicals, 97–8.
"Agricultural Repository," 97.
Agricultural societies recommended by Washington, 24; first establishment and increase of, 25; results of, 26; publication of the proceedings of, 99.
Agricultural wealth of California, 68; of the United States, 68.
Agriculture, history of, in the United States, 19; of the Indians, 21; exhaustive system of, 22; primitive condition of, a century ago, 22; efforts for the improvement of, 24; stimulated by foreign demand, 71; by canals and railroads, 72; total value of the products of, 76; scientific discoveries relating to, 99; prospects of, 101; annual value of, 157 (table); use of steam in, 263.
Albany, penitentiary of, 439.
Allen, Horatio, account of his first locomotive trip, 245.
"American Agriculturist," 98.
American bottom, first settlement of the, 74.
"American Farmer," 97.
American Watch Company, 371.
Americus, large ox, 48.
Ambler's mowing machine, 35.
Amoskeag Locomotive Works, 246; illustration of, 247.
Amoskeag steam fire engine, 260.
Andrews, Dr., permutation lock of, 397.
Annealing, process of, 402.
Apples, primitive culture and use of, 81; thirty good native varieties of, 82; at the South, 82.
Apple trees in California, 83.
Apricots in California, 83.
Arkwright's cotton-spinning invention, 108, 275.
Astor, John Jacob, 139; the fur trade of, 344.
Atlanta and West Point railroad, 205.
Atlantic, first crossing of the, by steam, 180.
Atlantic slope, area of the, 101.
Auburn prison, silk manufacture in, 395; trial of solitary confinement in, 436.
Axes, manufacture of, 341.
Ayrshire cows, good milkers, 49; importations of, 50.
Ayrshire bull, portrait of, 45.

Bakewell, improvement in the breeding of cattle by, 39.
Baldwin, M. W., engine builder, 246.
Baldwin's steam car for cities, 251.
Ballast, use of, in railroad construction, 195.
Baltimore, the oyster trade of, 385; hospitals of, 449.
Baltimore and Ohio railroad, 192; account of, 203, 245; premium for coal-burning engine offered by, 246.
Baltimore and Susquehanna railroad, anecdote of the first engine on, 251–2.
Baltimore clippers, 162.
Bank of England, 145, 151.
Bankrupt law, operation of the, 152.
Banks, multiplication of, 143, 151; failure of, 151.
Bark, oak and hemlock, 319.
Barley, production and geographical distribution of, 78.
Batchelder, John, sewing-machine patent of, 414.
Bay State Mills, 308.
Beads, glass, manufacture of, 405.
Beam engines, 252.
Beans, production and exports of, 79.
Bean's sewing-machine patent, 414.
Beaver cloth, 305.
Bedford hog, the, 63.
Beech-nut hog, picture of, 61.
Bee culture, 90.
Beeswax and honey, production of, 90.
Belting, rubber, manufacture of, 411.
Berkshire hog, picture of, 62.
Berlin decree, the, 139–40.
Bernard, General, 177.
Beverly, Mass., first cotton mill at, 277, 280.
Bigelow's power loom for carpets, 306.
Black Hawk horses, origin and qualities of, 54.
Black River canal, 185.
Blackstone canal, 190.
Blanchard, Thomas, hat-felting process of, 349.
Bleaching, improvements in, 276; of cotton goods, 288; of paper stock, 297.
Blodgett & Lerow, sewing machine of, 414.
Blowers for steamboats, introduced by R. L. Stevens, 241.
Blue grass, Kentucky, 80.
Bock, Henry, tambouring machine of, 414.
Bohemia, manufacture of glass in, 399.
Boilers, water gauges for, 229; pumps connected with, 233; act for the inspection of, 242; stationary, bad management of, 254; inspection law required for, 255, 268.
Bones for manure, 100.
Bony fish, for manure, the taking of, 385.
Book farming, prejudice against, 25.
Books, agricultural, 98.
Boots and shoes, importations and manufacture of, 316; manufacture of, in Massachusetts, &c., 324; by machinery, 325; qualities and prices of, 325.
Boston, export of apples, 82; lumber business of, 97; railroad enterprise of, 192, 197; clothing trade of, 310; shoe trade of, 324; ice trade of, 387, 388; glassworks in, 399; Prison Discipline Society of, 439; hospitals of, 449; dispensaries of, 452, 453 (table).
Boston and Maine railroad, 197.
Boston and Providence railroad, 197.
Boston Locomotive Works, 246.
Bottles, manufacture of, 405.
Boydell's engines, 264.
Bradshaw, John, sewing-machine patent of, 414.
Bramah lock, the, 397.
Brazil, export of flour to, 107; cotton imported from, 117.
Breadstuffs, fluctuations in European demand for, 71.
Breaking machine, the, 302.
Breech-loading weapons, 332.
Breed, definition of, 41.
Breeding, two modes of, 40.
Bricks, early importation of, 356; material of, 357; manufacture of, 358; machines for, 358.
Broadcloth, the fulling of, 302–3.
Brooks Brothers, clothing establishment of, 310.
Brooklyn, boiler explosion in, 254; hospitals of, 449; dispensaries of, 454.
Brooklyn Ship Timber Bending Company, 267.

Brooklyn Water Works, pumping engine at, 258.
Brown, Noah, 240.
Brown stone houses, 359.
Brussels carpet, 307.
Buckskin gloves, 326, 327.
Buckwheat, production and geographical distribution of, 78; land cleansed by its cultivation, 78.
Buffalo robes, 345.
Buildings and building material. 353.
Bunker, Elias, sloop of, 178; captain of the Fulton, 179.
Burr & Co., hat body manufactory of, 349.
Butler, Charles, 208.
Butter, great production of, from 73 cows, 39; from an Ayrshire cow, 50; production of, per cow, in different States, 51.
Byfield breed of hogs, 64.

Calico printing, 276; improvements in, 277; processes of, 288; statistics of, 290.
California, domestic animals in, 68; agricultural wealth of, 68; agricultural development of, 77; fruit and wine of, 83; vintage and silk culture of, 102; gold discovered in, 154; capital and goods sent to, 155; routes to, 224.
Caloric engine, the, 270–71.
Camden and Amboy railroad, 202.
Canada, operation of the treaty with, 156.
Canadian ponies, origin of, 53.
Canal up the Potomac projected by Washington, 71.
Canals, American, 173, 184; mode of constructing and operating, 185–6; principal, table of, 190; of New York, financial results of, 190; for coal transportation (table), 190; sensation produced by, 191.
Candy and confectionery, 392.
Cane, sugar. See Sugar cane.
Cane carrier, the, description of, 128.
Cannon, improvements in, 334; metal for, 335; casting, 335; proving, 336.
Caoutchouc. See India-rubber.
Carding, hand, picture of, 299.
Carding machine, improvements in, 276; operation of, 287; introduction of, 301.
Card-making machine, 276, 301.
Cards, wool, 300; machine for making, 301.
Carhart's melodeons, 434.
Carpenter & Plass's pumping engine, 263.
Carpets, use and manufacture of, in America, 306; kinds of, 306, 307; quantity of, made in New York and Massachusetts, 308.
Carriages, manufacture of, 360; materials of, 361; illustrations of, 363–6; process of making, 367; statistics of, 368.
Carrying trade in colonial times, 135; during the French wars, 138; English decree against the, 139; cessation of, 140.
Car-springs, rubber, 411.
Cartwright, power loom of, 108, 276.
Cary's boiler, 244, 259.
Cast iron, best metal for guns, 335.
Cattle two centuries ago, 20; cruel treatment of, 20, 23; in Virginia, the first in the United States, 37; laws for the preservation of, 37; in the other colonies, 37, 38; Danish, in New Hampshire, 38; native sources of, 38; mode of keeping in Virginia, 38; increase in the average weight of, 40; two modes of improvement of, 40; native, not a race or breed, 41; selection of, for breeding, 42; progress in the qualities of, 47; statistics of, 47, 51; importations of improved breeds of, 47–50.
Cavalry, diminished importance of, 328.
Cayuga and Seneca Lake canal, 184.
Census of 1860, tables, 169–70.
Census statistics, imperfection of, 73.
Central railroad of New York, 200; of New Jersey, 202; of Pennsylvania, 203; of Virginia, 204; of Georgia, 205; of Illinois, 205; of Michigan, 208.
Champlain or Northern canal, 184.
Charcoal roads, 176.
Charleston, railroad connections of, 205.
Cheese, great production of, from one farm, 39; production of, per cow, in different States, 51; whole amount of, 51.
Chemung canal, 185.
Chenango canal, 185.
Chicago, rise and growth of, 75; preëminent as a grain depot, 75; statistics of the grain trade of, 76; preëminent as a lumber market, 96; receipts of lumber at, 96; effect of railroads upon the grain trade of, 220 (table); general railroad business of, 221 (table); steam elevators of, 264.
Chickering, Jonas, manufacture and improvement of the piano by, 433.
Chickering's piano-forte manufactory, picture of, 352.
Childers, trotting horse, portrait of, 56.
China, American cotton goods sent to, 107; former course of trade with, 146; English war with, 164; American treaty with, 164; land transportation in, 172; American steamers in, 231.
Chincha islands, guano obtained from, 100.
Chouteau, Pierre & Co., fur traders, 345.
Cigars, manufacture of, in Hamburg, 87.
Cincinnati, pork-packing in, 65; early steam transportation of, 181; railroad connections of, 205; steam fire engines at, 259; hospitals of, 449.
Cities, street railroads in, 223; plans of steam cars for, 251; prisons in. 439.
Civil engineering, American triumphs in, 230.
Clark, G. B., mulberry plantation of, 394.
Clay for brick, 358.
Clay, Henry, importation of Herefords by, 48; compromise tariff of, 147.
Clearing house, exchanges at the, 160.
Clermont, the, Fulton's first steamboat, 179.
Clinton, De Witt, 72, 184.
Clipper ships, 162; in the California trade, 167.
Clocks, early manufacture of, 368; wooden and brass, process of making, 369; exportation of, 370.
Cloth, home-spun, 301.
Clothing trade, the, rise and growth of, 309; management of, 309–10.
Cloth manufacture, wool used for, 302.
Cloth printing, 304.
Cloths and cassimeres, imports of, 312.
Clover and grass seeds, production of, by sections, 79.
Coal discovered in Pennsylvania, 190; quantity of, transported, 219; public works built for, 220.
Coasters, travelling by, 179.
Cod fishery, the, mode of conducting, 378–81; illustration of, 380.
Cœlebs, short-horn bull, 47.
Cole's "American Fruit Book," 84.
Colles, Christ'r, first steam engine in America built by, 227.
Colling, Charles and Robert, breeders of short-horns, 39.
Colonies, the American, restriction of commerce and manufactures in, 133; trade of, with the West Indies, &c., 134; fisheries of, 135; table of exports from, in 1770, 136; the revolution in, 137.
Coloring matters, 203.
Colt, Samuel, invention of the revolver by, 331; the manufactory of, 331.
Comet, the, second western steamboat, 239.
Commerce, foreign, of the United States, history of, 104–5; colonial, restricted by Great Britain, 133–7; with the West Indies, 134; effect of the revolution upon, 137; activity of, after the war of 1812, 143; after the revulsion of 1837, 152; table of, for 70 years, 157; remarkable advance of, 168; of the great lakes, 186–7.
Commercial disasters, table of losses from, 152.
Conant, J. L., sewing-machine patent of, 414.
Conestoga horses, 54.
Conestoga wagon, 184.
Connecticut, the clock business in, 368–70; silk culture and manufacture in, 393.
Conner, James, fire-proof chest made by, 396.
Cooking by steam. Papin's account of, 266–7.
Cooks', Messrs., carriage manufactory, 361; picture of, 366.
Corlies' sewing-machine patent, 414.
Cooper, William, invention of, for enamelling glass, 405.
Corliss and Nightengale's stationary engines, 253, 254.
Corn, Indian, native mode of cultivating, 21; Ojibway legend of the origin of, 68; first cultivation of, by the colonists, 69; early exports of, 69; census statistics of, 70; increased exportation of, 70; table of exports of, 71; late introduction of, into the West, 75; exports of, to Great Britain, 1840–1858, 158.
Corning and Sotham, of Albany, importation of Herefords by, 49.
Cornish engines, 258.
Corn laws, English, repeal of, 153, 157.
Cotswold sheep, picture of, 57.
Cotton, the demand for, 106; the high prices of labor sustained by, 106; the most important article of export, 107; importation of, into England, 108; improvements in the manufacture of, 108; increase in exportations of, 109; prices for different qualities of, 109; increase in American consumption of, 110; raw and manufactured, decline in cost of, 110; first cultivation and exportation of, 111; picture of cleaning, by hand and by the gin, 112; progress of the production of, since the invention of the gin, 113–16; monopoly of the foreign market for, 117; sources of the supply of, 117; qualities of, from different countries, 118; process of cultivating, 120; high prices maintained by, 122; effect of the war upon the production of, 124; effects of, upon American commerce, 141; exports of, 1790–1859, 158; the transportation of, favorable to railroads, 205; effect of railroads upon, 220 (table); raw, divisions of, 286; for paper-making, 293.

Cotton clothing, demand for, 157.
Cotton gin, invention of the, 111, 277; description of the, 111; picture of a, 112; infringements of the patent for, 113; effect of, upon production, 113.
Cotton goods, importation of, 105; sent from the United States to China, 107.
Cotton manufactures, progress of, 274; inventions in, 275–6, 286; table of dates of, 277; in the United States, 277, 280; in 1809, 281; protective duties on, 283; table of, in 1831, 283; returns of, in 1840, 284; table of, in 1860, 285; the processes of, 286–290; exports and imports of, 290; table of the progress of, 290.
Cotton plant of Europe and America, 110.
Cotton States, the, progress of the population of, 116; superiority of the climate and labor of, 119.
Cotton yarn, prices of, 110.
Cows in New England at its settlement, 19; in Virginia, 23; in Virginia, not housed nor milked in winter for fear it would kill them, 38; in Rhode Island in 1750, 39; great prices for, in England, 40; selection of, for breeding, 42; treatment of, in New England, 42; comparative statement of the products of, 51; proportion of, to population, in the States, 51.
Cranberry, culture of the, 84.
Creampots (cows), 47.
Crèche, the, 454.
Credit, system of, 148; evils of, 148.
Creole cane, origin of, 127.
Crocheting machine, Thimonier's, 414.
Crompton's mule spinner, 108, 275–6.
Crooked Lake canal, 185.
"Cultivator," the, 98.
Cumberland national road, the, 174, 177.
Currency, inflation of, 146.
Currier, operations of the, 319.
Curves in railroads, 193–4.
Cushing, Caleb, treaty with China negotiated by, 164.
Cutlery, American manufacture of, 339; grinding and polishing of, 340; statistics of, 342.
Cut-off, steam, the theory of the, 232–3; experiments upon the, 272.

Dahlgren, Captain, improved guns of, 335.
Darker's steam car for cities, 251.
Darlington railroad, 191.
Davis, Phineas, coal-burning engine built by, 203, 246.
Davy, Sir Humphry, 99.
Deer skins as a medium of exchange, 344.
Delano, Jesse, fire-proof chests of, 396.
Delaware and Hudson canal, 185; enlargement of, 186.
Delaware and Raritan canal, 190, 202.
Delaware and Schuylkill Company, 173.
Denison, E. B., on American locks, 398.
Detectors, low-water, 270.
Devonshire cattle, qualities and importations of, 49.
Dewsbury trade, the, 315.
Dismal Swamp canal, 173.
Dispensaries in the United States, 452; in New York and Boston, 453 (table).
Dix, Dorothea L., efforts of, in behalf of the insane, 442.
Dowley, L. A., importation of Herefords by, 49.
Donkey engine, the, 241; use of, 260, 263.
Double Duke, short-horn bull, portrait of, 43.
Downing's "Fruit and Fruit Trees of America," 84.
Drawing frame, the, 287, 302.
Dressing machine, invention of the, 276.
Dummy engine, the, 250.
Dunderberg, the, 338.
Dwellings, number and value of, 354; improved style of, 355.
Dynamometer, the, 176.
Dyeing of cotton goods, 289; of woollens, 301, 303; of leather, 320.
Dye-stuffs for woollens, 304.

Eagle Cotton Mill, Pittsburg, 284.
East Indies, cotton imported from, 117: inferior quality of, 118.
Eggs, consumption of, 90.
Egypt, one of the chief sources of cotton, 117.
Elevators, the, of Chicago, 76.
Electro-gilding, 377.
Electro-plating, 372; illustrations of, 373–6.
Eliot's "Essays on Field Husbandry," 97.
Embargo, the, of 1808, 140; effects of, 142.
Emigration into the United States explained, 106; to the United States from Germany, 146; of planters to the west, 152; from New England to the west, 188; of foreign paupers, 446, Commissioners of, 446.
Engineers, steam, 254, 268; advice to, 270.
England, importation of food into, 71; consumption of tobacco in, 87; sources of the cotton supply of, 117, 275, 277; restrictions of, upon colonial trade, 133, 139; loss of the naval supremacy of, 143; Bank of, 145, 151; warehouse system of, 146; short harvests in, 152; navigation laws of, 161; cotton manufactures in, 275.
Eolodicon, the, 433.
Ericsson's screw propeller, 167, 180, 240; steam fire engine, 259; caloric engine, 270–71; turreted war steamers, 338.
Erie canal, construction of the, 72, 166, 184; effect of the opening of, 180, 181; enlargement of, 186; effect of, on western New York, 186.
Erie railroad, account of the, 200.
Essex, the, 338.
Essex hog, improved, picture of, 62.
Evans, Oliver, 228, 229; "Orukter Amphibolos" of, 235 (picture), 243; on steam wagons, 244.
Eve, J., cotton gin of, 113; rotary engine of, 253.
Everett, Edward, anecdote of, about American ice in India, 389.
Exchanges at the New York clearing house, 160.
Explosions, steam, 242.
Export, three chief articles of, 107.
Exports, table of colonial, 136; of domestic, 141, 158; of American, British, and French, 1800–1865, 168. (See Imports and exports.)

Factory operatives in New England, 282.
Faile, Edward G., Devon cow and bull owned by, 44, 46.
Fairbanks, W. W., engine builder, 246.
Farmers, their primitive condition a century ago, 22; their fear of innovation, 23; influence of the Revolution upon, 24; backward in joining agricultural societies, 25; their improvement by means of, 26.
"Farmers' Cabinet," 98.
Farming in America in early times, 19; by the Indians, 21; by the early settlers of Illinois, 74, 75.
Farm implements, general account of, 26.
Farms, number and value of, in the United States, 102.
Fawkes engine, the, 264.
Felting, the process of, 304–5; of hat bodies, 349.
Finkle & Lyon's sewing machine, illustrations of, 418.
Fire-arms, introduction and improvements of, 328; illustrations of, 329–30.
Fire engines, steam, 244; origin and kinds of, 259.
Fish, eating of, at stated times, decreed by Queen Elizabeth, 162.
Fisher, steam carriages built by, 244.
Fisheries, colonial, of New England, 135; growth of the, 162; account of, 377; European, importance of, 378; American, 378; of the lakes, 385; statistics of the, 386.
Fishing bounties, the, 162, 378.
Fitch, the fur of the, 347.
Fitch, John, picture of the steamboats of, 226; first condensing engine built by, 227; his boats, how propelled, 229; the honor due to, 234; picture of his propeller, 235.
Flat boats on the western rivers, 165, 180, 182, 234 (picture).
Flax and hemp, culture of, 89; statistics of, 90.
Flax-seed, exports of, 89.
Flint glass, 404.
Flock paper, 298.
Flora, short-horn cow, 47.
Florida, sugar-cane cultivated in, 127.
Flour, early exports of, 73; trade of Chicago in, 76; demand for Southern, 107; exports of, 1831–1838, 148; to Great Britain, 1840–1858, 158; and provisions, 1790–1858, 158; effect of the Western railroad upon the trade in, 197; the grinding of, 432.
Floyd gun, the, 337.
Fly frame, the, 287.
Food, importation of, into England, 71.
Forest trees of the United States, 91.
Fortunatus or Holderness, short-horn bull, 48.
Foundling hospitals, 454.
Fourdrinier machine, the, 295.
Foster, Wm., first importer of merino sheep, 59.
Fowls, foreign varieties of, 90–91.
Fox, silver, fur of the, 345.
France, revenue from tobacco in, 85; imports of cotton into, 109; free trade with, 138; effect of the revolution of 1848 in, upon commerce, 154; system of roads in, 174.
Free-trade treaty between France and England, 138.
French, D., steamboat built by, 239.
Fruit, former and present importance of, 81; native varieties of, 82; production of, 82; at the South, 82; increasing exportation of, 83; no danger of a glut of, 83; in California, 83; imports of, from the Mediterranean, 83; census statistics of, 84.
Fruit-raising, works on, 84.
Fruit trees, annual sale of, 82.
Fuel for locomotives, 249; economy in, 250; for stationary engines, 256.
Fulling-mill, the, 302.

Fulton, Robert, first steamboat of, 165, 179, 229, 236 (picture); builds steamboats at Pittsburg, 239; steam battery built by, 241.
Fulton, the, navigation of Long Island Sound by, 179–80.
Fur, hat bodies formed from, 305.
Furs, kinds and comparative value of, 345; table of, 346; preparation of, 347.
Fur trade, history of the, 343.

Gallatin, Albert, on cotton manufactures in 1809, 281.
Gayler, C. J., fire-proof safes of, 396.
"Genesee Farmer," 98.
Genesee Valley canal, 185.
George's Banks, cod fishery of, 381; halibut fishery of, 382.
Georgetown and Pittsburg canal, 188.
Georgia, colonial exports of, 137; railroad system of, 205; silk culture in, 393.
Gibbs, James E. A. See Willcox & Gibbs.
Gilding metals, various modes of, 372.
Girard, Stephen, 139.
Glass, importance and uses of, 398; history of, 399; statistics of, 400; materials of, 400; process of manufacturing, 401; crown, 401; cylinder, 402; window, consumption and imports of, 403; plate, 403; grinding and polishing, 403; silvering, 404; bending, 404, flint, 404; colored, 405; enamelled, 405; soluble, 405, bottle, &c., 405.
Gloucester, Mass., the mackerel business of, 383.
Gloves, skins for, 318; kinds and manufacture of, 326.
Glucose or grape sugar, 130.
Gold, discovery of, in California, 154; effect of, on the price of labor, 107; as an article of export, 157.
Gold's steam-heating apparatus, 265.
Goodale and Marsh's steam excavator, 264.
Goodyear, Charles, invention of vulcanized rubber by, 410.
Government roads, 177.
Governor, the, of steam engines, 233.
Grain, trade in, at Chicago, &c., 76.
Granite for building, 359.
Grapes in California, immense growth of, 83.
Grass and hay crop, importance of the, at the North, 79.
Grasses first cultivated in New England, 20; progress in the cultivation of, 80.
Grass seed, production of, 79.
Gravel roads, 176.
Gray, William, the ships of, 139.
Grazing in Texas, 102.
Great Britain, inadequate home production in, 71; trade with, after the revolution, 138; comparative area of, 157; corn and pork exported to, 158; commercial advantages of, 161; sources of the cotton of, 275, 277; progress of manufactures in, 290.
Great Eastern, the, 241.
Greenough, J. J., first sewing-machine patentee, 414.
Greenville and Columbia railroad, 205.
Greenwood, Miles, 259.
Grice and Long's steam car for cities, 251.
Grover & Baker's sewing machine, invention of, 419; description of, 424; warehouse of, 428.
Guano, introduction and use of, 100.
Gulf region, the, area of, 101; grazing in, 102.
Guns, manufacture of, 334. (See Cannon.)
Gutta percha, manufactures of, 411.

Halibut fishery, the, 382; growth of, 383.
Hall, Adam, truck frame in front of the engine used by, 246.
Hamburg, manufacture of cigars in, 87.
Hamilton, report of, upon manufactures, 141, 280, 300, 316.
Hamlin, Emmons, improved melodeon of, 434.
Handles of cutlery, 341.
Hanks, William, silk produced by, 373.
Hannibal and St. Joseph railroad, 209.
Hanson, Timothy, propagator of timothy grass, 80.
Hargreaves' spinning jenny, 108, 275.
Harrow, improvements in the, 32.
Hat bodies, process of manufacturing, 349.
Hats, woollen, manufacture of, 305–6; early manufacture of, 348; superiority of American, 349; improvements in making, 349.
Hay, importance of, at the North, 79; progress in the production of, 80; statistics of, 80; advantages and disadvantages of, 80; geographical distribution of, 81; improved quality of, 81.
Heating by steam, 265.
"Hell-gate" passage, 179.
Hemp, culture of, 89; at the West, 90.
Herd, discoverer of timothy grass, 80.
Herefords, improved by Tomkins, 40; imported into Kentucky by Henry Clay, 48; characteristics of, 49; other importations of, 49.
Herring fishery, the, mode of conducting, 381.
Herring, Silas C., manufacturer of fire-proof safes, 397.
Hiawatha, legend of, 68.
Hides, sources and statistics of, 317; kinds of, 317–18; preparation of, for tanning, 318, 320, 321; growing cost of, 323.
Hinckley and Drury, locomotive builders, 246.
Hittinger, Cook & Co.'s portable engine, 255; hoisting engine, 256.
Hobbs, A. C., lock-maker, 397, 398.
Hogs, illustrations of, 61, 62; first importations of, 63; first attempts at improving, 64; most profitable at the West, 64; proper mode of breeding, 64; mode of killing and dressing at Cincinnati, 65; packing, 66; products of, 66; statistics of, 66, 67.
Hoisting engines, 256.
Holland, S., on the mode of ascertaining horse-power, 228.
Holly on the caloric engine, 271.
Holly, of Seneca Falls, rotary engine of, 252–3; pump of, 260, 263.
Homes and asylums for the aged and infirm, 454.
Honey, production of, 90.
Hops, culture of, 88; improvements in the management of, 88; inspection and classification of, 89; fluctuations in price of, 89; statistics and geographical distribution of, 89.
Hopper, Isaac T., prison associations organized by, 440.
Horizontal steam engines, 252.
Horrocks, loom patented by, 276.
Horse railroads in cities, 223.
Horse-power of steam engines, how obtained, 228.
Horses, improvement of, in half a century, 52; first importations of, 53; increase in speed of, 53; favorite varieties of, for the road, 54; at the South, 54; statistics of, 54; kinds used by the early colonists at the West, 75.
Horticultural societies, 81.
Horticulture, works on, 84.
Hose, rubber, manufacture of, 411.
Hosiery and fancy knit work, 308.
Hospitals in the United States, 449; in New York, Boston, and Philadelphia, table of, 450.
Hospitals for the insane, 440; convention of superintendents of, 442; cost and accommodations of, 443; table of, 444.
Houses, materials of, 356; building of, and speculation in, 357.
Hovey's "Magazine of Horticulture," 84.
Howard, E., originator of American watch-making, 370.
Howe, Elias, Jr., invention of the sewing machine by, 414; proceedings of, 419; income of, 421; manufactory of, 429.
Howe, John J., pin machines of, 390.
Hudson river, navigation of, 234; steamboats on, past and present, 240.
Hudson river steamboat, picture of, 194.
Hudson's Bay Company, 343.
Humanitarian and corrective institutions, 435.
Hull, Jonathan, 240, 243.
Hussey's reaping machine, 35.

Ice, uses of, 386; the trade in, 387; mode of cutting and storing, 388; wastage of, 389.
Ice-houses, construction of, 388.
Ichaboe, the, and other guano islands, 100.
Illinois, settlement of, by the French, 74; by revolutionary soldiers, 75; rapid agricultural development of, 75; manufacture of agricultural implements in, 76; public improvements of, 189.
Illinois Central railroad, history of, 205; working of, 206; land department of, 207.
Imports and exports, table of, 1790–1807, 140; 1808–1820, 142; after the war of 1812, 143; table of, 1821–1830, 145; 1831–1840, 147; of certain articles, 148; 1841–1850, 153; 1851–1860, 156; for 70 years, 157.
India, cotton imported from, 117; exports and imports of cotton and cotton goods, 158; muslins of, 274; American ice in, 387, 389. (See East Indies.)
Indiana, internal improvements of, 189.
Indian corn. See Corn, Indian.
Indians, agriculture of the, 21; their astonishment at sight of a plough, 22.
India-rubber, source, uses, and manufacture of, 406; illustrations of, 407–8; vulcanized, how made, 410; articles made of, 411; imports and exports of, 412; growth of the manufacture of, 412.
Infants, institutions for the care of, 454.
Innovation, fear of, in farming, 23.
Insane, the, former treatment of, 440; first efforts for the amelioration of, 441; hospitals for, in the United States, 441, 444 (table); improvements in the treatment of, 443.
Insanity, American works on, 442.
Interest, made high by cheap lands, 103.
Ireland, Indian corn introduced into, 153; famine in, 164; prison system of, 438.
Iron, imported, compared with that of Pennsylvania, 105.
Iron-clad war-steamers, 338.

Ironsides, the, 338.
Isherwood, Chief Engineer, steam experiments of, 272.
Italy, importation of rags from, 292.

"Jacketing," 269.
Jackson, Patrick S., 281; Lowell originated by, 282.
Jails, county, 438; defects of, 439.
James, William T., 246.
James I., "Counterblast to Tobacco," 85.
James River Cotton Mill, 284.
James River and Kanawha Company, 190.
James Steam Mills, engines used in, 253.
Jay, treaty concluded by, 139.
J. C. Cary, the, steam fire engine, 244.
Jenks, ring spindle of, 286.
Jenny, Devon cow, portrait of, 44.
Jerome, Chauncy, manufacture of clocks by, 369.
Jerome Manufacturing Company, 370.
Jersey cows, value of, as milkers, 50; diffusion of, 50.
J. G. Storm, the, steam fire engine, 244.
Johnson and Morey, sewing machine of, 414.
Jones, H. C., burglar-proof lock of, 397.
"Journal of Prison Discipline," 440.

Keel boats on the Ohio, 165.
Kentucky, importation of short-horns into, 47; their improvement there, 48; Herefords imported into, by Henry Clay, 48; thorough-bred horses in, 54; blue grass, 80.
"Kettle-bottoms" (vessels), 163.
Kip-skins, definition and sources of, 318.
Knives, manufacture of, 340, 341.
Knowles, John, first sewing machine invented by, 413.

Labor, high wages of, 103; at the South, cheapness of, 119; comparison of free and slave, 120.
Laclede, St. Louis founded by, 343.
Lake cities, 166.
Lake region, area of the, 101
Lakes, the great, steamers and tonnage on, 166; ship-building on, 167; navigation of, 186; tonnage on, 187; first steam-boat on, 239; fisheries of, 385.
Lamb-skins, uses of, 318; treatment of, 320.
Lancaster gun, the, 334.
Land, how cleared by the Indians, 21; exhaustive cropping of the, 22; effect of the cheapness of, upon wages and interest, 103; speculation in, 147–8, 187; public sales and grants of, 157, 207.
Land grants to railroads, 207.
Lard, preparation and disposition of, 66; exports of, to Great Britain, 1840–1858, 158.
Lardner, remarks of, on England's self-superiority, 234; on the speed of locomotives, 249.
Lard oil, manufacture and uses of, 67.
Latta's steam car for cities, 251; steam fire engines, 259.
Leather, 316; tables of manufactures of, 316, 326; kinds of, 318; treatment of, after tanning, 319.
Leather splitting machines, 323.
Lee & Larned's steam fire engines, 244, 259.
Leeghwater engine compared with that of Brooklyn Water Works, 258.
Lenses, manufacture of, 405.
Leopold and Trevithick, inventors of the high-pressure engine, 229.
Libraries, township and district, 99.
Liebig on manuring, 100.
Lillie's safes, 397.
Lime, building, qualities and sources of, 358.
Liverpool and Manchester railway, 192.
Live stock, number and value of, in 1850, 1860, and 1866, 102. (See Cattle Stock.)
Livingston, Chancellor, introducer of the grass-fed hog, 64; monopoly of the Lower Mississippi trade claimed by, 181; opposed railroads, 197; associated with Fulton, 239.
Loaf sugar, how made, 392.
Locks, burglar-proof, 397–8.
Locks, canal, 185; inclined planes substituted for, 186.
Locomotive, the first, picture of, 194; coal-burning, invention of, 203; the first successful American, 205; premium for, 246.
Locomotive engines, principles of, 196; history of, 243; experiments with, 244; the first in the United States, 245; manufactures and exportation of, 246; difference between English and American, 249; cost, proper construction, and speed of, 249; running expenses of, 250.
Logging operations in Maine, 92–6; at Green Bay, 96.
Long and Norris, locomotive builders, 246.
Long Dock, the, at Jersey City, 202.
Long shawls for men's use, 308.
Looms, hand and power, picture of, 278. (See Power loom.)
Loper propeller, the, 167.
Louisiana, sugar cane cultivated in, 127.
Lowell, Mass., manufactories of, steam used in, 268; origin of, 282; factory system of, 285.
Lowell and Jackson, power loom of, 281; cotton mill established by, 282.
Lowell locomotive shop, 246.
Lumber, the trade in, 188; for building, sources and supply of, 356, 357.
Lumber business, the, 91; in Maine, 92; at Green Bay, 96; statistics of, 96.
Lunatics. See Insane.
Lynn, shoe manufacture of, 324.

Macadam roads, 176.
Machinery, benefits of, 269.
Machines, exportation of, prohibited by England, 281.
Mackerel fishery, the, mode of conducting, 383.
McLean Asylum, the, 441, 449.
Magic lock, the, 398.
Mail service of the United States, 174; contracts, 177.
Maine, account of lumbering in, 92–6; prison system of, 436.
Malthus, theory of, disproved, 36.
Manchester Company, the, cotton fabrics made by, 284.
Manning, William, patentee of the first successful mowing-machine, 135.
Mansfield, Conn., silk culture in, 393.
Manufactures, comparatively small exports of, 107; Northern, at the South, 122–3; colonial, home restriction of, 133; rise of, 144; in New England, 146; progress of, 1820–1830, 147; competition of home and foreign, 154; annual value of, 157; exports of, 1807–1859, 158; increase of, 159; use of steam in, 268; systematizing of, 361.
Manure, early neglect of, 23; artificial, 100; the taking of bony fish for, 385.
Maple sugar and molasses, production of, 130.
Marble for building, 359.
Marietta, Ohio, brig built at, 165.
Marten, stone, fur of the, 347.
Maryland, cotton mills in, 285.
Mason, Captain John, Danish cattle imported by, 37.
Mason, William, locomotive builder, 246.
Mason & Hamlin's organ harmonium, &c., 434.
Massachusetts, Agricultural Society of, 1792, 25; introduction of cattle into, 37; introduction of horses into, 53; of sheep, 59; wool-growing unprofitable in, 60; production of fruit in, 82; law for the inspection of hops in, 89; railroad system of, 196; cotton manufacture in, 284; table of woollen manufactures of, 312; boot and shoe manufacture of, 324; mackerel fishery of, 383; the ice business of, 387; silk bounty of, 394; prison system of, 438; General Hospital of, 449.
Matanzas, the, propeller, 240.
Mauch Chunk railroad, 192.
Maumee river, fisheries of the, 385.
Maysville road veto, 177.
McCormick's reapers, 35, 36.
Melodeon, the, 433.
Memphis and Charleston railroad, 208.
Mercantile agency, statistics of the, 159.
Merino sheep, first exhibition of, 25; importations and increase of, 59.
Merrimac and Monitor, encounter of the, 338.
Merryman, John, of Baltimore, his herd of Herefords, 49.
Mexican war, the, 164.
Mexico, ancient use of cotton in, 274.
Miami canal, 188.
Michigan, railroads of, 208.
Michigan, lake, first steamer on, 166.
Michigan, U. S. steamer, experiments upon, 272.
Middlesex canal, 173.
Milk, yield of, by an Ayrshire cow, 50; value of Jerseys for, 50.
Miller, E. L., builder of the first successful American locomotive, 205.
Mills, flour and grist, 431; statistics and operation of, 431–2.
Minié rifle, the, 328.
Mink fur, 347.
Minnesota, railroad system of, 207.
Mississippi, the, flat boats and steamers on, 181–3; navigation of, 234.
Mississippi railroad, the, 208.
Mississippi valley, &c., area of, 102.
Missouri, railroads of, 209.
Mobile, hospitals of, 452.
Mobile and Ohio railroad, 207.
Mohawk and Hudson railroad, 197, 245.
Mohawk Valley railroad, picture of the first locomotive on, 194.
Molasses, how drained from sugar, 128; maple, 130; use of, 391.
Monitors, the, 338.
Moody, Paul, 282; inventions of, 286.

Mordecai, Major, experiments of, on velocity of shot, 337.
Morgan horses, origin and character of, 54.
Morocco leather, 318; tanning of, 320.
Morris and Essex canal, 190.
Morris, Gouverneur, the Erie canal projected by, 173; report of, upon connecting the lakes and the Hudson, 184.
Morrison's steam crane, 265.
Morus multicaulis speculation, the, '90, 394.
Mould-board, the, improvements in, 30, 31; Jefferson's treatise on, 31.
Mowatt, John E., towboat business established by, 241, 243.
Mower, Excelsior, picture of, 33.
Mowing machines, 35; utility and economy of, 36.
Mulberry, culture of and speculation in the, 393–4.
Mule spinner, the, 275; picture of, 279.
Mummy cloths, material of, 275; used to make paper, 293.
Mungo, manufacture and uses of, 315.
Muscovado sugar, 128.
Musical instruments, manufacture of, 433.
Mutton raising profitable at the East, 60.

Nap, the, of cloth, how formed, 303.
Narcotics, kinds used in different countries, 85.
Nasmyth, J., on Colt's revolver factory, 331.
Native cattle, not a race or breed, 41; improvement of, 42; at the West, 47.
Naval gunnery, changes in, 337, 338.
Naval power of the United States, 143.
Navigation, equality in, obtained by the United States, 171–2; internal, in early times, 178.
Navigation act, the, 145.
Negroes, lucrative employments of, 115; condition of, at the South, 119–21.
Nelson, short-horn bull, 48.
Newark, carriage-making at, 362.
Newbold, Charles, first patentee of a cast-iron plough, 31.
Newell's burglar-proof locks, 397.
New England, early farming in, 19; by the Indians, 21; the cattle in, 19, 20; introduction of cattle into, 37; decline of sheep-raising in, 59, 60; why wheat is not a prominent crop in, 73; rye profitable in, 78; fisheries and colonial trade of, 135; emigration from, to the West, 188; railroads in, 196–7; locomotive shops in, 246; cotton manufactures in, 281; factory operatives in, 282; fisheries of, 378.
"New England Farmer," 98.
New Hampshire, importations of Danish cattle into, 37, 38.
New Haven, the oyster business of, 385.
New Haven Clock Company, 370.
New Jersey once preëminent in wheat raising, 73; prison system of, 436.
New Jersey Central railroad, 202.
New Orleans, hospitals of, 452.
New Orleans, Jackson and Great Northern railroad, 208.
Newspapers, quantity of paper required for, 298.
New York, Agricultural Society of, 1791, 25; introduction of cattle into, 37; of horses, 53; of sheep, 59; four-fifths of the taxes of, paid by agriculture, 77; road system of, 175; canals of, 184; railroads of, 197; table of woollen manufactures of, 312; tanneries in, 317; leather manufactures of, 326; number and value of dwellings in, 354; amount of building materials used in, 360; carriage-making in, 362; prison system of, 436.
New York city, great fire of 1835 in, 148; shipping at, 1850–1865, 168; omnibuses and horse railroads in, 223; clothing trade of, 309; leather trade of, 317; fur trade of, 346; the hat business in, 349; Prison Association of, 439–40; relief of the poor in, 448; hospitals of, 449, 450 (table); pauperism in, 451 (table); dispensaries of, 452, 453 (table); other institutions of, 454–5.
New York Central railroad, 200.
"New York Farmer," 98.
"New York Herald," engines used by, 269.
Norris locomotive engine works, 246.
Norris, Lee, India-rubber invention of, 409.
North and South, no competition between, 121.
North Carolina, colonial exports of, 136.
North River boats, 180.
North River of Clermont (steamboat), picture of the, 236.
Northwest Fur Company, 343.
Nurseries and foundling hospitals, 454.
Nurseries, fruit, in the United States, 82.

Oats, production and geographical distribution of, 78.
Ogeechee canal, 190.
Ohio, increase in the value of stock in, 50; canal system of, 188.
Ohio Company for Importing English Cattle, 48.
Ohio river, navigation of, 165; drainage of, 166; the first steamboat on, 239.
Omnibuses in New York, 223; introduction and increase of, 360.
Oneida canal, 185.
Opium war, the, in China, 163–4.
Optical instruments, glass for, 404.
Orange and Alexandria railroad, 204.
Orchard grass, 80.
Orchards, planting of, 81.
Orleans, the, first western steamboat, 239.
Oscillating steam engines, 252.
Orukter Amphibolos, the, picture of, 235; account of, 248.
Oswego canal, 184.
Otter, sea, the fur of the, 345.
Oxen, New England working, superiority of, 42.
Oyster trade, the, 384.
Oysters, planting and breeding of, 384.

Pacific Fur Company, 344.
Pacific railroad, demand for the, 224; acts for and progress of the, 225; of Missouri, 209.
Pacific slope, area of the, 101; agricultural production of the, 102.
Paddle wheel, the, 240.
Panama railroad, 224.
Panic, the, of 1837, 151.
Paper, importance and first manufacture of, 291; materials for, 292–3; machinery for, 295; sizes of, 296; process of making, 296; hand-made, 297; census statistics of, 298.
Paper-hangings, manufacture of, 298.
Paper-soled shoes, 326.
Papin, Denis, his account of cooking by steam, 266–7; of the safety-valve, 267.
Parkersburg branch railroad, 204.
Paterson, locomotive works of, 246.
Patersons, the, of Baltimore, 139, 140.
Patterson, Mr., of Baltimore, breeder of Devons, 49.
Patton stock of cattle, 47.
Paul's patent for carding cotton, 108.
Pauperism, treatment of, 445; increase of, from immigration, 446; in New York, table of, 451.
Peach trees in California, 83.
Peaches, perfection of, at the South, 82.
Pear orchards in Mississippi and Georgia, 82; in Massachusetts, 83.
Pear trees, profit of, 83; in California, 83.
Pease and beans, production and exports of, 79.
Peel, Robert, calico printing by, 276.
Peltry, 347. (See Furs.)
Penitentiaries, city, 439.
Penknives, blades of, 340.
Penn Cotton Mill, Pittsburg, 284.
Pennsylvania, railroads and canals of, 188–9; line of improvements of, 202; coal transportation of, 219–20; cotton mills in, 284; silk production of, 393; glass manufacture of, 400; prison system of, 435; insane hospitals of, 441, 442 (note).
Pennsylvania railroad, 203; curves and high grade of, 230.
Penobscot, logging boom on the, 94.
Perkins, Jacob, 277, 304.
Permutation locks, 397.
Perry, the fleet of, 166.
Petersham cloths, 306.
Petersham Morgan, horse, portrait of, 55.
Philadelphia, locomotive works of, 246; benefit of the stationary engine to, 271; boot and shoe manufacture of, 324; dwellings in, 355; carriage-making in, 362; silk manufacture in, 395; Prison Society of, 439–40; hospitals of, 441, 449; dispensaries of, 452.
Piano, the, American manufactures of and improvements in, 433.
Pickering, Col. Timothy, breeder of the Woburn hog, 64.
Pierce, of Troy, air-tube patent of, 256.
Pinel, Philip, reform of the treatment of lunatics by, 441.
Pine lumber, classification of, 94.
Pine woods hog, picture of, 61.
Pins, manufacture of, 389; American improvements in, 390.
Pistols, revolving, 331; breech-loading, 333.
Pittsburg, glass manufacture of, 399.
Pittsburg, Fort Wayne, and Chicago railroad, 208.
Plank roads, 176.
Plaster of Paris, use of, for safes, 396.
Plating, processes of, 372.
Plough, astonishment of the Indians at first sight of a, 22.
"Plough, Loom, and Anvil," 98.
Ploughs, early scarcity and inefficiency of, 27; description of various kinds, 27–30; immense saving from the improvement of, 30; cast-iron, invention and manufacture of, 31; patents for, 31; steam, 263–4.
Plum trees in California, 83.
Plush, silk, for hats, 350.
Pomological Society, American, 82.
Poor, relief of the, systems of, 445; comparative statistics of, 447 (table); associations for, 446, 448.

Population, excess of, in Europe, over production, 71; progress of, in the United States, 132, 144.
Pork, packing of, 66; classification and disposition of, 66; exports of, to Great Britain, 1840–1858, 158.
Portable steam engines, 255; for farmers, 263, 264.
Postage, reduction of, 179.
Post-office Department, early operations of the, 174.
Potato crops in Great Britain, failure of, 153.
Potatoes, production and exports of, 79.
Poughkeepsie, pin manufactory at, 390.
Poultry and eggs, 90.
Poussin, Capt., 177.
Powell, of Philadelphia, importer of short-horns, 48.
Power loom, invention of the, 276; picture of, 278; Lowell's, 281; for woollens, 302; for carpets, 306.
"Prairie whales," 163.
Preble, Commodore, 165.
Preserves, preparation of, 392.
Prince & Co.'s melodeons, 434.
Prince Rupert's drops, 4 2.
Printing of calico, 276; of cloth, 304; of carpets, 307, 808.
Print works, cotton, 288; statistics of, 290.
Prison discipline. See Prisons.
"Prisoner's Friend," the, 440.
Prisons, State, solitary plan of, 435; silent, 436; comparison of the two, 437; intermediate, 438; county, 438; city, 439; societies for the improvement of, 439–40.
Products of the soil, 68.
Propeller, the first ever built, picture of, 235.
Propellers, lake, character of, 187; packet, between Philadelphia and New York, 190; origin of, 240; advantages and disadvantages of, 241. (See Screw propellers.)
Protective policy, the, 144, 152.
Providence, cotton mill at, 280.
Provisions and flour, exports of, 1790–1859, 158.
Prussian blue, how made, 67.
Public improvements, early, 173. (See Canals, Railroads, &c.)
Pump, force, for steam engines, 255.
Pumping engine of the Brooklyn Water Works, 258.
Pumps, steam, 258; importance of, 260.
Pyes' burglar-proof lock, 397.

Quincy granite, 359.
Quincy railroad, 192.

Rabbits' fur, 845.
Race, definition of, 41.
Rafting in Maine, 94.
Rag-pickers, 292.
Rags, table of imports of, 292; consumption of, 293; substitutes for, 293; grades of, 293–4; woollen, for shoddy, 313–14.
Rake, hand and horse, 36.
Railroad cars, manufacture of, 367.
Railroad companies, object of, 193.
Railroad iron, importation of, 156; quantity used, &c., 219.
Railroads, 191; the earliest, 192; benefits of, 198; principles of construction of, 193; power on, 196; continuous line of, from Bangor to New Orleans, 204, 208 (table); land grants to, 207; table of, in the United States, 209–219; financial results of, 219; travel on, 221; horse, in cities, 223; in the world, table of, 224; comparative cost of, 224; early origin of, 244–5; speed on, 249; aggregate saving of time by travel on, 250.
Rails, iron, 195; improvements in, 245.
Rat skins for gloves, 826.
Reaney & Neafy's steam fire engine, 259.
Reaper, Wheeler's, picture of, 34.
Reaping machines, great value of, 82; kind used by the Gauls, 32; triumph of American, at Paris, 35.
Reed instruments, musical, 433.
Reed's oscillator, 255.
Revolution, effect of the, upon commerce, 137.
Revolver, Colt's, invention and manufacture of, 331; other patents for, 332.
Ribbons, manufactories of, 395.
Rice, production of, 114–15.
Richelieu, policy of, in regard to tobacco, 85.
Ridgeley, Gen., breeder of the Woburn hog, 63.
Rifle, improvements in the, 328; Sharp's, 332; Whitney's, 333.
Ring spindle, the, 286.
Roads, state of, half a century ago, 52; origin and progress of, 172; different kinds and systems of, 174; proper construction of, 175; national, 176–7; of Connecticut, satirized, 192.
Roberts & Rich, safe manufacturers, 397.
Rodman, Lieut., improvement of, in gun-casting, 336.
Roger & Co., carriage factory of, 362.
Rogers, Smith & Co., plated goods of, illustrated, 373–6; manufactory of, 377.
Rogers Locomotive Works, 246.
Rotary steam engines, 252.
R. R. Cuyler, the, propeller, 240.
Russia, few roads in, 172.
Rum exported from the colonies, 135.
Rye, diminished cultivation of, 77; total product of, 77; profitable in New England, 78.

Sable, Russian and Hudson's Bay, 346.
Safes, fire-proof, history of, 395–7; burglar-proof, 397.
Safety valve, use of the, 229; account of the, 233; Papin's account of the, 267.
Sailors' Snug Harbor, the, 455.
St. Anthony, Minn., lumber business at, 257.
Salmon fishery, the, 382.
Sanders, Col., of Kentucky, importation of cattle by, 47.
Santee canal, 173.
Savannah, railroad from, 205.
Savannah, the, first ocean steamer, 180.
Schäffer, materials for paper used by, 293.
Schnebley's patent for reaping machine, 35.
Schuylkill and Susquehanna Company, 173.
Scissors, manufacture of, 340.
Scott, John, asbestos safe of, 397.
Screw propeller used by John Fitch, 229.
Screw propellers, on the lakes, losses of, 166; introduction of, 180. (See Propellers.)
Scythes, the manufacture of, 342.
Sea island cotton, 111; its production stationary, 117.
Seamen, American, impressed by England, 139.
Sewing machines, history of, 413; patents for, 414; illustrations of, 415–18, 421–2; growth of the manufacture of, 419; combination of patentees of, 420, 421; classes, operation, and description of, 421–7; applications of, 428; sales and manufactories of, 429; process of manufacturing, 429.
Sewing silk, American, 395.
Sharp's rifle, 332; manufactory for, 333.
Sheep, first exhibition of merino, 25; importations of, 59; statistics of, 59, 60, 63; decrease of, in New England, 59; increase of, in the South and West, 60; protection of, from dogs, 60; most valuable of domestic animals, 60.
Sherwood, Benjamin, revolving safe of, 397.
Ship-building, in the colonies, 135; table of, in 1771, 162; different styles of, 162; increase of, 163; on the lakes, 167; at the West and East compared, 359; table of, 360.
Shipping, American and foreign at New York, 1850–1865, 168.
Ship Timber Bending Company, 267.
Shoddy, 313; manufacture of, 314; uses of, 315.
Shoes. See Boots and shoes.
Short-horns, great sales of, in England, 40; importations of, 47; not suited to New England, 48; improvement of, in Kentucky, 48.
Sickle, use of the, 32.
Side wheel, the, 240.
Silk, culture of, 90; tricolor, from Lyons, 154; efforts to promote the production of, 393–4; raw, table of imports of, 395.
Silk hats, process of making, 350.
Silks, imports of, 1831–1840, 148; increased importation of, 156.
Silk-worms, management of, 393–4.
Silsby and Mynderse steam fire engine, 260; picture of, 261.
Sing Sing marble, 359.
Singer's sewing machine, illustrations of, 417; introduction of, 419; description of the manufacture of, 429.
Skinner, J. S., agricultural editor, 98.
Skins and furs used as currency, 75.
Skins of animals for leather, 817–18.
Skin-splitting machine, 320.
Skunk, fur of the, 345.
Slater, Samuel, cotton machinery introduced by, 280.
Slatersville, cotton mill at, 280.
Slave population in the United States, 172.
Slaves, condition of, in the South, 119.
Slave trade, inhibition of the, 141.
Slide valve, the, 229.
Sloops, travelling by, 178.
Small, James, cast-iron mould-boards and ploughs made by, 31.
Smith, Adam, upon high wages and interest, 103; on leather, 327.
Smith, J. B., paper of, on cotton, 118.
Soil, products of the, 68; fertility of the, at the West, 74; impoverishment of the, 87.
Sorghum syrup and sugar, 130.
South, the, no competition with the North, 121; Northern manufactures in, 122–3; results of the railroads of, 220; cotton manufactures at, 284; supply of lumber at, 357; silk culture in, 393.
South America, cotton imported from, 117.
South American wool, 313.

South Carolina, Agricultural Society of, 1784, 25; colonial exports of, 137.
South Carolina railroad, 192; account of, 204–5.
South Downs, improved Kentucky, picture of, 58.
Souther, John, locomotive works, 246.
Southern staples, 158.
Southern States, the, fruit in, 82; labor of, concentrated upon cotton, 110; cotton factories in, 115; character of the climate and labor of, 119.
Spear, Mr., safe-filling discovered by, 397.
Specie, imports and exports of, 145, 147, 148, 153, 156; exports of, 1821–1859, 158.
Specie circular, the, 151.
Specie payments, suspension and resumption of, 151.
Speculation, rise of, 147; results of, 151.
Spindles in cotton mills, 286, 288.
Spinning by hand, picture of, 279.
Spinning, cotton, 288.
Spinning-jenny, invention of the, 108, 275.
Spirits, imports of, 1831–1838, 148.
Spreading machine, for cotton, 287.
Springfield, manufacture of guns at, 334.
Squirrel furs, 347.
Stafford's breech-loading pistol, 333.
Stages, system of, 174, 178.
Stamp act, the, 137.
Stationary engines, 252; improvements still needed in, 269; universal use of, 271. (See Steam engines.)
Steam, progress of, on the Mississippi (table), 183; advantage of, for city travel, 250; laws of, 256–7; general results of the use of, 268; universal use of, 271; government experiments with, 272.
Steam battery built by Fulton, 241; wagons, advantages of, 244; fire engines, 244; ploughs, 263; elevators, 264; hammers, 265; cranes, 265; heating, 265; boiling, drying, cooking, 266; timber-bending, 267; press, the, 269; packing, vulcanized rubber for, 411.
Steam engine, the, history of, 227; the first in America, 227; wonders of the, 230–31; patents issued on account of, 231; component parts of, 232; applications of, to navigation, 240.
Steam engines, manner of obtaining the horse-power of, 228; low and high pressure, 229; American improvements in, 230; stationary, different kinds of, 252; improvements in, 253, 269; bad management of, 254; portable, 255; hoisting, 256; portable, for farmers, 263; objections to, 269; stationary, 271; government experiments upon, 272.
Steam engineers, 254, 268, 270.
Steam gauges, kinds of, 229; value of, 270.
Steam tonnage, 164; ocean and inland, 165; table of increase of, at the West, 183.
Steamboat, the first at the West, 165; racing, 183.
Steamboats, introduction of, 179; speed of, 180; illustration and notice of Fitch's, 226, 229; Fulton's, 229; Stevens's, 230; superiority of American, 231; history of, 234; the first on the Hudson, 234; at the West, 239; on the lakes, 239; explosion of, 242; act for the inspection of, 242.
Steamers, ocean, lines of, 164; losses of, 165; Western, description of, 183; on the lakes, 187; side-wheel, 241; use of coal in, 241; iron-clad, 338.
Stearine, uses of, 67.
Stearns & Marvin, safe manufacturers, 397.
Steel for cutlery, treatment of, 339–40; tempering of, 341.
Steers, George, 241.
Steinway & Sons' pianos, 433.
Stephenson's locomotives, 245.
Stern wheel, the, 240.
Stern-wheel boats, 183.
Stevens, Robert L., improvements in steamboats by, 230; blower introduced by, 241.
St. Louis, the founding of, 343; the fur trade of, 344; hospitals of, 452.
Stock, progress in the raising of, 37; products of, by States and sections, 51; in California, 68; total value of, in the United States, 68; proportion of, to the hay crop, in different States, 80.
Stockton gun, the, 334.
Stone, building, 359.
St. Paul, the fur trade of, 345.
Strawberries, culture of, 82.
Street railroads, advantages of steam on, 250; steam cars for, 251.
Stuart's sugar refinery, 392.
Suffolk hog, improved, picture of, 61.
Sugar, the culture of, at the South, 115-16; boiling of, 127; yield, profit, production, and consumption of, 129; other than cane, 130; imports of, 1831–1840, 148; large importation of, 156; failure of the Louisiana crop of, 156; comparative consumption of, 391; refined, mode of making, 291–2; superiority of American, 392.
Sugar cane, introduction of, 127; varieties of, 127; mode of cultivating, 128; mills for, 128.
Sun and planet motion, 230.
Sunday school, the first in New England, 280.
Super-heated steam, 256.
Surat cotton, character and price of, 118, 119.
Surgical instruments, manufacture of, 342.
Swine, introduction and improvement of, 63. (See Hogs.)
Symington, William, 229.

Table cutlery, manufacture of, 340.
Tambouring machine, Bock's, 414.
Tannin, quality and sources of, 319.
Tanning, 316; materials for, 319; process of, 321; new process of, 323.
Tariff, the, effect of, 122; reduction of, 147; of 1842, 152; of 1816–1828, 144–5; table of imports and exports under, 145; on cotton and woollen goods, 283; on woollens, 312.
Taunton Locomotive Company, 246.
Tawing, the process of, 320.
Tecumseh, Devon bull, portrait and history of, 46.
Tennessee, premium fleece at the London World's Fair, raised in, 60; railroads of, 209.
Terry, Eli, first maker of wooden clocks, 368.
Texas, grazing in, 102; sugar cane cultivated in, 127.
Thimonier, crocheting machine of, 414.
Thomas's "American Fruit Culturist," 84.
Thomaston lime, 358.
Threshing machine, the, 36.
Timber, varieties of, 94–5; for ship-building, 359; for carriages, 362.
Timber-bending by steam, 267, 359.
Time, modes of measuring, 368.
Timothy grass, discovery and propagation of, 80.
Tires, American improvement in, 361.
Tobacco, cultivation of, in Virginia, 72; impoverishment of the soil by, 80; use of, and opposition to, 85; production and exports of, 86; proper cultivation of, 86; geographical distribution of, 87; manufacture and consumption of, 87; and rice, exports of, 1790–1859, 158.
Tomkins, breeder of Herefords, 40.
Toucey, Hon. Isaac, 273.
Tonnage, American, 140 *et seq.*; entered and cleared in 1771, 162; comparative table of, 1789–1858, 163; of the interior, 163; steam, 164; on the lakes, 166 (table), 187; lessened by steam and railroads, 167; progress of, 1851–1858, 167; effect of the war upon, 168; steam, table of, 243.
Tooke's "History of Prices," 109.
Trade, domestic, of the United States, 159.
Traders, Indian, operations of, 187.
Trades carried on in the colonies, 133–4.
Trading voyage, course of a, 146.
Transportation, means of, 172; reduction of the cost of, 184, 186, 191, 193.
Travel, changes in, 181–3, 187, 221, 240; aggregate saving of time in, by railroads, 250; and transportation, improvements in, illustrated, 171.
Trotting, popularity of, in the United States, 53.
Tudor, Frederick, originator of the ice trade, 387.
Tuke, William, improved treatment of lunatics by, 441.
Tunnels in railroads, 195.
Turnpike companies, 176; roads, 177.

United States, the, area and present and prospective population of, 101; number of farms and plantations in, 102; value of live stock and crops in, 102; high prices in, 103, *et seq.*; progress in wealth and population of, 132, 144; condition of, after the revolution, 137; naval power of, 143; domestic trade of, 159; table of the growth of, 160; shipping of, 161; commercial prospects of, 168; table of railroads in the, 209–219; improvement of, through steam navigation, 234; freedom of industry in, 339; individual industries of, 353; dwellings in, 354.
United States Bank, 143, 146, 151.

Van Rensselaer, Stephen, 197.
Velocity of shot, experiments upon, 337.
Vera Cruz, expedition to, under Gen. Scott, 164.
Vesuvius, the, third western steamboat, 239.
Vine, culture of the, in California, 83.
Virginia, introduction of cattle into, 37; early mode of keeping cattle in, 38; introduction of horses into, 53; neglect of wheat in, 72; cultivation of tobacco in, 86; exhaustion of the soil of, by constant cropping, 87; public improvements in, 190; the oyster trade of, 384.
Virginia and Tennessee railroad, 204.
Virginia Central railroad, 204.

Walk-in-the-Water, first steamboat on Lake Erie, 239.
Wabash and Erie canal, 189.

Wages, high rate of, from cheap lands, 103; affected by the European standard, 104; how maintained, 105; by the cotton production, 106; by California gold, 107.
Wares, internal production of, 159.
Warehouse system, the English, 146.
Wagon-making, 367.
Watt, James, inscription on the monument of, 227; inventor of the low-pressure engine, 229.
Waterbury, pin manufactory at, 390.
Waltham, Mass., cotton mill at, 282; watch manufacture at, 371.
War of 1812, 143.
Washington, advocacy of agricultural societies by, 24; canal projected by, 71; interest of, in internal improvement, 173.
Washington, the steamboat, explosion of, 242.
Washington Iron Works, portable engine manufactured at, 255.
Washington, Pa., sewing silk made at, 393.
Watches, American, distinctive character of, 370; process of manufacturing, 371.
Watson, Elkanah, first exhibition of merino sheep by, 25.
Wealth, progress of, in the United States, 132, 144; present and prospective, 168.
Weaving, cotton, 288; woollen, 302; carpet, 306.
West, the, agricultural development of, 74, 75; interior navigation of, 165; ship-building at, 359.
West India colonies shut to American vessels, 163.
West Indies, the, cotton imported from, 117; trade of the American colonies with, 134, 137; cotton first obtained from, 275.
Western railroad of Massachusetts, 193; history and connections of, 196.
Whale, white, leather from the, 319.
Whale fishery, the, rise of, 135; illustration of, 379; history of, 385–6; mode of conducting, 386; statistics of, 386.
Wheat, early cultivation of, 72; subject to great casualties, 73; early exports of, 73; at the West, 74; trade of Chicago in, 76; total production of, by sections, 77; total exports of, 77; in California, 77; exported from the South, 115; imported from Russia, 148; value of the crop of 1850, 156; exports of, to Great Britain, 1840–1858, 158; received across the lakes (table), 187.
Wheeler's patent reaper, picture of, 34.
Wheeler & Wilson's sewing machine, illustrations of, 415–16; invention of, 419; description of, 422–3; manufactory of, 429.
Wheeling, glass works at, 400.
Wheels of steam vessels, 240; of carriages, 361; of railroad cars, 367.
Whiskey, American, in demand in Europe, 155.
White leather, how made, 320.
White River canal, 189.
White Water canal, 189.
Whitehead, patent speeder perfected by, 284.
Whittemore's machine for making cards, 301.
Whitney's cotton gin, 111; effect of, upon commerce, 141.
Whitney, Eli, rifle factory of, 333.
Wilder, Enos and B. G., fire-proof safe of, 397.
Willy, patent, for cotton, 287.
Willcox, J. M., paper mill of, 291–2.
Willcox & Gibbs's sewing machine, invention of, 420; illustrations of, opposite 420–21; description of, 425 (third class).
Winans, Messrs., locomotive builders, 246.
Wine, production and quality of, in California, 83; census returns of, 84.
Wines, imports of, 1831–1838, 148.
Wilton carpet, 307.
Wilson, Allen B. See Wheeler & Wilson.
Woburn hog, the, 63.
Wolston system, the, of steam ploughing, 264.
Wood used in house-building, 91; for fuel, 97.
Wood on Railroads, extract from, 193.
Woodward's steam pump, 260, 263.
Wool, exportation of, prohibited by England, 281; American manufacture of, 1810–1850, 300; spinning of, 302; for carpets, source and preparation of, 307; home-grown, 312–13; South American, 313; inadequate supply of, 313.
Wool and woollens, statistics of, 60, 63.
Wool-growing in the United States, 59; most profitable at the South and West, 60; statistics of, 60.
Woollen manufactures, development of, 300; processes of, 301; various kinds of, 301–8; census statistics of, 311.
Women's Prison Association of New York, 440.
Worcester railroad, 196.
Worsted, the manufacture of, 301; zephyr, 308.
Worthington's steam pump, 260, 263.
Wright, L. W., solid-head pin machine of, 390.
Wyatt's patent for spinning cotton, 108.

Yale, Linus, Sr. and Jr., burglar-proof locks of, 398.
Yarn, cotton, prices of, 110; grades of, 288; decline in cost of, 290.
Young, Arthur, labors of, 99.
Young Denton, short-horn bull, 48.

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CONTENTS

MINING INDUSTRY.

	PAGE
Introductory Remarks	17
Iron Works in Virginia previous to 1622	17
First Blast Furnace in 1702	17
IRON	18
First Trial of Anthracite Coal for manufacfacturing	18
Great Britian produces more than half of the whole product of the world	19
Iron produced from 1828 to 1840	20
MATERIALS EMPLOYED IN THE MANUFACTURE	20
Ore in Pennsylvania, Maryland, Tennessee, New York, Canada, and Wisconsin	21
Consumption of Charcoal per Ton of Iron	22
Quantities of Air used in Blast Furnaces	23
Furnaces in the Lehigh Valley	23
DISTRIBUTION OF ORES	24
Ores in New Jersey	25
Ores in Pennsylvania	26
Great Chestnut Hill Ore-bed	27
Ores in Maryland	28
Ores in Southern States	28
Ores in Western States	29
IRON MANUFACTURE	32
Description of Blast Furnaces	32
WROUGHT IRON	36
PUDDLING	37
List of Rolling Mills in 1856	40
Mills making Railroad Iron in 1856	40
Boiler Plate and Sheet Iron Manufactories in 1856	41
IRON WIRE	41
NAILS	41
List of Nail Manufactories in 1856	42
STEEL	43
Cast Steel	44
Table of Iron Works in operation and abandoned in 1856	45
Production of Pig Iron	46
Distribution of Furnaces by States	46
Product of Wrought Iron	46
Value of the Iron product in 1856	47
COPPER	48
New Jersey Mines	49
Tennessee Mines	50
Lake Superior Mines	51
Product of the Pittsburgh and Boston Company Mines from 1852 to 1860	53
Minesota Company	55
Product of do from 1848 to 1860	56
Statistics of Lake Superior Mines	57
COPPER SMELTING	58
USEFUL APPLICATIONS OF COPPER	60
Cost of Smelting Copper	60
Manufacture of Brass	62
GOLD	63
Vermont Mines	64
Virginia do	64
North Carolina Mines	69
Georgia do	69
Pike's Peak do	70
California do	71
Australia do	71
Annual production of Gold in the World at the time of its discovery in California	71
Length and Cost of Artificial Water-courses in California	72
Quartz Mining	73
Table of annual productions of the Mines of California from 1848 to 1857	73

	PAGE
Various Machines for Mining purposes	74
Tables showing the amount of Gold coined by the U.S. Government, and where produced	78-9
The uses of Gold	80
LEAD	81
Localities of Mines	82
Iowa Mines	84
Table showing the shipments of Lead from the Upper Mississippi from 1821 to 1841	85
Table showing the production and importation of Lead from 1832 to 1858	87
LEAD SMELTING	87
USEFUL APPLICATIONS OF LEAD	91
Lead Pipe	91
Shot and Bullets	92
American process of making Shot,	93
WHITE LEAD	94
List of American White Lead Works	96
ZINC	96
New Jersey Mines	96
Pennsylvania do.	97
METALLURGIC TREATMENT AND USES	98
EUROPEAN MANUFACTURE	100
List of the Silesian Company Works	102
Schedule of the cost of Zinc Ore on shipboard at Antwerp	103
ZINC PAINT	103
Description of Manufacture	104
PLATINUM	107
IRIDIUM AND OSMIUM	110
MERCURY	110
California Mines	111
Almaden Mine in Spain	111
Total annual production of various Mines	111
METALLURGIC TREATMENT	114
USEFUL APPLICATIONS OF MERCURY	114
SILVER	115
COBALT	116
NICKEL	117
CHROME OR CHROMIUM	118
MANGANESE	119
TIN	119
COAL	120
VARIETIES OF COAL	121
Relative value of different kinds of Coal	124
GEOLOGICAL AND GEOGRAPHICAL DISTRIBUTION OF COAL	124
AMOUNT OF AVAILABLE COAL	133
Extent of Coal Fields in different States	133
Relative amount of Coal Fields of Europe and America	134
Table showing annual amount of Lead produced in Pennsylvania and Maryland from 1820 to 1860	134
TRANSPORTATION OF COAL TO MARKET	135
Table of Railroads and Canals constructed for transporting Coal	142
USEFUL APPLICATIONS OF COAL	146
ILLUMINATING GAS	147
List of Gas Co.'s, with amount of Capital, &c.	148
Process of making Gas	152
GAS FOR STEAMBOATS AND RAILROAD CARS	156
HYDROCARBON OR COAL OILS	156
Table of Coal Oil Works in the United States	157
History and method of manufacture	158
PETROLEUM OR ROCK OIL	163
Petroleum in the United States	164
Daily yield of seventy-four Oil Wells	165
List of Petroleum Refining works	170
LAND SETTLEMENT, INTERNAL TRADE	169
Land Sales in Ohio	170
Canals in the West	172
First Locomotive built in this Country	174
Population of Land States in 1830 and in 1860	175
Detroit and Chicago	177
RIVER CITIES, ATLANTIC CITIES	180
Statistics of New Orleans	182
NEW YORK, TELEGRAPH, GOLD	185
Comparative Exports of the Atlantic Cities	187
Harnden Express	188
Growth of New York	190
Bulls and Bears	195
Hotels in New York	197

BANKS IN THE UNITED STATES.

BILLS OF CREDIT	198
Congress Issues, $358,465,000	199
Ten Thousand Dollars for a Cocked Hat	199
First Bank of the United States	201
One Hundred and Twenty Banks go into operation in four years	201
Table of relative growth of Banks	203
Table of Number of Banks, and Capital	204
Banks Located in New York	204
Alabama with Carolina, do	208
Clearing House System	209
Table of Capital of all Banks	209

UNITED STATES MINT.

ESTABLISHMENT OF THE MINT, STANDARD OF COIN, &c.	212
Value of the Dollar and the Pound Sterling in Colonial Paper Money	213
Alloy of Gold Coin	214
United States Coinage	214
California Gold	215
Weight of Silver Coin	216

PAGE

Amount of New Silver Coin 216
Deposit of Domestic Gold at United States Mint and Branches 216
Amount of Specie in 1821 217

INSURANCE.

Fire, Marine, and Life 219
Number and Capital of New York Companies 222
Capital, Premiums, and Risks of the Fire Companies of the United States 223
Marine Insurance 224
Life Insurance 225
Comparative Rates of Domestic Life Insurance 226

IMMIGRATION.

General Migration 228
Colonies of the United States 228
Early Immigration 229
Naturalization Laws 230
Number of Immigrants for the last forty years, with their Birth-places 231
European Migration—French and German. 232
Decrease in Population of Ireland 235
Allowance on Passage 236
Saving part of the Passage Money 239
Landing in New York—Future Homes 240
Table of Immigration 240
Location of Immigrants in the United States 242
Amount of Money received in the United States by Immigrants 243
Amount of Money remitted by Friends in aid of Immigration 243
Number of Natives arriving from abroad ... 244

SOCIAL AND DOMESTIC LIFE.

Introduction 245
Domestic Architecture 245
Description of Buildings 246
Houses South 247
Introduction of Anthracite Coal 248
Nott's Stoves 248
Furniture, Furnishing Goods, &c 249
China, Glass, Silver Forks, &c 251
Food, Cooking, &c 252
Cooking Stoves 253
Dress 253
Social and Mental Culture 259

BOOKS.

Book Trade, Publishing, &c 262
First Booksellers in America 263
American Bible Society 264

PAGE

Harper and Brothers, Appletons 264
Number of Book Publishers in the United States 265
Gift-Book Sales 265
Sale of Old Books 266
Subscription Sales 267
Circulation of Popular Works 267
School Book Trade 268
Reprints and American Books 269
Book Binding 269
Books of Wood and Metal 272
Description of Binding 273
Writers of America 274
Theologians, Statesmen, Novelists, Historians 274
Early Founders of the Colony Good Writers 274
Works of James Madison 275
Judge Marshall, Story, Wheaton, John Quincy Adams, and others 276
Cooper, Hawthorne, Willis 279–280
Prescott and Bancroft 284
Lady Authors 285
Printing Press 286
Franklin's Press 286
Hoe and Adams Presses 297
Types 298
Machines for Casting Types 298
Stereotype, Electrotype 300
Newspapers 301
City Papers 303
Number of Papers in the United States 307
Telegraph—Origin 308
Morse, House, and Hughes Machines 311
First Lines 313
Various Lines and Companies 313
Penalty for refusing to transmit Messages .. 314
Comparison between Telegraphs and Couriers 315

THE ARTS OF DESIGN IN AMERICA.

Horace Walpole 316
American Art begins with Benjamin West .. 317
Stuart, Robert Fulton 318
Sketches of the Lives of Prominent Painters 318 to 325
Sculptors .... 326 to 328
Engraving 332
Dr. Anderson 332
Copper-Plate Engraving 333
American Bank Note Company 333
Descriptions of Engraving 334
Lithography, Daguerreotype, Academies of Art, &c 335

PAGE

EDUCATION AND EDUCATIONAL INSTITUTIONS.

DEVELOPMENT IN THE COLONIAL PERIOD 337
Early Efforts in Virginia................. 337
do do in New York............... 338
Early Efforts in Colonies of Massachusetts and Connecticut...................... 338
Town Action in behalf of Schools.......... 339
COLONIAL LEGISLATION AND ACTION IN THE ORDER OF THEIR SETTLEMENT............ 341
Virginia............................. 341
Massachusetts......................... 342
Rhode Island, Connecticut................ 344
New Hampshire........................ 345
New York............................ 346
Maryland............................. 347
New Jersey, Pennsylvania............... 348
Delaware, North Carolina................ 349
South Carolina, Georgia.................. 350
RESULTS AT THE CLOSE OF OUR COLONIAL HISTORY................................ 350
REVOLUTIONARY AND TRANSITION PERIOD..... 351
Opinions and Efforts of Noah Webster, George Washington, John Adams, Thomas Jefferson........................... 352
Opinions and Efforts of James Madison, John Quincy Adams, Benjamin Rush, John Jay, De Witt Clinton, Chancellor Kent, Daniel Webster........................... 353
PROGRESS OF COMMON OR ELEMENTARY SCHOOLS 355
Letter from Noah Webster............... 355
do do Heman Humphrey........... 356
do do Joseph T. Buckingham........ 359
do do Dr. Nott.................... 362
Recollections of Peter Parley............. 363
The Homespun Era of Common Schools, by Horace Bushnell, D.D.................. 369
Letter from William Darlington, M.D., LL.D. 370
Schools in Philadelphia.................. 371
School Holiday in Georgia................ 373
Old Field School or Academy in Virginia... 377
Remarks............................. 380

PAGE

What is Education?..................... 383
Remarks on the Common School System in the United States...................... 384
ACADEMIES, HIGH SCHOOLS, &c............... 388
Letter of Josiah Quincy.................. 389
Address of Hon. Edward Everett.......... 391
COLLEGES................................ 392
PROFESSIONAL, SCIENTIFIC AND SPECIAL SCHOOLS 393
THEOLOGICAL SCHOOLS..................... 393
LAW SCHOOLS............................ 394
MEDICAL SCHOOLS......................... 394
MILITARY AND NAVAL SCHOOLS............... 395
NORMAL SCHOOLS, &c....................... 397
SCHOOLS OF SCIENCE FOR ENGINEERS, &c...... 400
The Lawrence School.................... 401
SCHOOLS OF AGRICULTURE................... 402
COMMERCIAL SCHOOLS...................... 403
SCHOOLS FOR MECHANICS.................... 403
FINE ARTS—FEMALE EDUCATION............. 404
SCHOOL-HOUSES, APPARATUS, AND TEXT-BOOKS 406
The Horn-Book.......................... 413
New England Primer..................... 414
Webster's Spelling Book.................. 416
School Apparatus........................ 422
LIBRARIES............................... 423
Astor Library, Boston City Library........ 424
New York Mercantile Library............ 425
Table of Libraries in the United States...... 429
LYCEUMS, &c............................. 432
INSTITUTIONS FOR THE INSTRUCTION OF DEAF AND DUMB........................... 434
Rev. Thomas H. Gallaudet................ 435
INSTITUTIONS FOR THE BLIND................ 439
INSTITUTIONS FOR IDIOTS.................... 440
INSTITUTIONS FOR EDUCATION OF ORPHANS.... 445
REFORMATORY INSTITUTIONS.................. 446
Educational Statistics of the United States.. 451
Table of American Colleges............... 452
do Theological Schools.............. 454
do Law Schools, Medical Schools..... 455
do Deaf and Dumb Institutions...... 456
do Blind Institutions............... 457

LIST OF ILLUSTRATIONS.

		Page.
1,	Fancy Title,...... (*Steel Plate.*)	
2,	Chestnut Hill Mine,..........	27
3,	Blast Furnace,....... (*Fig. A,*)	35
4,	" " ....(*Fig. B,*)	35
5,	Hydraulic Mining, ...	65
6,	Tunneling at Table Mountain, Cal.	66
7,	Large Rocker,..............	67
8,	Stamps for Crushing Gold Ores, .	68
9,	Burke Rocker,..............	74
10,	Crushing Mill, or Arrastre, ...	75
11,	Scotch Hearth Furnace, ...	88
12,	Apparatus for working Platinum, .	108
13,	View of New Almaden Quick Silver Mine,...............	113
	Map of the Anthracite region, Pa., Mines,..................	126
14,	Map showing Different Strata, in Coal Regions, Pa.,.........	130
15,	Map showing Different Strata in Coal Regions, Pa.,.........	132
16,	Mt.Pisgah Plane,Mauch Chunk,Pa.	137
17,	Great Open Quarry of the Lehigh,	138
18,	Baltimore Company's Mine, Pa., .	139
19,	Colliery Slope,...............	140
20,	View at Mauch Chunk,........	141
	Niagara Falls, (*Steel Plate,*)	175
	Victoria Bridge, (*Steel Plate,*) ..	178
21,	Upper Mississippi, (*Steel Plate,*) .	182
22,	U. S. Bank, Pa., (*Steel Plate,*) ..	206
23,	Buildings on Fire, ...	219
24,	Fashion, 1776,.........	255
25,	Evening Dress, 1780,.........	255
26,	Fashion, 1780,.........	255
27,	" 1785,.........	255
28,	Evening Dress, 1795,.........	255
29,	" " 1797,.........	255
30,	Fashion, 1800,.........	255
31,	" 1805,.........	255
32,	Children, 1805,.........	255
33,	Fashions, 1812,.........	255
34,	Boys, 1812,.........	255
35,	Men, 1812,.........	255
36,	Women, 1815,.........	256
37,	Men, 1818,.........	256
38,	Women, 1820,.........	256
39,	Men, 1825,.........	256
40,	" 1828,.........	256
41,	Winter Dress, 1833,.........	256
42,	Boys and Girls, 1833,.........	256
43,	Men, 1833,.........	256
44,	Women, 1833,.........	256
45,	" 1840,.........	256
46,	Men, 1844,.........	256
47,	Women, 1850,.........	256
48,	Franklin Press,..............	289
49,	Washington Press,...........	289
50,	Hand Press, Steam Inking machine,	290
51,	Improved Inking Apparatus,....	290
52,	Patent Single Cylinder Machine, .	291
53,	Eight Cylinder Machine,.......	292
54,	Ten Cylinder Machine,........	293
55,	Four Color Machine,..........	294
56,	Bed and Platen Power Machine, .	295
57,	Railroad Ticket Machine,......	296
58,	Morse' Telegraph Apparatus,....	309
59,	Fishing at Newport,..........	330
60,	Country View,..............	330
61,	Spring, ...	331

		Page.
62,	Summer,	331
63,	Fall,	331
64,	School Houses as they were,	406
65,	" " "	406
66,	" " as they are,	407
67,	Village School House,	407
68,	View of Girard College,	408
69,	Packer Collegiate Institute,	409
70,	" " Garden Front,	410
71,	" " Interior,	410
72,	Norwich Free Academy,	411
73,	Chicago City University,	412
74,	Horn Book of 18th Century,	413
75,	John Hancock,	414
76,	Burning of John Rogers at the Stake,	414
77,	In Adam's Fall we sinned all,	415
78,	Heaven to Find, the Bible mind,	415
79,	Christ Crucified, for Sinners died,	415
80,	The Deluge Drowned, the Earth around,	415
81,	Elijah hid, by Ravens fed,	415
82,	The Judgment made Felix afraid,	415
83,	As Runs the Glass,	415
84,	My Book and Heart must never part,	415
85.	Job feels the Rod,	415
86,	Proud Korah's troop was swallowed up,	415
87,	Lot fled to Zoar,	415
88,	Moses was he who Israel's host led through the Sea,	415
89,	Noah did view the Old World and New,	415
90,	Young Obadias, David, Josias,	415
91,	Peter denied his Lord and cried,	415
92,	Queen Esther sues,	415
93,	Young pious Ruth left all for Truth,	415
94,	Young Samuel dear, the Lord did fear,	415
95,	Young Timothy learnt Sin to fly,	415
96,	Vasthi for Pride was set aside,	415
97,	Whales in the Sea,	415
98,	Xerxes did die,	415
99,	While Youth doth cheer Death may be near,	415
100,	Zaccheus he did climb the Tree,	415
101,	The Boy that Stole Apples,	416
102,	Country Maid,	417
103,	Cat and Rat,	417
104,	Fox and Swallow,	418
105,	Fox and Bramble,	418
106,	The Partial Judge,	418
107,	Bear and Two Friends,	419
108,	Two Dogs,	419
109,	Eye, Nose, &c.,	420
110,	Arm, Hand, &c.,	420
111,	Eagle's Nest,	420
112,	Vertebrates,	420
113,	Articulates,	420
114,	Mollusks,	420
115,	Radiates,	420
116,	Animals of the Seal Kind,	420
117,	Birds,	421
118,	Flowers,	421
119,	Geological Chart,	421
120,	School Apparatus as it was,	422
121,	School Apparatus as it is,	422
122,	Boston City Library. Exterior,	425
123,	Boston City Library. Interior,	426
124,	American Asylum for Deaf and Dumb,	437
125,	Pennsylvania Asylum for Blind,	440
126,	Asylum for Idiots, Syracuse, N. Y.	444

MINING INDUSTRY OF THE UNITED STATES.

INTRODUCTORY REMARKS.

The mineral wealth of the American colonies does not appear to have been an object of much interest to the early settlers. Congregated near the coast, they were little likely to become acquainted with many of the mineral localities, most of which are in the interior, in regions long occupied by the Indian tribes. The settlers, moreover, probably possessed little knowledge of mining, and certainly lacked capital which they could appropriate in this direction. Some discoveries, however, were made by them very soon after their settlement, the earliest of which were on the James river, in Virginia. Beverly, in his "History of the Present State of Virginia," published in London in 1705, makes mention of iron works which were commenced on Falling Creek, and of glass-houses which were about to be constructed at Jamestown just previous to the great massacre by the Indians, in 1622. This undertaking at Falling Creek is referred to by other historians, as by Stith, in his "History of Virginia" (1753), p. 279. A Captain Nathaniel Butler, it appears, presented to the king, in 1623, a very disparaging account of the condition of the colony, mentioning, among other matters, that "the Iron Works were utterly wasted, and the People dead; the Glass Furnaces at a stand, and in small Hopes of proceeding." The committee of the company, in their reply to this, affirm that "great Sums had been expended, and infinite Care and Diligence bestowed by the Officers and Company for setting forward various Commodities and Manufactures; as Iron Works," etc., etc. Salmon, in his "Modern History" (1746), vol. iii, pp. 439 and 468, refers to the statement of Beverly, mentioning that "an iron work was set up on Falling Creek, in James River, where they found the iron ore good, and had near brought that work to perfection. The iron proved reasonably good; but before they got into the body of the mine, the people were cut off in that fatal massacre (of March, 1622), and the project has never been set on foot since, until of late; but it has not had its full trial." This author also refers to the representations of the Board of Trade to the House of Commons, in 1732, as containing notices of the iron works in operation in New England. From various reports of the governor of Massachusetts Bay and other officials of this colony, there appear to have been, in 1731, as many as six furnaces and nineteen forges for making iron in New England, as also a slitting mill and nail factory connected with it.

The first blast furnace in the colonies appears to have been built in 1702, by Lambert Despard, at the outlet of Mattakeeset pond, in Plymouth County, Massachusetts, and a number more were afterward set in operation to work the bog ores of that district. Their operations are described in the "Collections of the Massachusetts Historical Society" for 1804, by James Thacher, M. D., who was himself engaged in the manufacture. In Rhode Island and Providence Plantations, the same kinds of ore were found and worked at about the same period. Alexander gives the year 1715 as the epoch of blast furnaces in Maryland, Virginia, and Pennsylvania. These enterprises were regarded with great disfavor in the mother country. In 1719 an act was brought forward in the House of Lords, forbidding the erection of rolling or slitting mills in the American colonies, and in 1750 this was made a law.

In Connecticut, Governor Winthrop was much interested in investigating the character of the minerals about Haddam and Middletown. In 1651 he obtained a license giving him almost unlimited privileges for working any mines of "lead, copper, or tin, or any minerals; as antimony, vitriol, black lead, alum, salt, salt springs, or any other the like, * * * to enjoy forever said mines, with the lands, woods, timber, and water within two or three miles of said mines." And in 1661, another special grant was made to him of any mines he might discover in the neighborhood of Middletown. It does not appear, however, that he derived any special advantage from these privileges, although he used to make frequent excursions to the different localities of minerals, especially to the Governor's Ring, a mountain in the north-west corner of East Haddam, and spend three weeks at a time there with his servant, engaged, as told by Governor Trumbull to President Styles, and recorded in his diary, in "roasting ores, assaying metals, and casting gold rings." John Winthrop, F.R.S., grandson of Governor Winthrop, was evidently well acquainted with many localities of different ores in Connecticut, and sent to the Royal Society a considerable collection of specimens he had made. It is supposed that among them Hatchett found the mineral columbite, and detected the new metal which he named columbium. At Middletown, an argentiferous lead mine was worked, it is supposed, at this period, by the Winthrops, and the men employed were evidently skilful miners. When the mine was reopened in 1852, shafts were found well timbered and in good preservation, that had been sunk to the depth of 120 feet, and, with the other workings, amounted in all to 1,500 feet of excavation. The oldest American charter for a mining company was granted in 1709, for working the copper ores at Simsbury, Connecticut. Operations were carried on here for a number of years, the ore raised being shipped to England, and a similar mining enterprise was undertaken in 1719, at Belleville, in New Jersey, about six miles from Jersey City. The products of the so-called Schuyler mine at this place amounted, before the year 1731, to 1,386 tons of ore, all of which were shipped to England. At this period (1732) the Gap mine, in Lancaster county, Pennsylvania, was first opened and worked for copper, and about the middle of the century various other copper mines were opened in New Jersey; also, the lead mine at Southampton, Mass., and the cobalt mine at Chatham, Conn. In 1754 a lead mine was successfully worked in Wythe county, in southwestern Virginia, and this is still productive. It is probable that, by reason of the higher value of copper at that period, and the lower price paid for labor than at present, some of the copper mines may have proved profitable to work, though it is certain this has not been the case with them of late years. The existence of copper in the region about Lake Superior was known, from the reports of the Jesuit missionaries, in 1660, and one or two unsuccessful attempts were made to work it during the last century by parties of Englishmen. The lead mines of the upper Mississippi, discovered by Le Sueur in his exploring voyage up the river in 1700 and 1701, were first worked by Dubuque, a French miner, in 1788, upon the tract of land now occupied by the city in Iowa bearing his name.

Such, in general, was the extent to which this branch of industry had been carried up to the close of the last century. The only coal mines worked were some on the James river, twelve miles above Richmond, and the capacity of these for adding to the wealth of the country was not by any means appreciated. The gold mines were entirely unknown, and the dependence of the country upon Great Britain for the supply of iron had so checked the development of this branch of manufacture, that comparatively nothing was known of our own resources in the mines of this metal. The most important establishments for its manufacture were small blast furnaces, working bog ores, and the bloomaries of New York and New Jersey, making bar iron direct from the rich magnetic ores.

The progress of the United States in these branches will be traced in the succeeding chapters, one of which will be devoted to each of the principal metals.

CHAPTER I.

IRON.

The early history of the iron manufacture in the American colonies has been noticed in the introductory remarks which precede this chapter. Since the year 1750 the restrictions imposed upon the business by the mother country had limited the operations to the production of pig iron and castings, and a few blast furnaces were employed in New England and the middle Atlantic states. A considerable portion of the pig iron was exported to Great Britain, where it was admitted free of duty, and articles of wrought iron and steel were returned from that country. In 1771 the shipment of pig iron from the colonies amounted to 7,525 tons. By the sudden cessation of commercial relations on the breaking out of the war, the country was thrown upon its own resources, but was illy prepared to meet the new and extraordinary demands for iron. The skill, experience, and capital for this business were all alike wanting, and even the casting of cannon was an undertaking that few of the furnace masters were prepared to venture upon. The bog ores found in Plymouth county, Mass., together with supplies from New Jersey, sustained ten furnaces; and in Bridgewater, cannon were successfully cast and bored by Hon. Hugh Orr, for the supply of the army. They were also made at Westville, Conn., by Mr. Elijah Bachus, who welded together bars of iron for the purpose. The Continental Congress, also, was forced to establish and carry on works for furnishing iron and steel, and in the northern part of New Jersey, the highlands of New York, and the valley of the Housatonic in Connecticut, they found abundance of rich ores, and forests of the best wood for the charcoal required in the manufacture. At their armory at Carlisle, Pa., the first trials of anthracite for manufacturing purposes were made in 1775. But the condition of the country was little favorable for the development of this branch of industry, and after the war, without capital, a currency, or facilities of transportation, the iron business long continued of little more than local importance. The chief supplies were again furnished from the iron works of Great Britain, the establishment of which had in great part been owing to the restrictions placed upon the development of our own resources; and while that country continued to protect their own interest by prohibitory duties that for a long period excluded all foreign competition, the iron interest of the United States languished under a policy that fostered rather the carrying trade between the two countries than the building up of highly important manufactories, and the establishment around them of permanent agricultural settlements through the home market they should secure. Hence it was that the manufacture in Great Britain was rapidly accelerated, improved by new inventions, strengthened by accumulated capital, and sustained by the use of mineral coal for fuel, almost a century before we had learned in the discouraging condition of the art, that this cheap fuel, mines of which were worked near Richmond in Virginia, before 1790, could be advantageously employed in the manufacture. The natural advantages possessed by Great Britain powerfully co-operated with her wise legislation; and as her rich deposits of iron ore and coal were developed in close juxtaposition, and in localities not far removed from the coast, the iron interest became so firmly established that no nation accessible to her ships could successfully engage in the same pursuit, until, by following the example set by Great Britain, its own mines and resources might be in like manner developed. Thus encouraged and supported, the iron interest of Great Britain has prospered at the expense of that of all other nations, till her annual production amounts to more than one-half of the seven millions or eight millions of tons produced throughout the world; and the products of her mines and furnaces have, until quite recently, been better known, even in the extreme western states, where the cost of "Scotch pig iron" has been more than doubled by the transportation, than has that of the rich ores of these very states. And thus it is the annual production of the United States scarcely yet amounts to 1,000,000 tons, notwithstanding the abundance and richness of her mines, both of iron ores and of coal, and the immense demands of iron for her own consumption. So great are the advantages she possesses in the quality of these essential materials in the production of iron, that according to the statement of an able writer upon this subject, who is himself largely engaged in the manufacture, less than half the quantity of raw materials is required in this country to the ton of iron, that is required in Great Britain, "thus economizing labor to an enormous extent. In point of fact, the materials for making a ton of iron can be laid down in the United States at the furnace with less expenditure of human labor than in any part of the known world, with the possible exception of Scotland." ("On the Statistics and Geography of the Production of Iron," by Abram S. Hewitt, N. Y., 1856, p. 20). The tables presented by this writer, of the annual production, show striking vicissitudes in the trade, which is to be accounted for chiefly by the fluctuations in prices in the English market depressing or encouraging our own manufacture, and by the frequent changes in our tariff.

"In 1810 the production of iron, entirely charcoal, was 54,000 tons. In 1820, in consequence of the commercial ruin which swept over the country just before, the business was in a state of comparative ruin, and not over 20,000 tons were produced.

In 1828	the product	was	130,000	tons.
" 1829	"	"	142,000	"
" 1830	"	"	165,000	"
" 1831	"	"	191,000	"
" 1832	"	"	200,000	"
" 1840	"	"	315,000	"

In 1842 it fell to less than 230,000 tons, the result of the remission of duties under the compromise tariff. In 1846 Secretary Walker estimated it to be 765,000 tons, the result of the combined action of the high tariff of 1842 and the high prices in England, caused by the new demand for railways. In 1847 and 1848 it reached 800,000 tons. In 1849 it fell to 650,000 tons. In 1850, by the census returns it was reduced to 564,755 tons; and it continued to fall off until the first of January, 1853, when the whole product did not exceed 500,000 tons; still leaving it, even at the lowest point, second only to Great Britain. The make then began to increase, so that in 1855 it had reached at least 1,000,000 of tons. This estimate is not confirmed in the tables prepared by the committee of the Association of Iron Manufacturers for 1856, which will be presented in more detail in the course of this chapter. Not reckoning the bar and blooms made direct from the ore, which in 1856 is given as 28,633 tons, the production of pig metal in 1854 was 724,833 tons; in 1855, 728,973 tons; and in 1856, 812,917 tons. The annual production at the present time probably falls short of this amount.

Until the year 1840, charcoal had been the only fuel used in the manufacture of iron; and while it produced a metal far superior in quality to that made with coke, the great demands of the trade were for cheap irons, and the market was chiefly supplied with these from Great Britain. The introduction of anthracite for smelting iron ores in 1840 marked a new era in the manufacture, though its influence was not decidedly felt for several years afterward.

MATERIALS EMPLOYED IN THE MANUFACTURE.

Before attempting to exhibit the resources of the United States for making iron, and the methods of conducting the manufacture, it is well to give some account of the materials employed, and explain the conditions upon which this manufacture depends. Three elements are essential in the great branch of the business—that of producing pig iron, viz: ores, fuel to reduce them, and a suitable flux to aid the process by melting with and removing the earthy impurities of the ore in a freely flowing, glassy cinder. The flux is usually limestone, and by a wise provision, evidently in view of the uses to which this would be applied, limestone is almost universally found conveniently near to iron ores; so also are stores of fuel commensurate with the abundance of the ores.

The principal ores are hematites, magnetic and specular ores, the red oxides of the secondary rocks, and the carbonates. Probably more than three-quarters of the iron made in the United States is from the first three varieties named, and a much larger proportion of the English iron is from the last—from the magnetic and specular ores none. Hematites, wherever known, are favorite ores. They are met with in great irregular-shaped deposits (apparently derived from other forms in which the iron was distributed), intermixed with ochres, clays, and sands, sometimes in scattered lumps and blocks, and sometimes in massive ledges; they also occur in beds interstratified among the mica slates. Although the deposits are regarded as of limited capacity, they are often worked to the depth of more than 100 feet; in one instance in Berks county, Penn., to 165 feet; and when abandoned, as they sometimes are, it is questionable whether this is not rather owing to the increased expenses incurred in continuing the enormous excavations at such depths, than from failure of the ore. Mines of hematite have proved the most valuable mines in the United States. At Salisbury, in Connecticut, they have been worked almost uninterruptedly for more than 100 years, supplying the means for supporting an active industry in the country around, and enriching generation after generation of proprietors. The great group of mines at Chestnut Hill, in Columbia county, Penn., and others in Berks and Lehigh counties in the same state, are of similar character.

The ore is a hydrated peroxide of iron, consisting of from 72 to 85 per cent. of peroxide of iron (which corresponds to about 50 to 60 per cent. of iron), and from 10 to 14 per cent. of water. Silica and alumina, phosphoric acid, and peroxide of manganese are one or more present in very small quantities; but the impurities are rarely such as to interfere with the production of very excellent iron, either for foundry or forge purposes—that is, for castings or bar iron. It is easily and cheaply mined, and works easily in the blast furnace. On account of its deficiency in silica it is necessary to use a limestone containing this ingredient, that the elements of a glassy cinder may be provided, which is the first requisite in smelting iron; or the same end may be more advantageously attained by adding a portion of magnetic ore, which is almost always mixed with silica in the form of quartz; and these two ores are consequently very generally worked together—the hematites making two-thirds or three-quarters of the charge, and the magnetic ores the remainder.

Magnetic ore is the richest possible combination of iron, the proportion of which cannot exceed 72.4 per cent., combined with 27.6 per cent of oxygen. It is a heavy, black ore, compact or in coarse crystalline grains, and commonly mixed with quartz and other minerals. It affects the magnetic needle, and pieces of it often support small bits of iron, as nails. Such ore is the loadstone. It is obtained of various qualities; some sorts work with great difficulty in the blast furnace, and others are more easily managed and make excellent iron for any use; but all do better mixed with hematite. The magnetic ores have been largely employed in the ancient processes of making malleable iron direct from the ore in the open forge, the Catalan forge, etc., and at the present time they are so used in the bloomary fires. They are found in inexhaustible beds of all dimensions lying among the micaceous slates and gneiss rocks. These beds are sometimes so extensive that they appear to make up the greater part of the mountains in which they lie, and in common language the mountains are said to be all ore.

Specular ore, or specular iron, is so named from the shining, mirror-like plates in which it is often found. The common ore is sometimes red, steel gray, or iron black, and all these varieties are distinguished by the bright red color of the powder of the ore, which is that of peroxide of iron. Magnetic ore gives a black powder, which is that of a less oxidized combination. The specular ore thus contains less iron and more oxygen than the magnetic; the proportions of its ingredients are 70 parts in 100 of iron, and 30 of oxygen. Though the difference seems slight, the qualities of the two ores are quite distinct. The peroxide makes iron fast, but some sorts of it produce an inferior quality of iron to that from the hematite and magnetic ores, and better adapted for castings than for converting into malleable iron. The pure, rich ores, however, are many of them unsurpassed. It is found in beds of all dimensions, and though in the eastern part of the United States they prove of limited extent, those of Missouri and Lake Superior are inexhaustible. Magnetic and specular ores are associated together in the same district, and sometimes are accompanied by hematite beds; and it is also the case, that iron districts are characterized by the prevalence of one kind only of these ores, to the exclusion of the others.

The red oxides of the secondary rocks consist, for the most part, of the red fossiliferous and oolitic ores that accompany the so-called Clinton group of calcareous shales, sandstones, and argillaceous limestones of the upper silurian along their lines of outcrop in Pennsylvania, Maryland, and eastern Tennessee, and from Oneida county, N. Y., westward past Niagara Falls, and through Canada even to Wisconsin. The ore is found in one or two bands, rarely more than one or two feet thick, and the sandstone strata with which they are associated are sometimes so ferruginous as to be themselves workable ores. The true ores are sometimes entirely made up of the forms of fossil marine shells, the original material of which has been gradually replaced by peroxide of iron. The oolitic variety is composed of fine globular particles, united together like the roe of a fish. The ore is also found in compact forms, and in Wisconsin it is in the condition of fine sand or seed. Its composition is very variable, and its per-centage of iron ranges from 40 to 60. By reason of the carbonate of lime diffused through some of the varieties, these work in the blast furnace very freely, and serve extremely well to mix with the silicious ores.

Of the varieties of carbonate of iron, the only ones of practical importance in the United States are the silicious and argillaceous carbonates of the coal formation, and the similar ores of purer character found among the tertiary clays on the western shores of Chesapeake Bay. The former varieties are the chief dependence of the iron furnaces of Great Britain, where they abundantly occur in layers among the shales of the coal formation, interstratified with the beds of coal—the shafts that are sunk for the exploration of one also penetrating beds of the other. The layers of ore are in flattened blocks, balls, and kidney-shaped lumps, which are picked out from the shales as the beds of these are excavated. The ore is lean, affording from 30 to 40 per cent. of iron; but it is of easy reduction, and makes, when properly treated, iron of fair quality. In Pennsylvania, Ohio, western Virginia, Kentucky, and Tennessee, the ores occur with the same associations as in England; but the supply is, for the most part, very precarious, and many furnaces that have depended upon them are now kept in operation only by drawing a considerable portion of their supplies from the mines of Lake Superior, more than one thousand miles off. Among the horizontally stratified rocks west of the Alleghanies, the same bands of ore are traced over extensive districts, and are even recognized in several of the different states named. One of the most important of these bands is the buhrstone ore, so called from a cellular, flinty accompaniment which usually underlies it, the whole contained in a bed of peculiar fossiliferous limestone. So much carbonate of lime is sometimes present in the ore, that it requires no other flux in the blast furnace. Its per-centage of iron is from 25 to 35. Along the line of outcrop of some of the carbonates are found deposits of hematite ores, the result of superficial changes in the former, due to atmospheric agencies long continued. In southern Ohio, at Hanging Rock particularly, numerous furnaces have been supported by these ores, and have furnished much of the best iron produced at the west.

The carbonates of the tertiary are found in blocks and lumps among the clays along the shores of the Chesapeake at Baltimore, and its vicinity. The ores are of excellent character, work easily in the furnace, make a kind of iron highly esteemed—particularly for the manufacture of nails—and are so abundant that they have long sustained a considerable number of furnaces. They lie near the surface, and are collected by excavating the clay beds and sorting out the balls of ore. The excavations have been carried out in some places on the shore below the level of tide, the water being kept back by coffer dams and steam pumps.

Bog ores, with which the earliest furnaces in the country were supplied, are now little used. They are rarely found in quantities sufficient for running the large furnaces of the present day, and, moreover, make but an inferior, brittle quality of cast iron. They are chiefly found near the coast, and being easily dug, and also reduced to metal with great facility, they proved very convenient for temporary use before the great bodies of ore in the interior were reached. Some furnaces are still running on these ores in the south-west part of New Jersey, and at Snowhill, on the eastern shore of Maryland, and the iron they make is used to advantage in mixing at the great stove foundries in Albany and Troy with other varieties of cast iron. It increases the fluidity of these, and produces with them a mixture that will flow into and take the forms of the minutest markings of the mould.

Charcoal has been the only fuel employed in the manufacture of iron until anthracite was applied to this purpose, about the year 1840, and still later—in the United States—coke and bituminous coal. So long as wood continued abundant in the iron districts, it was preferred to the mineral fuel, as in the early experience of the use of the latter the quality of the iron it produced was inferior to that made from the same ores with charcoal, and even at the present time, most of the highest-priced irons are made with charcoal. The hard woods make the best coal, and after these, the yellow pine. Hemlock and chestnut are largely used, because of their abundance and cheapness. The charcoal furnaces are of small size compared with those using the denser mineral coal, and their capacity rarely exceeds a production of ten or twelve tons of pig iron in twenty-four hours. In 1840 they seldom made more than four tons a day; the difference is owing to larger furnaces, the use of hot blast, and much more efficient blowing machinery. The consumption of charcoal to the ton of iron is one hundred bushels of hard-wood coal at a minimum, and from this running up to one hundred and fifty bushels or more, according to the quality of the coal and the skill of the manager. The economy of the business depends, in great part, upon the convenience of the supplies of fuel and of ores, of each of which rather more than two tons weight are consumed to every ton of pig iron. As the woods are cut off in the vicinity of the furnaces, the supplies are gradually drawn from greater distances, till at last they are sometimes hauled from ten to fourteen miles. The furnaces near Baltimore have been supplied with pine wood discharged from vessels at the coaling kilns close by the furnaces. Transportation of the fuel in such cases is a matter of secondary importance.

The mineral coals are a more certain dependence in this manufacture, and are cheaply conveyed from the mines on the great lines of transportation, so that furnaces may be placed anywhere upon these lines, with reference more especially to proximity of ores. Thus they can be grouped together in greater numbers than is practicable with charcoal furnaces. Their establishment, however, involves the outlay of much capital, for the anthracite furnaces are all built upon a large scale, with a capacity of producing from twenty to thirty tons of pig iron a day. This requires machinery of great power to furnish the immense quantities of air, amounting in the large stacks to fifteen tons or more every hour, and propel it through the dense column, of fifty to sixty feet in height, of heavy materials that fill the furnace. The air actually exceeds in weight all the other materials introduced into the furnace, and its efficiency in promoting combustion and generating intensity of heat is greatly increased by the concentration to which it is subjected when blown in under a pressure of six or eight pounds to the square inch. It is rendered still more efficient by being heated to temperature sufficient to melt lead before it is introduced into the furnace; and this demands the construction of heating ovens, through which the blast is forced from the blowing cylinders in a series of iron pipes, arranged so as to absorb as much as possible of the waste heat from the combustible gases that issue from the top of the stack, and are led through these ovens before they are finally allowed to escape. The weight of anthracite consumed is not far from double that of the iron made, and the ores usually exceed in weight the fuel. The flux is a small and cheap item, its weight ranging from one-eighth to one-third that of the ores.

The location of furnaces with reference to the market for the iron is a consideration of no small importance, for the advantages of cheap material may be overbalanced by the difference of a few dollars in the cost of placing in market a product of so little value to the ton weight as pig iron.

The following statement presents the cost of the materials and of other items which go to make up the total expense of the production at different localities near the sea-board. The general expenses at the localities named are reduced to a low amount by the large scale upon which the business is conducted.

At different points on the Hudson river, anthracite furnaces are in operation, which are supplied with hematites from Columbia and Dutchess counties, N. Y., and from the neighboring counties in Massachusetts, at prices varying from $2.25 to $3.00 per ton; averaging about $2.50. They also use magnetic ores from Lake Champlain, and some from the Highlands below West Point, the latter costing $2.50, and the former $3.50 to $4.50 per ton; the average being about $3.50. The quantities of these ores purchased for the ton of iron produced are about two tons of hematite and one of magnetic ore, making the cost for the ores $6.75. Two tons of anthracite cost usually $9, and the flux for fuel about 35 cents. Actual contract prices for labor and superintendence have been $4 per ton. Thus the total expense for the ton of pig iron is about $20.10; or, allowing for repairs and interest on capital, full $21.

In the Lehigh valley, in Pennsylvania, are numerous furnaces, which are supplied with anthracite at the low rate of $3 per ton, or $6 to the ton of iron. The ores are mixed magnetic and hematites, averaging in the proportions used about $3 per ton, or, at the rate consumed of 2½ tons, $7.50 to the ton of iron. Allowing the same amount—$4.35—for other items, as at the Hudson river furnaces, the total cost is $17.85; or, with interest and repairs, nearly $19 per ton. The difference is in great part made up to the furnaces on the Hudson by their convenience to the great markets of New York, Troy, and Albany.

The charcoal iron made near Baltimore shows a higher cost of production than either of the above, and it is also subject to greater expenses of transportation to market, which is chiefly at the rolling mills and nail factories of Massachusetts. Its superior quality causes a demand for the product and sustains the business. For this iron per ton 2½ tons of ore are consumed, costing $3.62½ per ton, or $9.06; fuel, 3½ cords at $2.50, $8.75; flux, oyster shells, 30 cts.; labor (including $1.50 for charring) $2.75; other expenses, $2; total, $22.86.

At many localities in the interior of Pennsylvania and Ohio, iron is made at less cost, but their advantages are often counterbalanced by additional expenses incurred in delivering the metal, and obtaining the proceeds of its sale. Increased facilities of transportation, however, are rapidly removing these distinctions. At Danville, on the Susquehanna river, Columbia county, Pennsylvania, the cost of production has been reduced to an unusually low amount, by reason of large supplies of ore close at hand, the cheapness of anthracite, and the very large scale of the operations. Pig iron, as shown by the books of the company, has been made for $11 per ton. Its quality, however, was inferior, so that, with the expenses of transportation added, it could not be placed in the eastern markets to compete with other irons. The rolling mills connected with the furnaces afforded the means of converting it into railroad bars, with which, from the increased value of the iron, the cost of transportation was of less moment.

DISTRIBUTION OF THE ORES.

The magnetic and specular ores of the United States are found in the belt of metamorphic rocks—the gneiss, quartz rock, mica and talcose slates, and limestones—which ranges along to the east of the Alleghanies, and spreads over the principal part of the New England states. It is only, however, in certain districts, that this belt is productive in iron ores. The hematites belong to the same group, and the important districts of the three ores may be noticed in the order in which they are met from Canada to Alabama. Similar ores are also abundant in Missouri, and to the south of Lake Superior.

New England States.—In New Hampshire magnetic and specular ores are found in large quantities in a high granitic hill called the Baldface Mountain, in the town of Bartlett. The locality is not conveniently accessible, and its remoteness from coal mines will probably long keep the ore, rich and abundant as it is, of no practical value. At Piermont, on the western border of the state, specular ore, very rich and pure, is also abundant, but not worked. At Franconia a small furnace, erected in 1811, was run many years upon magnetic ores, obtained from a bed of moderate size, and which in 1824 had been worked to the depth of 200 feet. In 1830 the iron establishments of this place were still objects of considerable interest, though from the accounts of them published in the *American Journal of Science* of that year, it appears that the annual production of the blast furnace for the preceding nine years had averaged only about "216 tons of cast iron in hollow ware, stoves, machinery, and pig iron"—a less quantity than is now produced in a week by some of the anthracite furnaces. One forge making bar iron direct from the ore produced forty tons annually, and another 100 tons, consuming 550 bushels of charcoal to the ton. The cost of this, fortunately, was only from $3.75 to $4.00 per hundred bushels. A portion of the product was transported to Boston, the freight alone costing $25 per ton.

In Vermont these ores are found in the metamorphic slates of the Green Mountains, and are worked to some extent for mixing with the hematite ores, which are more abundant, being found in many of the towns through the central portion of the state, from Canada to Massachusetts. In 1850 the number of blast furnaces was ten, but their production probably did not reach 4,000 tons per annum, and has since dwindled away to a much less amount. At the same time there were seven furnaces in Berkshire, Mass., near the hematite beds that are found in the towns along the western line of the state. These had a working capacity of about 12,000 tons of pig iron annually, and this being made from excellent ores, with charcoal for fuel, its reputation was high and the prices remunerative; but as charcoal increased in price, and the cheaper anthracite-made iron improved in quality, the business became unprofitable; so that the extensive hematite beds are now chiefly valuable for furnishing ores to the furnaces upon the Hudson river, where anthracite is delivered from the boats that have come through the Delaware and Hudson canal, and magnetic ores are brought by similar cheap conveyance from the mines on the west side of Lake Champlain. Through Connecticut, down the Housatonic valley, very extensive beds of hematite have supplied the sixteen furnaces which were in operation ten years ago. The great Salisbury bed has already been named. In the first half of the present century it produced from 250,000 to 300,000 tons of the very best ore; the iron from which, when made with cold blast, readily brought from $6 to $10 per ton more than the ordinary kinds of pig iron. The Kent ore bed was of similar character, though not so extensive.

New York.—Across the New York state line, a number of other very extensive deposits of hematite supported seven blast furnaces in Columbia and Dutchess counties, and now furnish supplies to those along the Hudson river. In Putnam county, magnetic ores succeed the hematites, and are developed in considerable beds in Putnam Valley, east from Cold Spring, where they were worked for the supply of forges during the last century. These beds can again furnish large quantities of rich ore. On the other side of the river, very productive mines of magnetic ore have been worked near Fort Montgomery, six miles west from the river. At the Greenwood furnace, back from West Point, was produced the strongest cast iron ever tested, which, according to the report of the officers of the ordnance department, made to Congress in 1856, after being re-melted several times to increase its density, exhibited a tenacity of 45,970 lbs. to the square inch. The beds at Monroe, near the New Jersey line, are of vast extent; but a small portion of the enormous quantities of ore in sight, however, makes the best iron. Mining was commenced here in 1750, and a furnace was built in 1751, but operations have never been carried on upon a scale commensurate with the abundance of the ores. In the northern counties of New York, near Lake Champlain, are numerous mines of rich magnetic ores. Some of the most extensive bloomary establishments in the United States are supported by them in Clinton county, and many smaller forges are scattered along the course of the Ausable river, where water power near some of the ore beds presents a favorable site. Bar iron is made at these establishments direct from the ores; and at Keeseville nail factories are in operation, converting a portion of the iron into nails. In Essex county there are also many very productive mines of the same kind of ore, and Port Henry and its vicinity has furnished large quantities, not only to the blast furnaces that were formerly in operation here, but to those on the Hudson, and to puddling furnaces in different parts of the country, particularly about Boston. In the interior of Essex county, forty miles back from the lake, are the extensive mines of the Adirondac. The ores are rich as well as inexhaustible, but the remoteness of the locality, and the difficulty attending the working of them, owing to their contamination with titanium, detract greatly from their importance. On the other side of the Adirondac mountains, in St. Lawrence county, near Lake Ontario, are found large beds of specular ores, which have been worked to some extent in several blast furnaces. They occur along the line of junction of the granite and the Potsdam sandstone. The iron they make is inferior—suitable only for castings. The only other ores of any importance in the state are the fossiliferous ores of the Clinton group, which are worked near Oneida Lake, and at several points along a narrow belt of country near the south shore of Lake Ontario. They have sustained five blast furnaces in this region, and are transported in large quantities by canal to the anthracite furnaces at Scranton, in Pennsylvania, the boats returning with mineral coal for the furnaces near Oneida Lake.

New Jersey.—From Orange county, in New York, the range of gneiss and hornblende rocks, which contain the magnetic and specular ores, passes into New Jersey, and spreads over a large part of Passaic and Morris, and the eastern parts of Sussex and Warren counties. The beds of magnetic ore are very large and numerous, and have been worked to great extent, especially about Ringwood, Dover, Rockaway, Boonton, and other towns, both in blast furnaces and in bloomaries. At Andover, in Sussex county, a great body of specular ores furnished for a number of years the chief supplies for the furnaces of the Trenton Iron Company, situated at Philipsburg, opposite the mouth of the Lehigh. On the range of this ore, a few miles to the north-east, are extensive deposits of Franklinite iron ore accompanying the zinc ore of this region. This unusual variety of ore consists of peroxide of iron about 66 per cent., oxide of zinc 17, and oxide of manganese 16. It is smelted at the works of the New Jersey Zinc Company at Newark, producing annually about 2,000 tons of pig iron. The metal is remarkable for its large crystalline faces and hardness, and is particularly adapted for the manufacture of steel, as well as for producing bar iron of great strength.

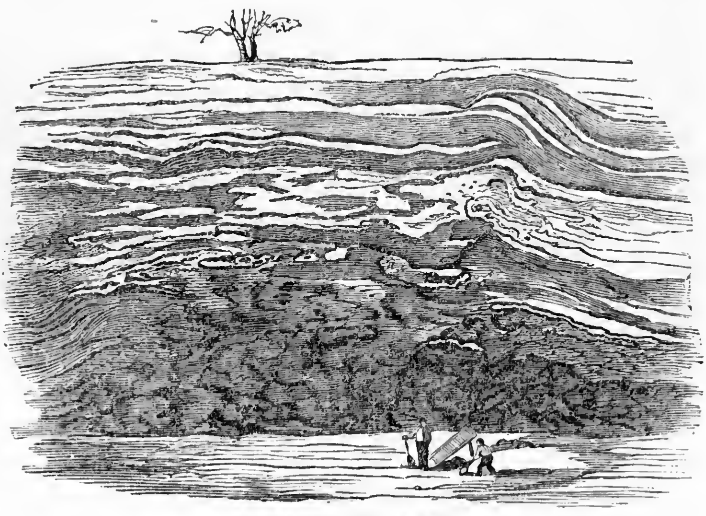
As the forests, which formerly supplied abundant fuel for the iron works of this region, disappeared before the increasing demands, attention was directed to the inexhaustible sources of anthracite up the Lehigh valley in Pennsylvania, with which this iron region was connected by the Morris canal and the Lehigh canal; and almost the first successful application of this fuel to the smelting of iron ores upon a large scale was made at Stanhope, by Mr. Edwin Post. A new era in the iron manufacture was thus introduced, and an immense increase in the production soon followed, as the charcoal furnaces gave place to larger ones constructed for anthracite. The Lehigh valley, lying on the range of the iron ores toward the southwest, also produced large quantities of ore, which, however, was almost exclusively hematite. Hence, an interchange of ores has been largely carried on for furnishing the best mixtures to the furnaces of the two portions of this iron district; and the operations of the two must necessarily be considered together. The annual production, including that of the bloomaries of New Jersey, has reached, within a few years, about 140,000 tons of iron. But in a prosperous condition of the iron business this can be largely increased without greatly adding to the works already established, while the capacity of the iron mines and supplies of fuel are unlimited. The proximity of this district to the great cities, New York and Philadelphia, adds greatly to its importance.

Pennsylvania.—Although about one-third of all the iron manufactured in the United States is the product of the mines of Pennsylvania, and of the ores carried into the state, the comparative importance of her mines has been greatly overrated, and their large development is rather owing to the abundant supplies of mineral coal conveniently at hand for working the ores, and, as remarked by Mr. Lesley ("Iron Manufacturer's Guide," p. 433), "to the energetic, persevering German use for a century of years of what ores do exist, than to any extraordinary wealth of iron of which she can boast. Her reputation for iron is certainly not derived from any actual pre-eminence of mineral over her sister states. New York, New Jersey, Virginia, and North Carolina, are far more liberally endowed by nature in this respect than she. The immense magnetic deposits of New York and New Jersey almost disappear just after entering her limits. The brown hematite beds of her great valley will not seem extraordinary to one who has become familiar with those of New York, Massachusetts, Vermont, Virginia, and Tennessee. Her fossil ores are lean and uncertain compared with those of the south; and the carbonate and hematized carbonate outcrops in and under her coal measures will hardly bear comparison with those of the grander outspread of the same formations in Ohio, Kentucky, and western Virginia." The principal sources of iron in the state are, first, the hematites of Lehigh and Berks counties—the range continuing productive through Lancaster, also on the other side of the intervening district of the new red sandstone formation. The ores are found in large beds in the limestone valley, between the South and the Kittatinny mountains; those nearest the Lehigh supply the furnaces on that river, already amounting to twenty-three in operation and four more in course of construction, and those nearer the Schuylkill supply the furnaces along this river. The largest bed is the Moselem, in Berks county, six miles west-south-west from Kutztown. It has been very extensively worked, partly in open excavation and partly by underground mining, the workings reaching to the depth of 165 feet. Over 20,000 tons a year of ore have been produced, at a cost of from $1.30 to $1.50 per ton.

Magnetic ores are found upon the Lehigh, or South mountain, the margin on the south of the fertile limestone valley which contains the hematite beds. These, however, are quite unimportant, the dependence of the great iron furnaces of the Lehigh for these ores being on the more extensive mines of New Jersey; while the only supplies of magnetic ores to the furnaces of the Schuylkill and the Susquehanna are from the great Cornwall mines, four miles south of Lebanon. An immense body of magnetic iron ore, associated with copper ores, has been worked for a long time at this place, at the junction of the lower silurian limestones and the red sandstone formation. The bed lies between dikes of trap, and exhibits peculiarities that distinguish it from the other bodies of iron ore on this range. The Warwick, or Jones' mine, in the south corner of Berks county, resembles it in some particulars. Its geological position is in the upper slaty layers of the Potsdam sandstone, near the meeting of this formation with the new red sandstone. Trap dikes penetrate the ore and the slates, and the best ore is found at both mines near the trap. Copper ores are also found in connection with the iron ores, but not in workable quantities. The Warwick mine has been worked more than seventy-five years, and has yielded for twenty years together an average of 7,000 tons of ore. Other magnetic ores are found in Lancaster and Chester counties, but are quite unimportant as sources of iron. Along the Maryland line, on both sides of the Susquehanna, chrome iron has been found in considerable abundance in the serpentine rocks, and has been largely and very profitably mined for home consumption and for exportation. It furnishes the different chrome pigments, and their preparation has been carried on chiefly at Baltimore.

A portion of the hematites which supply the furnaces on the Schuylkill, occur along a narrow limestone belt of about a mile in width, that crosses the Schuylkill at Spring Mill, and extends north-east into Montgomery county, and south-west into Chester county. Their production has been very large, and that of the furnaces of the Schuylkill valley dependent upon these and the other mines of this region has been rated at 100,000 tons of iron annually.

The great Chestnut hill hematite ore bed, three and a half miles north-east of Columbia, Lancaster county, covers about twelve acres of surface, and has been worked in numerous great open excavations to about 100 feet in depth, the ore prevailing throughout among the clays and sands from top to bottom. "The floor of the mine is hard, white Potsdam sandstone, or the gray slaty layers over it. The walls show horizontal wavy layers of blue, yellow, and white laminated, unctuous clays, from forty to sixty feet deep, containing ore, and under these an irregular layer of hard concretionary, cellular, fibrous, brown hematite from ten to thirty feet thick down to the sandstone." ("Iron Manufacturer's Guide, p. 562.") In the accompanying wood-cut, the darkly shaded portions represent the hematites, while the lighter portions above are chiefly clays. Professor Rogers supposes that the ore has leached down from the upper slaty beds through which it was originally diffused, and has collected upon the impervious sandstone, which in this vicinity is the first water bearing stratum for the wells.



CHESTNUT HILL MINE.

The repeated occurrence of the lower silurian limestones and sandstones along the valleys of central Pennsylvania, from the Susquehanna to the base of the Alleghany mountain, is accompanied through these valleys with numerous beds of hematite; and to the supplies of ore they have furnished for great numbers of furnaces, is added the fossiliferous ore of the Clinton group, the outcrop of which is along the slopes of the ridges and around their ends. Many furnaces have depended upon this source of supply alone. As stated by Lesley, there were, in 1857, 14 anthracite furnaces that used no other, and 11 anthracite furnaces which mixed it either with magnetic ore or hematite, or with both. Montour's ridge, at Danville, Columbia county, referred to on page 24, is one of the most remarkable localities of this ore. Professor Rogers estimated, in 1847, that there were 20 furnaces then dependent upon the mines of this place, and producing annually an average of 3,000 tons of iron each, with a consumption of 9,000 tons of ore, or a total annual consumption of 180,000 tons. At this rate, he calculated that the available ore would be exhausted in 20 years.

Between the Clinton group and the coal measures are successive formations of limestones, sandstones, shales, etc., which form a portion of the geological column of many thousand feet in thickness; and among these strata, ores like the carbonates of the coal measures are occasionally developed, and these are recognized and worked at many localities along the outcrop of the formations to which they belong. Though of some local importance, they do not add very largely to the iron production of the state. Along the summit of the Alleghany mountain the base of the coal measures is reached, which thence spread over the western portion of the state, nearly to its northern line. The ores which belong to this formation are chiefly contained among its lower members, and found in the outcrop of these around the margin of the basin. At some localities they have been obtained in considerable abundance, and many furnaces have run upon them alone; but for large establishments of several furnaces together, they prove a very uncertain dependence.

Maryland.—The metamorphic belt crosses this state back of Baltimore, and is productive in chromic iron and copper ores, rather than in magnetic and specular ores. Some of the former, highly titaniferous, have been worked near the northern line of the state, on the west side of the Susquehanna; and at Sykesville, on the Potomac, a furnace has been supplied with specular ores from its vicinity. Several hematite beds within twenty miles of Baltimore have supplied considerable quantities of ore for mixture with the tertiary carbonates, upon which the iron production of the state chiefly depends. Beds of these occur near the bay from Havre de Grace to the District of Columbia. In the western part of the state large furnaces were built at Mount Savage and Lonaconing to work the ores of the coal formation; but the supply has proved insufficient to sustain them. In 1853 the capacity of the blast furnaces of the state was equal to a production of over 70,000 tons of iron. This, however, has never been realized.

Southern States.—South of Maryland the same iron belt continues through Virginia, the Carolinas, and Georgia; and although it is often as productive in immense beds of the three varieties of ore—the magnetic, specular, and hematite—as in the other states along its range, these resources add comparatively little to the material wealth of the states to which they belong. Through Virginia, east and west of the Blue Ridge, hematite ores abound in the limestone valleys, and magnetic ores are often in convenient proximity to them. Many small furnaces have worked them at different times, but their product was always small. Three belts of magnetic ore, associated with specular iron and hematites, are traced across the midland counties of North Carolina, and have furnished supplies for furnaces and forges in a number of counties—as Lincoln, Cleveland, Rutherford, Stokes, Surry, Yadkin, Catawba; and Chatham, Wake, and Orange counties upon the eastern belt. The belt of ore from Lincoln county passes into South Carolina, and through York, Union, and Spartanburg districts. It crosses the Broad River at the Cherokee ford, and though the whole belt is only half a mile wide, it presents numerous localities of the three kinds of ore, and of limestone also in close proximity, and finely situated for working. Several other localities are noticed in the "State Geological Report," by M. Tuomey, who remarks, on page 278, that "if iron is not manfactured in the state as successfully as elsewhere, it is certainly not due to any deficiency in natural advantages." In northern Georgia the ferruginous belt is productive in immense bodies of hematite, associated with magnetic and specular ores, in the Allatoona hills, near the Etowah river, in Cherokee and Cass counties. This, which appears to be one of the great iron districts of the United States, though bountifully provided with all the materials required in the manufacture, and traversed by a railroad which connects it with the bituminous coal mines of eastern Tennessee, supports only six small charcoal furnaces of average capacity, not exceeding 600 or 700 tons per annum each. In Alabama, hematites and specular ores accompany the belt of silurian rocks to its southern termination, and are worked in a few bloomary fires and two or three blast furnaces. The fossiliferous ore of the Clinton group is also worked in this state.

Tennessee in 1840 ranked as the third iron-producing state in the Union. The counties ranging along her eastern border produced hematite ores, continuing the range of the silurian belt of the great valley of Virginia; those bordering the Clinch river produced the fossil ore of the Clinton group, there known as the dyestone ore; and western Tennessee presented a very interesting and important district of hematites belonging to the subcarboniferous limestone in the region lying east of the Tennessee and south of the Cumberland river.* The

* "It is remarkable that most of these deposits

furnaces of this district, which have numbered 42 in all, were the greater part of them in Dickson, Montgomery, and Stewart counties. They were all supplied with charcoal for fuel, at a cost of $4 per hundred bushels. In 1854 the product of pig iron was 37,918 tons; but it gradually declined to 27,050 tons in 1857; and in August, 1858, only 15 furnaces were in operation. The secretary of the American Iron Association, in his report of 1858, remarks that in spite of the old establishments of the manufacture, and wealth of ore deposits south of the Kentucky-Tennessee line, the capital and energy of the trade is moving northward down the two great rivers of that region toward the Ohio and its rolling mills.

Kentucky.—The western part of this state contains, in the counties of Calloway, Trigg, Lyon, Caldwell, Livingston, and Crittenden, an important district of hematite ores—the continuation northward of that of Tennessee. In 1857 10 charcoal furnaces produced 15,600 tons of iron. Eastern Kentucky, however, has a much more productive district in the counties of Carter and Greenup, which is an extension south of the Ohio of the Hanging Rock iron district of Ohio. The ores are carbonates and hematite outcrops of carbonates, belonging to the coal measures and the subcarboniferous limestone. They are in great abundance; a section of 740 feet of strata terminating below with the limestone named, presenting no less than 14 distinct beds of ore, from three inches to four feet each, and yielding from 25 to 60 per cent. of iron. One bed of 32 per cent. iron contains also 11 per cent. bitumen—a composition like that of the Scotch "black band" ore. Others contain so much lime, that the ores are valuable for fluxing as well as for producing iron. The furnaces use charcoal and coke. Their production, taken with that of the same district in Ohio, places this region, as will be seen in the tables to follow, among the first in importance in the United States.

Ohio.—The ores of this state, like those of Kentucky, belong almost exclusively to the coal measures and the limestone formations beneath. In both states some of the fossiliferous ore also is found, but it is comparatively unimportant. The productive beds are near the base of the coal formation, ranging from the Hanging Rock district of Scioto and Lawrence counties north-east through Jackson, Hocking, Athens, Perry, Muskingum, Tuscarawas, Mahoning, and Trumbull counties, to the line of Mercer county in Pennsylvania. The uncertain character of the ores, both as to supply and quality, is strikingly shown by the fact that many of the furnaces of the more northern counties depend for a considerable portion —one-fourth or more—of the ores they use upon the rich varieties from Lake Superior and Lake Champlain. Although the long transportation makes these ores cost nearly three times as much per ton as those of the coal formation, some furnaces find it more profitable to use the former, even in the proportion of three-fourths, on account of the much better iron produced, the greater number of tons per day, and the less consumption of fuel to the ton. The fuel employed is charcoal in many of the furnaces; some have introduced raw bituminous coal to good advantage.

Indiana, Illinois, and Iowa contain no important bodies of iron ore. The coal measures, which cover large portions of these states, are productive in some small quantities of the carbonates, in the two former, which give support to a very few furnaces; but in Iowa they contain no workable beds at all.

Michigan.—The iron region of this state is in the upper peninsula, between Green Bay and Lake Superior. Magnetic and specular ores are found throughout a large portion of this wild territory, in beds more extensive than are seen in any other part of the United States—perhaps than are anywhere known. The district approaches within twelve miles of the coast of Lake Superior, from which it is more conveniently reached than from the south side of the peninsula. The ores are found in a belt of crystalline slates, of six to ten miles in

are of what is called pot ore, that is, hollow balls of ore, which, when broken open, look like broken caldrons. One of them, preserved by Mr. Lewis, is 8 feet across the rim! Another is six feet across. The majority are crossed within by purple diaphragms or partitions of ore, and the interstitial spaces are filled with yellow ochre. Some, like the great eight-foot pot, are found to be full of water. The inside surface is mammillary, irregular, sometimes botryoidal or knobby, but the outside is pretty smooth and regular. All these pots were undoubtedly once balls of carbonates of lime and iron segregated in the original deposit. . . . Gypsum and pyrites are both often found in these Tennessee pots."—*Iron Manufacturer's Guide, p.* 603.

width, that extends west from the lake shore, and is bounded north and south by a granitic district. They are developed in connection with great dikes and ridges of trap, which range east and west, and dip with the slates at a high angle toward the north. The ores also have the same direction and dip. Localities of them are of frequent occurrence for eighteen miles in a westerly direction from the point of their nearest approach to Lake Superior. A second range of the beds is found along the southern margin of the slate district; and about thirty miles back from the lake, where the slates extend south into Wisconsin, similar developments of ore accompany them to the Menomonee river and toward Green Bay. The quality of the ore found at different places varies according to the amount of quartz, jasper, hornblende, or feldspar that may be mixed with it; but enormous bodies are nearly pure ore, yielding from 68 to 70 per cent. of iron, and free from a trace even of manganese, sulphur, phosphorus, or titanium. A single ridge, traced for about six miles, rising to a maximum height ot fifty feet above its base, and spreading out to a width of one thousand feet, has been found to consist of great longitudinal bands of ore, much of which is of this perfectly pure character. Another ridge presents precipitous walls fifty feet high, composed in part of pure specular ore, fine grained, of imperfect slaty structure, and interspersed with minute crystals of magnetic oxide; and in part of these minute crystals alone. Another body of one thousand feet in width, and more than a mile long, forms a hill one hundred and eighty feet high, which is made up of alternate bands of pure, fine grained, steel-gray peroxide of iron, and deep red jaspery ore—the layers generally less than a fourth of an inch in thickness, and curiously contorted. Their appearance is very beautiful in the almost vertical walls. On one of the head branches of the Esconaba is a cascade of thirty-seven feet in height, the ledge over which the water falls being a bed of peroxide of iron, intermixed with silicious matter.

For the supply of the few furnaces and bloomary establishments already in operation in this district, and for the larger demands of distant localities, the ores are collected from open quarries, and from the loose masses lying around. A railroad affords the means of transporting them to Marquette, on the lake shore, whence they are shipped by vessels down the lake. The business already amounts to more than 100,000 tons per annum, and is increasing very rapidly. The name Bay de Noquet and Marquette railroad suggests a southern terminus of this road on Green Bay, and when an outlet is opened in this direction, the production of iron ores will no doubt exceed that of any other region upon the globe. Large quantities will be reduced with charcoal in blast furnaces and bloomaries in the region itself; and when the forests in the vicinity of the works are cut off, the extensive timbered lands around Lake Michigan and Lake Huron will furnish inexhaustible supplies of fuel, which may be brought in vessels to the furnaces, as the pine wood from the forests around Chesapeake Bay has long been delivered to the furnaces on its western shore. Anthracite and bituminous coal will also be brought back as return cargoes by the vessels that carry the ores to the coal fields of Ohio and Pennsylvania. With its vast inland navigation and wonderful resources of iron and of copper also, the north-western portion of our country promises to be the scene of a more extended and active industry than has ever grown out of the mines of any part of the world.

Wisconsin.—Magnetic and specular ores in bodies, somewhat resembling those of the region just described, are found in the extreme northern part of Wisconsin, upon what is known as the Penokie range, distant about 25 miles from Chegwomigon Bay, Lake Superior. Bad River and Montreal River drain this district. The ores, from their remoteness, are not soon likely to be of practical importance. Other immense bodies of these ores, estimated to contain many millions of tons, are found on Black River, which empties into the Mississippi below St. Croix river, on the line of the Land Grant Branch railroad. A furnace has been built by a German company to work these mines. In the eastern part of Wisconsin the oolitic ore of the Clinton group is met with in Dodge and Washington counties, and again at Depere, seven miles south-east of Green Bay. In the town of Hubbard, Dodge county, forty miles west from Lake Michigan, is the largest deposit of this ore ever discovered. It spreads in a layer ten feet thick over 500 acres, and is estimated to contain 27,000,000 tons. It is in grains, like sand, of glistening red color, staining the hands. Each grain has a minute nucleus of silex, around which the oxide of iron collected. The per-centage of metal is about fifty. This ore will probably be worked near Milwaukee with Lake Superior ores, the La Crosse railroad, which passes by the locality, already affording the means of cheap transportation.

Missouri.—This state must be classed among the first in the abundance of its iron ores, though up to this time comparatively little has been done in the development of its mines. The ores are exclusively hematites, and the magnetic and specular, and all occur in the isolated district of silurian rocks—formations which almost everywhere else in the western middle states are concealed beneath the more recent formations. In the counties along the line of the Pacific railroad south-west branch, Prof. Swallow, the state geologist, reports no less than ninety localities of hematite. These are in Jefferson, Franklin, Crawford, Phelps, Pulaski, Marion, Green, and other counties. The first attempts to melt iron in Missouri, and probably in any state west of Ohio, were made in Washington county, in 1823 or 1824, and with the hematites of the locality were mixed magnetic ores from the Iron mountain. In Franklin county there is but one furnace, though on both sides of the Maramec are beds of hematite pipe ore, which cover hundreds of acres. The Iron mountain district is about sixty miles back from the Mississippi river (the nearest point on which is St. Genevieve), and extends from the Iron mountain in the south-east part of Washington county into Madison county. It includes three important localities of specular ore: the Iron Mountain, Pilot Knob, and Shepherd mountain. The first is a hill of gentle slopes, 228 feet high above its base, and covering about 500 acres—a spur of the porphyritic and syenitic range on the east side of Bellevue valley. In its original state, as seen by the writer in 1841, it presented no appearance of rock in place, its surface was covered with a forest of oak, the trees thriving in a soil wholly composed of fragments of peroxide of iron, comminuted and coarse mixed together. Loose lumps of the ore were scattered around on every side but the north, and upon the top were loose blocks of many tons weight each. Mining operations, commenced in 1845, developed only loose ore closely packed with a little red clay. An Artesian well was afterward sunk to the depth of 152 feet. It passed through the following strata in succession: iron ore and clay, 16 feet; sandstone, 34 feet; magnesian limestone, 7½ inches; gray sandstone, 7½ inches; "hard blue rock," 37 feet; "pure iron ore," 5 feet; porphyritic rock, 7 feet; iron ore 50 feet to the bottom. The ore appears to be interstratified with the silicious rocks with which it is associated in a similar manner to its occurrence at the other localities, and data are yet wanting to determine how much may exist in the hill itself, as well as below it. Enough is seen to justify any operations, however extensive, that depend merely upon continued supplies of ore. In quality the ore is a very pure peroxide; it melts easily in the furnace, making a strong forge pig, well adapted for bar iron and steel. Two charcoal furnaces have been in operation for a number of years, and up to the close of 1854 had produced 24,600 tons of iron. The flux is obtained from the magnesian limestone, which spreads over the adjoining valley in horizontal strata.

Pilot Knob is a conical hill of 580 feet height above its base, situated six miles south of the Iron mountain. Its sides are steep, and present bold ledges of hard, slaty, silicious rock, which lie inclined at an angle of 25° to 30° toward the south-west. Near the top the strata are more or less charged with the red peroxide of iron, and loose blocks of great size are seen scattered around, some of them pure ore, and some ore and rock mixed. At the height of 440 feet above the base, where the horizontal section of the mountain is equal to an area of fifty-three acres, a bed of ore is exposed to view on the north side, which extends 273 feet along its line of outcrop, and is from nineteen to twenty-four feet in thickness. It is included in the slaty rocks, and dips with them. Other similar beds are said to occur lower down the hill; and higher up others are met with to the very summit. The peak of the mountain is a craggy knob of gray rocks of ore, rising sixty feet in height, and forming so conspicuous an object as to have suggested the name by which the hill is called. The ore is generally of more slaty structure than that of the Iron mountain, and some of it has a micaceous appearance. The quantity of very pure ore conveniently at hand is inexhaustible. The production of iron will be limited more for want of abundance of fuel than of ore. Charcoal, however, may be obtained in abundance for many years to come, and bituminous coal may also be brought from the coal mines of Missouri and Illinois, as the ores also can be carried to the river to meet there the fuel. The locality is already connected with St. Louis by a railroad. A blast furnace was built here in 1846, and another in 1855. A bloomary with six fires was started in 1850, and has produced blooms at an estimated cost of $30 per ton.

Shepherd mountain, about a mile distant from the Pilot Knob toward the south-west, is composed of porphyritic rocks, which are penetrated with veins or dikes of both magnetic and specular ores. These run in various directions, and the ores they afford are of great purity. They are mined to work together with those of the Pilot Knob. The mountain covers about 800 acres, and rises to the height of 660 feet above its base. Other localities of these ores are also known, and the occurrence of specular ore is reported by the state geologists in several other counties, as Phelps, Crawford, Pulaski, La Clede, etc.

In other parts of the United States and its territories great bodies of iron ore are known to exist, which will probably become valuable at some future time. In Arkansas are found very pure magnetic ores, remarkable for their high magnetic property. Near Santa Fé, in New Mexico, specular ores abound, which must before long be used to furnish the iron required for that region, instead of transporting it, as at present, at heavy cost from the iron districts near the Mississippi river. In California reports are made of the existence of masses of rich ores, comparable in extent even with those of Lake Superior.

IRON MANUFACTURE.

Iron is known in the arts chiefly in three forms—cast iron, steel, and wrought iron. The first is a combination of metallic iron, with from $1\frac{1}{2}$ to 5 or $5\frac{1}{2}$ per cent. of carbon; the second is metallic iron combined with $\frac{1}{2}$ to $1\frac{1}{2}$ per cent. of carbon; and the third is metallic iron, free as may be from foreign substances. These differences of composition are accompanied with remarkable differences in the qualities of the metal, by which its usefulness is greatly multiplied. The three sorts are producible as desired directly from the ores, and they are also convertible one into the other; so that the methods of manufacture are numerous, and new processes are continually introduced. The production of wrought iron direct from the rich natural oxides, was until modern times the only method of obtaining the metal. Cast iron was unknown until the 15th century. Rude nations early learned the simple method of separating the oxygen from the ores by heating them in the midst of burning charcoal; the effect of which is to cause the oxygen to unite with the carbon in the form of carbonic acid or carbonic oxide gas, and escape, leaving the iron free, and in a condition to be hammered at once into bars. The heat they could command in their small fires was insufficient to effect the combination of the iron, too, with the carbon, and produce the fusible compound known as cast iron. In modern times the great branch of the business is the production of pig metal or cast iron in blast furnaces; and this is afterward remelted and cast in moulds into the forms required, or it is converted into wrought iron to serve some of the innumerable uses of this kind of iron, or to be changed again into steel. In this order the principal branches of the manufacture will be noticed.

The production of pig metal in blast furnaces is the most economical mode of separating iron from its ores, especially if these are not extremely rich. The process requiring little labor, except in charging the furnaces, and this being done in great part by labor-saving machines, it can be carried on upon an immense scale with the employment of few persons, and most of those ordinary laborers. The business, moreover, has been greatly simplified and its scale enlarged by the substitution of mineral coal for charcoal—the latter fuel, indeed, could never have been supplied to meet the modern demands of the manufacture.

Blast furnaces are heavy structures of stone work, usually in pyramidal form, built upon a base of 30 to 45 feet square, and from 30 to 60 feet in height. The outer walls, constructed with immense solidity and firmly bound together, inclose a central cavity, which extends from top to bottom and is lined with large fire brick of the most refractory character, and specially adapted in their shapes to the required contour of the interior. The form of this cavity is circular in its horizontal section, and from the top goes on enlarging to the lower portion, where it begins to draw in by the walls changing their slope toward the centre. This forms what are called the boshes of the furnace—the part which supports the great weight of the ores and fuel that fill the interior. For ores that melt easily and fast they are made steeper than for those which are slowly reduced. The boshes open below into the hearth—the central contracted space which the French name the crucible of the furnace. The walls of this are constructed of the most refractory stones of large size, carefully selected for their power to resist the action of fire, and seasoned by exposure for a year or more after being taken from the quarry. Being the first portion to give out, the stack is built so that they can be replaced when necessary. The hearth is reached on each side of the stack by an arch, extending in from the outside. On three sides the blast is introduced by iron pipes that pass through the hearth-stones, and terminate in a hollow tuyere, which is kept from melting by a current of water brought by a lead pipe, and made to flow continually through and around its hollow shell. (See fig. *d.*) The fourth side is the front or working-arch of the furnace, at the bottom of which access is had to the melted materials as they collect in the receptacle provided for them at the base of the hearth or crucible. This arch opens out into the casting-house, upon the floor of which are the beds in the sand for moulding the pigs into which the iron is to be cast. Upon the top of the stack around the central cavity are constructed, in first-class furnaces, large flues, which open into this cavity for the purpose of taking off a portion of the heated gaseous mixtures, that they may be conveyed under the boilers, to be there more effectually consumed, and furnish the heat for raising steam for the engines. A portion of the gases is also led into a large heating-oven, usually built on the top of the stack, in which the blast (distributed through a series of cast iron pipes) is heated by the combustion. These pipes are then concentrated into one main, which passes down the stack and delivers the heated air to the tuyeres, thus returning to the furnace a large portion of the heat which would otherwise escape at the top, and adding powerfully to the efficiency of the blast by its high temperature. The boilers, also conveniently arranged on the top of the furnace, especially when two furnaces are constructed near together, are heated by the escape gases without extra expense of fuel, and they furnish steam to the engines, which are usually placed below them. On account of the enormous volume of air, and the great pressure at which it is blown into the furnace, the engines are of the most powerful kind, and the blowing cylinders are of great dimensions and strength. Some of the large anthracite furnaces employ cylinders 7½ feet diameter, and 9 feet stroke. One of these running at the rate of 9 revolutions per minute, and its piston acting in both directions, should propel every minute 7,128 cubic feet of. air (less the loss by leakage) into the furnace—a much greater weight than that of all the other materials introduced. It is, moreover, driven in at a pressure (produced by the contracted aperture of the nozzle of the tuyeres in relation to the great volume of air) of 7 or 8 lbs. upon the square inch. Two such cylinders answer for a pair of the largest furnaces, and should be driven by separate engines, so that in case of accident the available power may be extended to either or both furnaces. It is apparent that the engines, too, should be of the largest class and most perfect construction; for the blast is designed to be continued with only temporary interruptions that rarely exceed an hour at a time, so long as the hearth may remain in running order—a period, it may be, of 18 months, or even 4 or 5 years. Furnaces were formerly built against a high bank, upon the top of which the stock of ore and coal was accumulated, and thence carried across a bridge, to be delivered into the tunnel-head or mouth of the furnace. The more common arrangement at present is to construct, a little to one side, an elevator, provided with two platforms of sufficient size to receive several barrows. The moving power is the weight of a body of water let into a reservoir under the platform when it is at the top. This being allowed to descend with the empty barrows, draws up the other platform with its load, and the water is discharged by a self-regulating valve at the bottom. The supply of water is furnished to a tank in the top either by pumps connected with the steam engine or by the head of its source.

The furnaces of the United States, though not congregated together in such large numbers as at some of the great establishments in England and Scotland, are unsurpassed in the perfection of their construction, apparatus, and capacity; and none of large size are probably worked in any part of Europe with such economy of materials. The accompanying wood-cut (fig. *a*) will give an idea of the form and dimensions of one of first class, and may be taken to represent one of the pair of furnaces belonging to the Thomas Iron Company, in the Lehigh valley, Pennsylvania, though the plan is so far modified in the cut as to place the working-arch and casting-house upon a different side. The boiler-stack, which extends 80 feet in length along the level of the oven, O, for heating the blast, is not represented. A duplicate boiler-stack and heating-oven, connected with the other furnace, also stand upon the high platform, which extends from the top of one furnace-stack to that of the other—a distance of about 110 feet, and at an elevation above the bottom of the hearth of 45 feet. The furnace is carried 15 feet higher than this by a low, dome-like structure, in fire brick, which contains an annular flue, EE, 6 feet high and 4 feet wide, into which the gaseous products of combustion are drawn through the horizontal flues, FF, 8 in all. From the annular ring one-fourth of the gases pass into the heating-oven, O, and are burned around the pipes, sufficient atmospheric air being admitted for their combustion; and the other three-fourths flow under the five boilers, and are consumed in the great chamber, 80 feet long, 6 feet high, and about 16 feet wide, beneath them. This is seen in fig. *b*, which is a horizontal section on the top of the stacks.

In fig. *a*, A is the central cavity of the furnace, 60 feet in height, 18 feet in diameter at the top of the boshes, BB (14 feet above the bottom), and 8 feet in diameter at the tunnel-head, on the level of the charging platform, P. The boshes form a cone like a funnel, and the hearth, H, then represents the neck of the funnel. This is 5 feet high, and 7 feet across. The blast is admitted on three sides, by four tuyeres, side by side, in each arch. It is brought down from the heating-oven by the main pipe, *y*, which is 18 inches in diameter. On the fourth side of the furnace is the working-arch, W, by which access is had to the hearth for letting out the cinder and metal. The former flows from time to time over the dam-stone, *d*, and down the cinder-slope, *m*, and the latter is let out through an opening under the dam-stone as often as it rises so as to threaten running over. The block, T, in front of the hearth, is supported by the side stones, and stretches across from one to the other. Under this the workmen thrust long iron bars, and pry up and loosen the cinder whenever it gets thick and endangers obstruction of the blast. The lining of furnaces is made of the best of fire brick, a foot or more deep, moulded in shapes for the circle. Behind this lining is a narrow space filled with sand, and back of this is another fire-brick lining. The heating-oven, as designed in the cut, is 25 feet high, and about the same length, by 10 feet wide. This gives abundant space for the gases to circulate freely and be thoroughly consumed before escaping through the chimneys on the top. In this oven are 5 rows of arched oval pipes, 12 in each row. They stand 10 feet high, arranged on 6 bed-pipes, and their size is 8 by 4 inches. The blast set in operation in the space below the platform, is conducted into the receiver, R, which is a cylinder of boiler-plate iron, 108 feet long and 6½ feet diameter, designed to give uniformity of pressure to the current of air which passes from it to the heating-oven, and thence into the furnace. These receivers are of various forms, and are necessarily of great strength, to resist the pressure of the blast over their expanded surface. The chimney, S, in the cut, is connected with one of the boiler-stacks. This is more clearly seen in fig. *b*. The half omitted is a duplicate of that drawn, and would, if completed, show the other furnace to which the boilers and the chimney, S, belong. The other boilers, *b b*, are connected with the furnace, A. The manner of introducing the blast through the sides of the hearth is shown in fig. *c*, which is a horizontal section through the tuyeres, *t*.

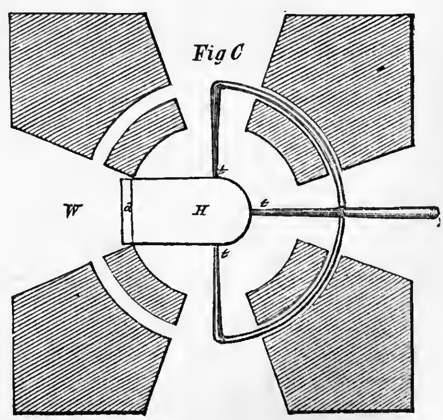


Fig. a.

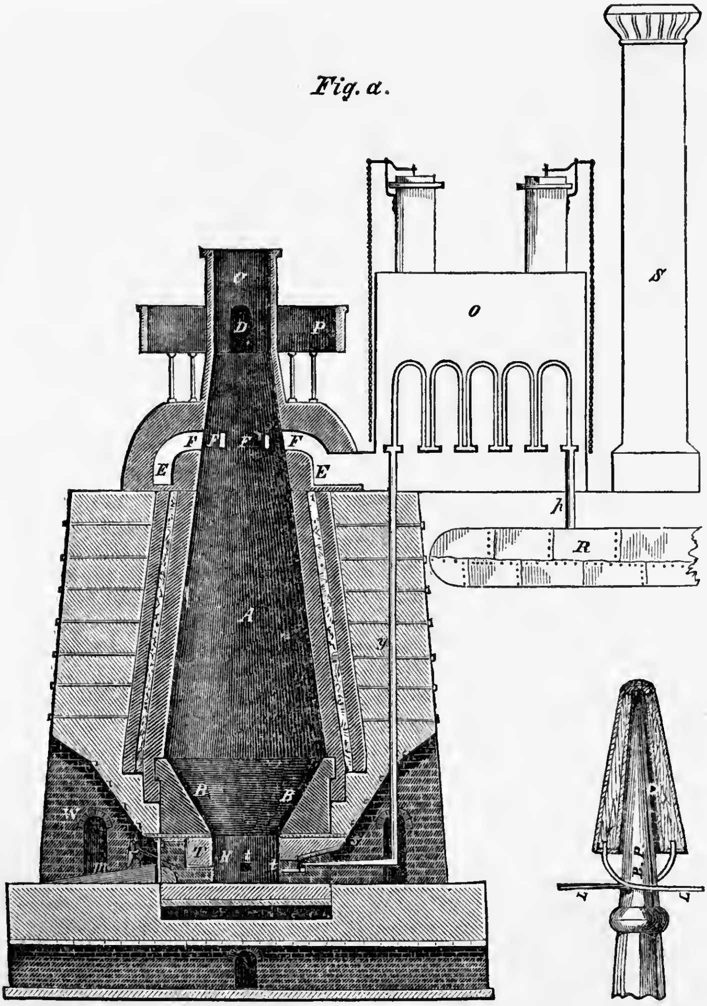
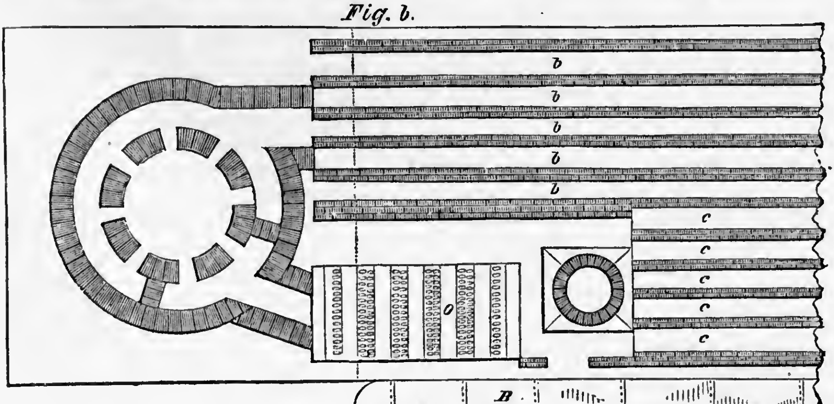


Fig. b.



Pig iron, as obtained from the blast furnaces, is classed as forge pig and foundry iron. The one kind is especially fitted for puddling, and not for recasting; while the other is suited for the latter purpose, and is kept for the use of the foundry. This is an establishment for remelting iron and casting it into moulded forms, as pipes, cannon, stoves, machinery, and the innumerable other articles which are made of cast iron. It is often connected with blast furnaces, but is also to be found in almost every large town, and in some the business is carried on upon a very extensive scale, the supplies of both crude iron and fuel being conveyed from a distance. The most extensive foundries in the United States are those of Albany and Troy, the great business of which is the manufacture of stoves. In the former city it has been stated that about 200,000 stoves are made every year. Cannon are cast at the foundries in Boston and Pittsburg, and other places in the United States. The property of cast iron to melt readily and take the form of the mould into which it is poured renders this of great value, especially for multiplying in great numbers the same object. But this kind of iron being brittle, it is not suited to a great variety of articles which require some strength, and which, on account of their complicated forms and great numbers, it would be very desirable to make by some cheaper method than by hammering them out of wrought iron. To meet this want a method was invented of removing from small articles in cast iron the carbon, which makes the distinction between this and malleable iron, and of doing this without affecting the shape of the article. As hitherto practised, the articles to be decarbonized, as the crooked mountings of harness, the elbows of pipes, and numerous other things, are placed upon shelves in an oven, and covered with some pulverized oxide of iron, as common iron rust. Here they are kept hot for ten days to two weeks, when it is found the oxygen of the iron rust and the carbon of the cast iron have disappeared—united together and gone off in the state of a gaseous mixture of the two elements—leaving the castings in a malleable state, and the rust in the form of a metallic incrustation adhering to them. Although the process is slow and imperfect, the metallic crust as it forms interposing itself between the carbon and oxygen remaining, and the results of a heat are often unsatisfactory, the business has been prosecuted with great success in many towns in New England and the middle states. But by the inventions of Prof. A. K. Eaton, of New York, its character now promises to be essentially modified. The first object was to find some oxide, the base of which was also volatile, so that when decomposed all of it would escape, leaving room for fresh oxide to reach the cast iron. The oxide of zinc was found to answer this purpose, especially when used in the form of the native carbonate of the oxide. This being substituted for the oxide of iron, the decarbonization was rapidly effected, from 18 to 24 hours being sufficient to accomplish what required by the other method 10 days to two weeks. The process, moreover, effected another result. The vapors of zinc were collected and condensed in water, and thus this metal was obtained from its ore. By another very recent discovery of the same chemist, it appears that carbonate of soda, or crude soda ash, has a property, scarcely ever before recognized, of removing carbon from cast iron which is immersed in the fused alkali; and as the sodium generated in the process tends to combine with and remove from the iron the phosphorus, sulphur, and silicon, which in very small quantity materially injure its quality, this method is likely to prove still more important than the other. It is applicable also to the production of steel from cast iron, as will be noticed in treating of this article.

WROUGHT IRON.

Of the various methods of producing wrought iron direct from the ore, the most simple and the one in most extensive use is that of the bloomary fire. It consists of a receptacle, open in front, of about three feet from front to back, two feet in width, and depth below the opening one and a half feet. A tuyere for the blast enters on one side at this height above the bottom, and is connected with the pipes for heating the blast, which are arranged in the wide chimney that completes the top of the structure. The receptacle is filled with rich ores, freed as much as possible from all foreign mixtures, and mixed with sufficient charcoal to effect their reduction. This being fired, the blast is let on, and as the mass becomes softened by the heat, it is stirred up by heavy ringers or iron pokers, and the particles of iron are brought together and made to cohere in one lump or loup. This is then taken out and immediately placed under the forge hammer, or passed through the squeezer, by either of which processes it is freed from the cinder and oxide of iron, and converted into a bloom, an oblong block of wrought iron of convenient size for handling or for transportation. The process is not adapted for ores of less than sixty-five per cent. of iron, and even with these the waste is very great, two tons and a half being required to make one ton of blooms. The consumption of charcoal is about 250 bushels. Each fire can produce about one ton in twenty-four hours; or with rich magnetic ores in coarse particles, one hundred pounds per hour may be obtained. Two men are required to each fire, and their wages by contract are eleven dollars per ton of blooms. With ores costing nine dollars, and charcoal from fifteen to seventeen dollars for 250 bushels—rates which are common in northern New York—the cost of a ton of blooms is from thirty-five to thirty-seven dollars. The quality of the iron is better than the ores can be made to produce by other processes; for at the moderate heat employed, some of the foreign metallic bases present escape reduction, and do not combine with the iron, as they are likely to do in the high heat of the blast furnace. But on the other hand the quantity of iron lost in the cinder is large, and so is the consumption of fuel. The process is particularly adapted to thinly inhabited districts, where magnetic ores abound, water power can be had upon almost every stream, and charcoal is worth little more than the labor of preparing and hauling it to the works. A bloomary fire requires little capital to start it, and new ones can be added as fast as the business warrants the increase. As this declines, the fires may be stopped for a longer or shorter time without involving the serious losses occasioned by the interruption of the blast of the smelting furnace. The extent to which the business can be increased in any locality is limited by the necessary dependence of each fire upon two experienced workmen (in case it is run night and day), which is equivalent to the employment of two skilful men for every ton of iron made per day. Where such labor is not abundant, great difficulty may be experienced in keeping the works in operation. The great districts for bloomaries are the counties of Clinton and Essex, New York, northern New Jersey, and recently the iron district of Lake Superior. In 1850 there were no less than two hundred fires in the two counties named above, of which number twenty-one were in one establishment.

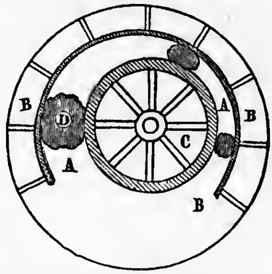
In order to reheat the blooms for hammering them into bars, a separate fire was formerly employed; but by a recent improvement the gaseous products of combustion that escape from the bloomary fire are conveyed into a reheating furnace, in which the blooms are placed, and into which the hot-air blast is blown through a large number of tuyeres, so as to introduce its oxygen throughout the partially consumed gaseous mixture. By this means an intense heat is generated, without extra expense of fuel, and two bloomary fires supply sufficient gases for one reheating furnace.

A great number of processes have been patented for making wrought iron direct from the ore, most of which are based on the general plan introduced by Mr. Clay, of Great Britain. The ore, pulverized and screened, is mixed with two-fifths of its weight of bituminous coal, and the whole is introduced into a side chamber connected with a puddling furnace. There being heated, and partially deoxidized by the reaction of the carbon of the coal, it is brought into a condition ready for being balled up into a loup in the puddling furnace, into which the charge is transferred. Renton's plan, which has been in use in New Jersey, is to introduce the finely pulverized ore, mixed with twenty per cent. of charcoal, into vertical fire-brick tubes, arranged over a puddling furnace and heated by its escape heat. These tubes are twelve feet long, and five by eighteen inches in section; open at top, and so contrived at bottom that the charge can be let out as desired into the puddling furnace. In Harvey's or Salter's process the ore, pulverized and mixed with charcoal, was spread upon an inclined shelf in the upper part of the chimney of the puddling furnace; and after being partially heated, it was pushed off on to a lower and hotter shelf; and so it was kept gradually moving down till it was at last delivered into the puddling furnace, new charges being introduced at the top to keep the charges full.

Puddling.—The great supplies of wrought iron are obtained from pig metal by the process called puddling. The principle of this operation is the removal of the carbon from the pig iron by exposing the melted metal to the action of the oxygen of the air, and causing it to escape in combination with this in the form of carbonic acid gas. The furnaces employed are reverberatory; the fire, of bituminous coal, wood, peat, or anthracite,being at one end, and the flame from it playing over a bridge from which it impinges upon the roof of a long, low oven, and is reflected down upon the floor of this, where the metal to be melted is placed. By thus separating the fuel from the metal, this is kept free from any injurious mixtures which might be introduced with the former. The best fuels are those which give the most flame, and when anthracite is used it is necessary to increase the draught by means of a fan blower; and in the United States this is commonly employed with bituminous coals also. The puddling furnaces are either single or double. The former are only worked on one side, and have a hearth area of sixteen to twenty-four square feet; while the double furnaces have a hearth area of about forty feet, and are worked from two opposite sides. Fire brick is used in their construction, and the whole is incased in cast iron plates, which are securely bound together with bars of iron. The floor of the hearth is formed of cast iron plates, covered with pulverized cinder in sufficient quantity to make, when it is melted, a complete layer of two or three inches in thickness. Around the hearth are hollow boshes of cast iron, left open at the ends for the free circulation of air to prevent their being overheated. Sometimes the blast is passed through them, thus taking away a portion of the heat to be returned to the fire. The hearth occupies a depression of about six inches in depth below the sill of the working-door. When the bed of cinder has become hard by cooling, some iron scales or forge cinder are added to it, and usually some pulverized magnetic iron ore also. It is then ready for the cast iron, which may be either in pieces of the original pigs, or in plate metal, which is pig iron partially refined by melting it in a refinery fire, in which it is exposed for a time to a current of air, and then running it out into flat cakes, and chilling these with cold water. The metal is improved in quality by this preliminary operation, and where fuel is cheap it is advantageously practised. In Pennsylvania it is done in small furnaces, called run-out fires. The charge of a single puddling furnace is from 350 to 500 pounds; the double furnace is charged with twice as much. The pieces are all less than twenty-eight pounds each. Before being introduced they are economically heated in an oven in the chimney. After being placed on the hearth, the doors are tightly closed, and a brisk fire is kept up for about a quarter of an hour, until the pieces are at a bright red heat. Through the hole in the side-door the workman then places them by means of an iron bar in the best position for being uniformly heated to the temperature required. In less than half an hour the pieces are so softened, that they can be broken into fragments by the bar working through the same hole in the door. When they are just ready to melt, the fire is checked by closing the damper on the top of the chimney, and water is thrown in, a little at a time, to cool the charge; or pulverized iron ore, or iron scales, or cinder are used instead of water. The workman then begins to stir the pieces about, beating the fragments with his hook or bar, until they are all reduced to powder. The fire is then gradually increased by raising the damper and adding fuel, while the stirring of the metal is continued. In less than an hour from the beginning the iron commences to form soft, spongy lumps, which, if well worked at sufficiently high heat, adhere to each other, so that they may be collected into balls of any size. This is what is called "coming to nature." The making up of the iron into balls requires active work, which must be continued without cessation till the whole is converted into these globular masses of seventy to one hundred pounds weight each. The balls as they are made are laid up against the fire bridge to protect them from the oxidizing action of the flame, as well as to get them out of the way; and when all are ready the furnace is closed for a few minutes to give them a thorough heat. They are then taken out one by one, and dragged in tongs or upon a car to the hammer or squeezer, to be forged into blooms. The time consumed in the puddling for each heat is usually an hour and a half, but sometimes much longer. As soon as one charge is out another is introduced, and the furnace is kept in constant operation, thus avoiding the loss of fuel that would attend its cooling.

A method of puddling is much practised, which is called boiling. The furnace used for this purpose is like the puddling furnace, except that the hearth is deeper, in order to give capacity for a greater quantity of forge cinder, upon a large supply of which the operation depends. This is spread over the bottom in sufficient quantity to form a layer 4 inches deep, and as it begins to cool, it is drawn up around the sides, so as to leave a depression in the centre. In this the iron is placed, and as soon as may be is melted down. The damper is then closed to keep the temperature uniform, and the iron and cinder are busily stirred; at the same time more cinder is thrown in—a handful at a time—till the contents begin to swell up and boil. This is owing to the formation of carbonic oxide from the carbon of the pig iron and the oxygen of the iron scales of the cinder, and as this gas rises it burns with a blue flame. Gradually the boiling subsides, by reason of the removal of the carbon, and the cinder settles down, leaving the iron in spongy masses, which would unite into one body if not worked over and broken up as in ordinary puddling. This being thoroughly done, it is then well heated and made up into balls for the hammer. The process requires more time, labor, and fuel than the other; but it produces better iron, and more of it from the same quantity of crude metal. Thus 95 per cent. is sometimes obtained from metal which, when treated by the other method, may yield only 80 per cent. The extent, however, to which the operation may be carried on is limited by the amount of cinder available, which is supplied wholly from the puddling furnaces.

The consumption of fuel in puddling is from 1,700 to 2,240 lbs. of anthracite or of bituminous coal to the ton of rough bars obtained. The waste of the metal is in great part made up, and sometimes wholly so, by the addition of rich ores to the charge. This plan was first adopted in the United States, and is now generally practised wherever such ores can be obtained. The cost of the labor employed in puddling is from \$3.50 to \$4 per ton. The forging of puddlers' balls into blooms is called shingling, and was formerly performed altogether under the forge hammer. This, however, is now very generally supplanted by the squeezer, of which there are two sorts—one a ponderous lever, the short arm of which, shaped like the upper jaw of a crocodile, opens and closes over a fixed lower jaw. The ball being placed between these is powerfully compressed, and being properly handled at the same time is made to receive the desired shape. A more perfect machine is the rotary squeezer invented by Mr. Henry Burden, of Troy. It consists of an upright cylinder of cast iron about 4 feet in diameter, the same height as the length of a bloom, and its face



serrated with vertical grooves. It is made to revolve within an elliptical shell, which is open on one side to receive the ball. As this is presented at the larger aperture on one side of the opening, it is drawn in by the revolution of the cylinder, and thoroughly squeezed, as it is rolled around between the two serrated faces. The space between these grows narrower by the slight eccentricity of the shell, and when the ball is brought round to the other side of the revolution of the cylinder and is there discharged, it is greatly reduced in diameter, and enlongated in the form of a cylindrical block.

The next process is to reduce this into rough bars. The bloom, without reheating, is taken directly to the roughing rolls, and passed between these; first through the largest space, and then successively through smaller and smaller grooves, until it is drawn out in the shape required. The iron is still very imperfect, being hard and brittle, with many flaws and imperfections. To convert it into merchantable iron, it is cut into short lengths by shears worked by machinery; and the pieces are made up into piles or faggots, which are placed upon the hearth of a "reheating furnace." This is made like a puddling furnace, with a very low roof, so designed that the space may be entirely occupied by the gaseous products of combustion to the exclusion of atmospheric air, the effect of which would be to oxidize and waste the metal, besides injuring its quality by introducing scales of the oxide. The hearth is made to slope toward the base of the chimney-flue at the back end, and being covered with pure silicious sand, the oxide of iron which forms combines with this, and flows down as a silicate of the protoxide of iron in a liquid cinder. When at a good welding heat the piles or faggots are taken out, and passed through the finishing rolls, which are of much superior construction to the roughing rolls, their faces being smooth and polished, and the shape of the grooves made as perfect as possible, to give all the forms of iron required in merchant bars. From faggots thus made the iron is prepared for railroad bars, the peculiar forms of which require rolls of complicated designs.

The rolling mills of the United States, in operation in 1856, were as follows:—

No. of Mills.	States.	Product. Tons.
1	Maine	4,500
19	Massachusetts	55,292
2	Rhode Island	4,475
5	Connecticut	5,759
1	Vermont	500
13	New York	55,172
10	New Jersey	28,403
91	Pennsylvania	241,484
4	Delaware	2,211
13	Maryland	14,812
12	Virginia	26,355
1	North Carolina	215
3	South Carolina	1,210
1	Georgia	900
3	Tennessee	2,680
15	Ohio	30,980
7	Kentucky	16,865
1	Indiana	Unfinished.
1	Illinois	"
4	Missouri	4,420
2	Michigan	1,848

The mills making railroad iron at the same time were the following, producing the quantities given:—

	Tons of Rails.
The Bay State, South Boston	17,871
" Rensselaer, Troy, N. Y.	13,512
" Trenton, N. J., about	13,000
" Phœnixville, Pennsylvania	18,592
" Pottsville, Schuylkill Co., Penn	3,021
" Lackawanna, Luzerne Co., Penn	11,338
" Rough and Ready, Danville, Penn	5,259
" Montour, Danville, Penn	17,538
" Safe Harbor, Lancaster Co., Penn	7,347
" Mount Savage, Cumberland, Maryland	7,159
" Cambria, Cambria Co., Penn	13,206
" Brady's Bend, Armstrong Co., Penn	7,533
" Cosalo, Lawrence Co., Penn	0
" Washington, Wheeling, Va	2,355
" McNickle, Covington, Ky	1,976
" Newbury, near Cleveland, Ohio	0
" Railroad Mill, Cleveland, Ohio	0
" Wyandotte, near Detroit, Mich	1,848
" Chicago, Ill	0
" Indianapolis, Indiana	0
	141,555

About 1,000 tons in addition to the above were rolled at Pottsville, in the Palo Alto mill; making a total production of 142,555 tons of railroad iron, two-thirds of which were made in Pennsylvania.

Sheet Iron.—For making sheet iron the bars are gradually spread out between smooth rolls, which are brought nearer together as the metal grows thinner. The Russians have a method of giving to sheet iron a beautifully polished surface, and a pliability and durability which no other people have been able to imitate. All attempts that have been made to learn the secret of this process have entirely failed, and the business remains a monopoly with the Russians. The nearest imitation of this iron is produced at Pittsburg, Pennsylvania, and several eastern establishments, by what is called Wood's process. This consists in rolling the common sheet at a certain temperature while it is covered with linseed oil. A very fine surface is thus produced, but the pliability and toughness of the Russian iron are wanting, even though the sheets are often annealed in close vessels, and the glaze and color are also inferior. Sheet iron is now extensively prepared for roofing, and other uses requiring exposure to the weather, by protecting its surface with a coating of zinc. This application is an American invention, having been discovered in 1827, by the late Prof. John W. Revere, of New York. In March, 1859, he exhibited, at a meeting of the Lyceum of Natural History, specimens of iron thus protected, which had been exposed for two years to the action of salt water without rusting. He recommended it as a means of protecting the iron fastenings of ships, and introduced the process into Great Britain. Sheets thus coated are known as galvanized iron, though the iron is now coated with zinc by other means as well as by the galvanic current. One method, that of Mallet, is to place the sheets, after they are well cleaned by acid and scrubbed with emery and sand, in a saturated solution of hydrochlorate of zinc and sulphate of ammonia; and after this in a bath composed of 202 parts of mercury and 1,292 of zinc, to every ton weight of which a pound of potassium or sodium is added. The compound fuses at 680° Fahrenheit, and the zinc is immediately deposited upon the iron surface. Another method is to stir the sheets in a bath of melted zinc, the surface of which is covered with sal ammoniac.

The use of heavy sheets or plates for building purposes is also a recent application of iron, that adds considerably to the demand for the metal. The plates are stiffened by the fluting, or corrugating, which they receive in a powerful machine, and may be protected by a coating of zinc. Their preparation is largely carried on in Philadelphia; and in the same works a great variety of other articles of malleable iron, for domestic and other uses, are similarly protected with zinc, as window shutters, water and gas pipes, coal scuttles, chains for pumps, bolts for ships' use, hoop iron, and telegraph and other wire.

The production of the principal boiler-plate and sheet iron establishments of the United States is thus given for the year 1856:—

	Tons.
East of the Delaware there are but two mills, both of which are in Jersey City. Product in 1856........	550
In E. Pennsylvania, on the Schuylkill and lower Susquehanna, 25 mills............	21,218
Near Wilmington, Delaware, 3 mills.......	1,374
Between Wilmington and Baltimore, 7 mills.	2,998
Pittsburg, Penn., 14 mills. Sheet iron, 6,437; boiler iron, 3,212; besides bars, rods, hoops, and nails..............	9,649
Sheet iron at the Sharon mill, Mercer Co. Penn.	500
Bloom mill, Portsmouth, S. Ohio, and Globe mill, Cincinnati, about.................	2,000
	38,289

A mill for boiler plate has been erected at St. Louis.

Iron Wire.—The uses of iron wire have greatly increased within a few years past. The telegraph has created a large demand for it; and with the demand the manufacture has been so much improved, especially in this country, that the wire has been found applicable to many purposes for which brass or copper wire was before required. It is prepared from small rods, which are passed through a succession of holes, of decreasing sizes, made in steel plates, the wire being annealed as often as may be necessary to prevent its becoming brittle. In this branch the American manufacturers have attained the highest perfection. The iron prepared from our magnetic and specular ore is unequalled in the combined qualities of strength and flexibility, and is used almost exclusively for purposes in which these qualities are essential. But where stiffness combined with strength is more important, Swedish and Norwegian iron also are used. Much of the iron wire now made is almost as pliable as copper wire, while its strength is about 50 per cent. greater. In Worcester, Mass., a large contract has been satisfactorily filled for No. 10 wire, one of the conditions of which was that the wire, when cold, might be tightly wound around another wire of the same size without cracking or becoming rough on the surface. Such wire is an excellent material for ropes, and considerable American iron is already required for this use, especially for suspension bridges. Wires are also used for fences, and are ingeniously woven into ornamental patterns. The so-called "netting fence," thus made, can be rolled up like a carpet. For heavier railing and fences, as for the front yards of houses, for balconies, window guards, etc., iron bars and rods are now worked into ornamental open designs, by powerfully crimping them and weaving them together like wires.

Nails.—Among the multitude of other important applications of malleable iron, that of nail making is particularly worthy of notice, as being in the machine branch of it—the preparation of cut nails—entirely an American process. Our advance in this department is ascribed to the great demand for nails among us in the construction of wooden houses. In England, even into the present century, nails were wrought only by hand, employing a large population. In the vicinity of Birmingham it was estimated that 60,000 persons were occupied wholly in nail making. Females and children, as well as men, worked in the shop, forging the nails upon anvils, from the "split iron rods" furnished for the purpose from the neighboring iron works. The contrast is very striking between their operations and those of the great establishments in Pennsylvania, consisting of the blast furnaces, in which the ores are converted into pig; of the puddling furnaces, in which this is made into wrought iron; of the rolling and slitting mills, by which the malleable iron is made into nail-plates; and of the nail machines, which cut up the plates and turn them into nails—all going on consecutively under the same roof, and not allowing time for the iron to cool until it is in the finished state, and single establishments producing more nails than the greater part of the workshops of Birmingham fifty years ago. Public attention was directed to machine-made nails as long ago as 1810, by a report of the secretary of the treasury, in which he referred to the success already attained in their manufacture in Massachusetts. "Twenty years ago," he states, "some men, now unknown, then in obscurity, began by cutting slices out of old hoops, and, by a common vice gripping these pieces, headed them with several strokes of the hammer. By progressive improvements, slitting mills were built, and the shears and the heading tools were perfected, yet much labor and expense were requisite to make nails. In a little time, Jacob Perkins, Jonathan Ellis, and a few others, put into execution the thought of cutting and of heading nails by water; but being more intent upon their machinery than upon their pecuniary affairs, they were unable to prosecute the business. At different times other men have spent fortunes in improvements, and it may be said with truth that more than a million of dollars have been expended; but at length these joint efforts are crowned with complete success, and we are now able to manufacture, at about one-third of the expense that wrought nails can be manufactured for, nails which are superior to them for at least three-fourths of the purposes to which nails are applied, and for most of those purposes they are full as good. The machines made use of by Odiorne, those invented by Jonathan Ellis, and a few others, present very fine specimens of American genius." The report then describes the peculiar character of the cut nail—that it was used by northern carpenters without their having to bore a hole to prevent its splitting the wood; that it would penetrate harder wood than the wrought nail, etc. At that time, it states, there were twelve rolling and slitting mills in Massachusetts, chiefly employed in rolling nail plates, making nail rods, hoops, tires, sheet iron, and copper, and turning out about 3,500 tons, of which about 2,400 tons were cut up into nails and brads. From that time to the present the manufacture of nails by machinery has been a profitable branch of industry in the south-eastern part of Massachusetts, the iron and the coal being furnished from the middle Atlantic states, and the nails, in great part, finding a market at the south. The following table presents the number of nail mills in operation in 1856. The smaller establishments are gradually going out of the business, and this is becoming more concentrated in the coal and iron regions, thus saving the cost of transportation in these heavy articles. The manufacturers of New England, however, ingeniously divert a part of their operations to the production of smaller articles, with which the cost of transportation is a less item in proportion to their value, such as tacks, rivets, screws, butts, wire, and numerous finished articles, the value of which consists more in the labor performed upon them and in the use of ingenious machinery than in the cost of the crude materials employed.

NAIL FACTORIES IN THE UNITED STATES, AND THEIR PRODUCTION IN 1856.

	Tons.
In south New England, 12 mills, nails principally	25,000
Troy, New York	4,000
Rockaway, Boonton, New Jersey, nails and spikes	8,250
Southern New Jersey	4,167
On the Schuylkill, 5 mills, about	9,000
On the lower Susquehanna, 2 mills, about	2,600
Middle Pennsylvania, 2 mills, about	2,000
Maryland, 2 mills	2,155
Richmond, 1 mill	1,075
Pittsburg, 14 mills, nails, spikes, rivets, tacks	14,195
Wheeling, 2 mills	6,465
Ironton, southern Ohio, 1 mill	775
Mahoning Co., N. E. Ohio, 1 mill	380
Buffalo	1,400
Total	81,462

The number of nail machines employed in these mills was 2,645.

A great variety of machines have been devised for nail making, very ingenious in their designs, and all too complicated for description. The iron is rolled out into bars for this manufacture, of 10 or 12 feet in length, and wide enough to make three or more strips, each one of which is as wide as the length of the nail it is to make. The cutting of these strips from the wider bars is the special work of the slitting mill, which is, in fact, but a branch of the rolling operation, and carried on in conjunction with it. The slitting machine consists of a pair of rolls, one above the other, each having 5 or 6 steel disks upon its axis, set as far apart as the width required for the nail-rod. Those upon one roll interlock with those upon the other, so that when the wide bar is introduced it is pressed into the grooves above and below, and cut into as many strips as there are spaces between the disks. This work is done with wonderful rapidity, several bars being passed through at once. In the nail factory each nail-making machine works upon one of these strips, or nail-rods, at a time, first clipping off a piece from the end presented to it, and immediately another, as the flat rod is turned over and the end is again presented to the cutter. The reason of turning it over for each successive cut is because the piece cut off for the nail is tapering, in order to make it a little wider at the end intended for the head than at the other, and thus, making the wider cut on alternate sides of the rod, this is regularly worked up into pieces of the proper shape. In the older operations a workman always sat in front of each machine, holding the rod and turning it over with every clip; but by a modern improvement this work is also done by mechanical contrivance. Each piece, as fast as it is clipped off, disappears in the machine. There it is seized between powerful jaws, and the head is pressed up from the large end by the short, powerful motion imparted to the piece of apparatus called the header. As it is released, it slides down and drops upon the floor, or in a vessel placed to receive the nails.

Machinery has been applied in the United States to the manufacture of horse-shoe nails, according to a number of patented plans. Of these, the most successful is probably that invented about the year 1848, by Mr. L. G. Reynolds, of Providence; also the inventor of the solid-headed pin. The form of this nail could not be given as in ordinary cut nails by the cutter, but the sides required to be pressed as well as the head. This involved the use of movable plates of suitable figure; and as it was found that the nails could not be shaped except when the metal was softened by heat, the plates must necessarily be of the hardest steel, and protected as effectually as possible from the effects of constant working of heated iron. These difficulties were fully overcome, and the nails, after being turned out, were toughened by annealing, giving them all the excellent qualities of hand-made nails, with the advantage of perfect uniformity of size, so that one nail answers as well as another for the holes in the horse-shoes. They are, moreover, made with great rapidity, each machine producing half a ton of nails in 12 hours. The process has been taken to Europe, and is there in successful operation. Spikes, also, have been made and headed in similar machines; and among all small articles in iron, none, perhaps, has proved so profitable to the inventor as the hook-headed spike, used for holding down, by its projecting head, the edge of the iron rails to the sill. This was the invention of Mr. Henry Burden, of Troy, whose machines for wrought-iron spikes and for horse-shoes have also proved very successful. By the latter, perfect shoes are turned out at the rate of 60 in a minute. This process has been introduced in most of the European countries.

STEEL.

As already remarked, steel differs in composition from metallic iron only by containing from ½ to 1½ per cent. of carbon, and from cast-iron by the latter containing a larger proportion of carbon, which may amount to 5.5 per cent. To readily convert these varieties into each other is an object of no small importance, for their properties are so entirely distinct, that they really serve the purposes of three different metals. Steel is particularly valuable for its extreme hardness, fine grain, and compact texture, which admits of its receiving a high polish. It is the most elastic of metals, and much less liable to rust than iron. It has the peculiar property of assuming different degrees of hardness, according to the rapidity with which it is chilled when heated; and it may be melted and run into moulds like cast iron, and the ingots thus prepared may be hammered, rolled, and forged into shapes like wrought iron; and these may finally be tempered to any degree of hardness desired. Differing so little in composition from metallic iron and from cast iron, and being so universally in demand for a multitude of uses, it would seem that it ought to be produced as cheaply as one or the other of the varieties, between which its composition places it. But this is far from being the case. While pig iron is worth only $20 to $30 per ton, and bar iron $60 to $90, cast steel in bars is worth from $250 to $300 per ton. This is chiefly owing to the difficulty of procuring in large quantities steel of uniform character, which the consumers of the article can purchase with perfect confidence that it is what they require and have been accustomed to use. The English boast, with good reason, of the position they occupy in this manufacture, which is almost a monopoly of the steel trade of the whole world. Though producing themselves little or no iron fit for making alone the best steel, they have imported enough of the Swedish and Norwegian bar iron to insure a good quality, and have been especially cautious to render this as uniform as possible. Their method of manufacture is to introduce carbon into the wrought iron by what is called the cementing process. On the continent of Europe steel is made to some extent, in Silesia and Styria, by removing from cast iron enough of its carbon to leave the proper proportion for steel, and then melting the product and casting it into ingot moulds. But this cheaper method does not appear to have been taken up in Great Britain. In the United States several processes are in operation, two of which are peculiarly American. The cementing method, as conducted in England, has been longest known, and will be first described. The cementing furnace is a sort of oven, furnished with troughs or shelves, upon which charcoal dust is laid for receiving the bars. These are placed edgewise in the charcoal, half an inch apart, and the spaces are filled in with more sifted coal. Enough is added to cover the bars, and upon this a second tier is laid in the same way, and so on till the trough is filled with several tons of iron, all of which is perfectly excluded from the air. The trough being secured with others in the oven, a fire is started under them. In about six days the bars have absorbed enough carbon to acquire the properties of the softer kinds of steel, such as are used for saws and springs. In a day or two longer it answers for cutting instruments, and some time after this it gains in hardness, so as to be fitted for cold chisels, for drills such as miners use, etc. Its character is ascertained at any time by drawing out one of the bars. After the change is effected the fire is extinguished, and about a week is allowed for the furnace and its contents to cool. When at last the bars are obtained, their surface is found to be covered with blisters, whence the steel is called blistered steel. The fibrous texture of the iron has given place to a granular structure, but is so irregular and uneven that the metal requires further treatment to perfect it. To make the English shear-steel, so called from its being originally employed for shears used in sheep-shearing, the bars are cut into lengths of a foot and a half, and a number of these are bound together to make a faggot. This is brought to a welding heat, and drawn down first under a forge-hammer, and then under the tilt-hammer. This weighs from 150 to 200 pounds, and strikes from 150 to 360 strokes a minute. The rapidity of the work keeps the steel at a glowing heat, and it is soon fashioned into a dense bar of smooth surface, susceptible of a polish, and suited for the manufacture of cutting instruments. Sometimes it is cut into pieces to be refaggoted, and drawn down again into bars, which are then called double-shear.

Cast steel is a still more dense and perfect variety. It is prepared by melting, in large crucibles, blistered steel broken into small pieces, and pouring the metal into moulds. These are then worked into shapes by the forge hammer and the rolls.

The American methods of making steel were discovered by Prof. A. K. Eaton, of New York, and the one now employed by the Damascus Steel Company was practically demonstrated by him in Rochester and its vicinity in 1851 and 1852. This consists in carbonizing and melting malleable iron in crucibles at one operation, by introducing into the pot with the pieces of iron a carbonaceous salt, such as the ferro-cyanide of potassium, either alone or in combination with charcoal powder. At an intense heat this salt rapidly carbonizes the iron, which thus first becomes steel, then fuses, and is poured into moulds. The quantity of the salt employed is proportional to the quantity of the iron and the quality of the steel required. The operation is successfully carried on in different establishments in New Jersey, New York, and Pennsylvania, and cast steel of the very best quality is produced at less expense than the article has ever before cost in this country. For bar steel, according to the prospectus of the company, the best charcoal-made iron is employed, costing $85 per ton, and this, together with the coal used for fuel, the chemical materials, the melting, crucibles, and hammering, make the whole cost about $142 per ton, while that of the imported article is $300 or more. The great difficulty in the process is to obtain suitable crucibles for withstanding the intense heat required to melt the charge of 60 lbs. of malleable iron. Those in use are blue-pots, costing $1.60 each. Though made of the best of plumbago, they stand only two or three meltings.

The other process, which is just now introduced into practice, is based upon the property of carbonate of soda to remove from cast iron the carbon it contains, when the metal is kept for a few hours in a bath of the melted alkali. The decarbonizing effect is in part due to the action of the oxygen of the alkaline base, which is given up to the carbon of highly heated cast iron, but principally to the decomposition of the combined carbonic acid, which gives to the carbon one of its atoms of oxygen, and is resolved into carbonic oxide. This property of soda was discovered by Prof. Eaton in 1856, but the fact that the carbonated or bicarbonated alkalies act principally by virtue of their carbonic acid, was only recently recognized and made practically available by him. The action of soda or its carbonates is not limited to the removal of the excess of carbon in cast iron. It combines with and removes those impurities which would prove fatal to the quality of the steel if remaining in it, as sulphur, phosphorus, and silicon; and the method thus admits of the use of crude irons, such as could never be applied to this manufacture by any other mode. The cast iron, in the form of thin plates, having been kept at a bright red heat in the bath of melted carbonate for a sufficient time, which is determined by occasionally taking out and testing some of the pieces, is transferred to the crucible, and is then melted and poured into moulds, as in the ordinary method of making cast steel. The crucibles, not being subjected to greater heat than is required for melting cast steel, endure much longer than when employed for melting wrought iron in the carbonizing process; thus a great saving is effected in the expense of the conversion; and this economy is still further increased by the use of a crude material, costing only from $20 to $30 per ton, in place of the superior qualities of wrought iron, worth $85 per ton. So great, indeed, is the saving, that the cost of the cast steel, when obtained in ingots, is found not to exceed the cost of the malleable iron employed in the other process.

Statistics.—The records of the production of iron of the United States are very incomplete up to the year 1854. Even the census returns are highly defective, as they often make no distinction between iron made from the ore and the products of the secondary operations of remelting and puddling. The first systematic attempts to obtain complete accounts of the business, as conducted in Pennsylvania, were made in 1850 by the Association of Iron Manufacturers, organized in Philadelphia. Mr. Charles E. Smith collected the returns, and published them in a small volume, together with other papers relating to the manufacture. In 1856 the association, through their secretary, Mr. J. P. Lesley, and their treasurer, Mr. C. E. Smith, obtained full returns from 832 blast furnaces, 488 forges, and 225 rolling mills in the United States, besides others in Canada, exhibiting their operations for the preceding three years. Some of these results are presented in the following tables:—

NO 1.—TABLE OF IRON WORKS IN OPERATION AND ABANDONED IN 1858.

	Anthracite Furnaces.	Charcoal and Coke Furnaces.	Abandoned Furnaces.	Bloomary Forges.	Abandoned Bloomaries.	Refinery Forges.	Abandoned Refineries.	Rolling Mills.	Abandoned.
Maine	..	1	..	..	..	..	..	1	..
New Hampshire	..	1	..	..	..	1	..	..	..
Vermont	..	5	..	5	..	..	..	1	..
Massachusetts	3	7	..	..	..	5	1	19	..
Rhode Island	..	..	..	..	..	..	..	2	..
Connecticut	1	14	..	..	..	6	..	5	..
New York	14	29	6	42	1	3	2	11	5
New Jersey	4	6	12	48	29	2	..	10	1
Pennsylvania	93	150	102	1	3	110	44	91	5
Delaware	..	..	1	..	..	..	..	4	..
Maryland	6	24	7	..	..	..	..	13	..
Virginia	..	39	56	..	..	43	..	12	..
North Carolina	..	3	3	36	..	..	..	1	1
South Carolina	..	4	4	2	..	..	..	3	..
Georgia	..	7	1	4	..	..	..	2	..
Alabama	..	3	1	14	..	..	..	..	..
Tennessee	..	41	33	50	2	9	3	3	2
Kentucky	..	30	17	..	..	4	9	8	..
Ohio	..	54	26	..	..	..	5	15	..
Indiana	..	2	3	..	..	..	..	1	..
Illinois	..	2	..	..	..	..	..	1	..
Michigan	..	7	..	3	..	..	..	2	..
Wisconsin	..	3	..	..	..	..	..	..	..
Missouri	..	7	..	..	..	3	..	5	1
Arkansas	..	..	..	1	..	..	..	..	..
Total	121	439	272	206	35	186	64	210	15

In working order,	560	Furnaces,	389	Forges,	210	Rolling Mills.	Total,	1,159
Abandoned,	272	"	99	"	15	"	"	386
In all,	832	"	488	"	225	"	"	1,545

The production of the blast furnaces in the different iron districts for the years 1854, 1855, and 1856, is exhibited in Table No. 2; their arrangement being according to the fuel employed and the quantities of iron produced in each district in 1856:—

TABLE NO. 2.—PRODUCTION OF PIG IRON.

Fuel.	District.	1854.		1855.		1856.	
Anthracite	Pennsylvania	....	208,603	....	255,326	....	306,972
"	Out of Pennsylvania	....	99,007	...	87,779	....	87,537
Charcoal and Coke	S. Ohio	56,081	79,010	47,982	64,162	70,455	92,116
" " "	E. Kentucky	22,929		16,180		21,661	
" " "	W. Pennsylvania	78,927	90,216	59,388	69,814	59,597	76,653
" " "	N. Ohio	11,289		9,926		17,056	
" " "	E. Pennsylvania	....	62,724	....	60,596	....	52,775
Charcoal	W. Tennessee	37,918	53,054	33,683	50,347	32,162	50,664
"	W. Kentucky	12,236		13,664		14,902	
"	S. Indiana	1,400		1,500		1,800	
"	S. Illinois	1,500		1,500		1,800	
Charcoal and Coke	S. W. Pennsylvania	11,052	12,982	18,217	20,559	29,400	30,867
" " "	N. W. Virginia	1,930		2,342		1,467	
" " "	Maryland	....	36,658	....	36,309	....	30,998
Charcoal	E. of the Hudson	....	30,420	....	32,826	..	29,937
"	N. and W. New York	....	19,197	....	19,736	....	18,847
"	Missouri	....	7,591	....	10,181	....	10,138
"	S. New York and N. New Jersey	....	13,435	....	7,901	....	5,683
"	E. and Middle Virginia	....	5,880	....	6,926	....	5,730
"	North and South Carolina	1,820	6,056	1,830	6,061	1,956	7,694
"	Georgia	2,391		2,715		2,807	
"	E. Tennessee and Alabama	1,845		1,516		2,931	
"	Michigan	....	990	....	950	3,678	6,178
"	Wisconsin	....	....	....	....	2,500	
Total production of pig iron in the United States	Tons.		725,823		728,973		812,789

TABLE NO. 3.—DISTRIBUTION OF THE FURNACES BY STATES.

I. ANTHRACITE FURNACES.

No.	States.	Product. Tons.
3	Massachusetts	4,443
1	Connecticut	0
14	New York	47,257
4	New Jersey	26,117
93	Pennsylvania	306,972
6	Maryland	10,720
121		394,509

II. COKE FURNACES.

No.	States.	Product. Tons.
21	Pennsylvania	39,953
3	Maryland	4,528
24		44,481

III. RAW BITUMINOUS COAL FURNACES.

No.	States.	Product. Tons.
6	Pennsylvania	8,417
13	Ohio	16,656
19		25,073

IV. CHARCOAL FURNACES.

No.	States.	Product. Tons.
1	Maine	2,100
1	New Hampshire	0
5	Vermont	2,420
7	Massachusetts	8,564
14	Connecticut	12,876
29	New York	21,774
6	New Jersey	2,100
143	Pennsylvania	96,154
21	Maryland	26,470
39	Virginia	14,828
3	North Carolina	450
4	South Carolina	1,506
7	Georgia	2,807
3	Alabama	1,495
41	Tennessee	28,476
30	Kentucky	36,563
41	Ohio	70,355
2	Indiana	1,800
2	Illinois	1,900
7	Missouri	10,138
3	Wisconsin	2,500
7	Michigan	3,678
416		348,954

	No. of Furnaces.	Tons.
Anthracite, as above	121	394,509
Coke, "	24	44,481
Raw Coal, "	19	25,073
Charcoal, "	416	348,954
Total pig	580	813,017

TABLE NO. 4.—PRODUCT OF WROUGHT IRON DIRECT FROM THE ORE, 1856.

Bloomaries.	States.	Product. Tons.
5	Vermont	1,650
42	New York	18,710
48	New Jersey	4,487
36	North Carolina	1,182
2	South Carolina	640
4	Georgia	40
14	Alabama	252
50	Tennessee	1,222
3	Michigan	450
204		28,633
	Pig iron as above	812,917
	Grand total production of iron from the ore in 1856	841,550

In addition to this amount, the importations for the year 1856 of iron designed for manufacture are estimated at 363,998 tons, consisting of Scotch pig, 55,403 tons; rolled and hammered iron, 298,275 tons; and scraps, 10,320 tons; and if to this be added for old rails reworked, 100,000 tons, and for scrap, 25,000 tons, the total amount of iron entering into domestic consumption was 1,330,548 tons. The importation of railroad iron not included in the above was 167,400 tons. The proportion of foreign iron introduced into the general consumption, not including rails, was about 30 per cent.

The value of the immediate products of the manufacture of domestic iron is thus given at the prices current in 1856:—

Foundry pig	302,154 tons	*a* $27,	$8,158,158
Foundry cold-blast charcoal iron for car wheels, &c.	35,000 "	*a* 35,	1,225,000
Rails	142,555 "	*a* 63,	8,980,965
Boiler and sheet	38,639 "	*a* 120,	4,636,680
Nails	81,462 "	*a* 84,	6,842,808
Bar, rod, hoop, and band	235,425 "	*a* 65,	15,302,625
Hammered iron	21,000 "	*a* 125,	2,625,000
Total			$47,771,236

Mr. Smith presents the following conclusion to the "Statistical Report of the Iron Manufacture:" "The great facts demonstrated are, that we have nearly 1,200 efficient works in the Union; that these produce annually about 850,000 tons of iron, the value of which in an ordinary year is $50,000,000; of this amount the portion expended for labor alone is about $35,000,000."

Since 1856 no attempts have been made to collect the statistics of the iron business of the United States, and consequently but a very general statement can be given of the changes which have taken place. The total annual production has probably not varied much from 800,000 tons—exceeding rather than falling short of this amount. In the Lehigh valley the business is rapidly increasing, while the charcoal iron manufacture in different parts of the country is steadily diminishing. In the vicinity of Baltimore only one furnace was in operation in November, 1860; and besides another at Texas, in Baltimore county, and one of the bog ore furnaces on the eastern shore, it is believed all the rest, including those in the bituminous coal region, were out of blast. The business, however, in general is in a sound condition, and great improvements have been made in diminishing the cost of the manufacture, by means of more care in the superintendence and by reducing the general expenses and the number of hands employed to the ton of iron produced.

The census of 1860 gives the following statistics of the iron production and manufacture of that year. There had been very little progress in the production of iron in the country for several years previous, in consequence of the very low rate of duty at which foreign railroad and other iron was admitted.

Iron blooms, valued at	$2,623,178
Pig iron	20,870,120
Bar, sheet and railroad iron	31,888,705
Iron wire	1,643,857
Iron forgings	1,907,460
Car wheels	2,083,350
Iron castings of all kinds	36,132,033
	$97,148,705

The opening of the war, in 1861, gave an extraordinary impetus to iron production and manufacture. The tariff and other causes reduced the importation to a minimum, while the demand for iron for the fabrication of small arms and cannon; for the construction of the large fleet of iron-clads, and for the other war vessels; for the building of locomotives, the casting of car wheels and furnishing the vast quantity of railroad iron needed to repair the old tracks destroyed by the contending armies, and to lay the tracks of new roads, extended the business vastly beyond all former precedent; and the requirement that the Pacific railroad and its branches shall be constructed solely of American iron, as well as the increase in its use for buildings, and for shipping, have maintained it in a prosperous condition.

The manufacture of steel and the other manufactures of iron, aside from those already enumerated, brought the aggregate production and manufacture of iron and steel, in 1860, up to $285,879,510. The revenue tax paid on iron and steel manufactures in 1864 indicates that the product of the branches taxed amounted to about $123,000,000. This estimate was far below the production, as many branches were not taxed, and the returns of that year were imperfect. The production and manufacture of 1865 were not less than 400 millions of dollars. There is every reason to expect that the development of the iron mines will be pushed forward with constantly increasing energy, and that the time is not far distant when many of the great repositories of ores we have described—now almost untouched—will be the seats of an active industry and centres of a thriving population, supported by the home markets they will create. The great valley of the west, when filled with the population it is capable of supporting, and intersected in every direction with the vast system of railroads, of which the present lines form but the mere outlines, will itself require more iron than the world now produces, and the transportation of large portions of this from the great iron regions of northern Michigan and Wisconsin, and of coal back to the mines, will sustain larger lines of transportation than have ever yet been employed in conveying to their markets the most important products of the country. The importation of foreign iron—already falling off in proportion to the increased consumption—must, before many years, cease, and be succeeded by exports for the supplies of other nations less bountifully provided for in this respect than the United States and Great Britain.

CHAPTER II.

COPPER.

The early attempts to work copper mines in the United States have already been alluded to in the introductory remarks to the department of this work relating to mining industry. The ores of this metal are widely distributed throughout the country, and in almost every one of the states have been found in quantities that encouraged their exploration—in the great majority of cases to the loss of those interested. The metal is met with in all the New England states, but only those localities need be named which have at times been looked upon as important.

Copper occurs in a native or metallic state, and also in a variety of ores, or combinations of the metal with other substances. In these forms the metallic appearance is lost, and the metal is obtained by different metallurgical operations, an account of some of which will be presented in the course of this chapter. Until the discovery of the Lake Superior mines, native copper, from its scarcity, was regarded rather as a curiosity than as an important source of supply. The workable ores were chiefly pyritous copper, vitreous copper, variegated copper, the red oxide, the green carbonate or malachite, and chrysocolla. The first named, though containing the least proportion of copper, has furnished more of the metal than all the other ores together, and is the chief dependence of most of the mines. It is a double sulphuret of copper and iron, of bright yellow color, and consists, when pure, of about 34 per cent. of copper, 35 of sulphur, and 30 of iron. But the ore is always intermixed with quartz or other earthy minerals, by which its richness is greatly reduced. As brought out from the mine it may not contain more than 1 per cent. of copper, and when freed as far as practicable from foreign substances by the mechanical processes of assorting, crushing, washing, jigging, etc., and brought up to a percentage of 6 or 7 of copper, it is in Cornwall a merchantable ore, and the mine producing in large quantity the poor material from which it is obtained may be a profitable one. Vitreous copper, known also as copper glance, and sulphuret of copper, is a lead gray ore, very soft, and contains 79.8 per cent. of copper, united with 20.2 per cent. of sulphur. It is not often found in large quantity. Variegated or purple copper is distinguished by its various shades of color and brittle texture. It yields, when pure, from 56 to 63 per cent. of copper, 21 to 28 of sulphur, and 7 to 14 of iron. The red oxide is a beautiful ore of ruby red color, and consists of 88.8 per cent. of copper and 11.2 per cent. of oxygen. It is rarely found in sufficient quantity to add much to the products of the mines. Green malachite is a highly ornamental stone, of richly variegated shades of green, famous as the material of costly vases, tables, etc., manufactured in Siberia for the Russian government. It is always met with in copper mines, especially near the surface, but rarely in large or handsome masses. It consists of copper 57.5, oxygen 14.4, carbonic acid 19.9, and water 8.2 per cent. Chrysocolla is a combination of oxide of copper and silica, of greenish shades, and is met with as an incrustation upon other copper ores. It often closely resembles the malachite in appearance. It contains about 36 per cent. of copper.

The first mines worked in the United States were peculiar for the rich character of their ores. These were, in great part, vitreous and variegated copper, with some malachite, and were found in beds, strings, and bunches in the red sandstone formation, especially along its line of contact with the gneiss and granitic rocks in Connecticut, and with the trap rocks in New Jersey. The mine at Simsbury, in Connecticut, furnished a considerable amount of such ores from the year 1709 till it was purchased, about the middle of the last century, by the state, from which time it was occupied for sixty years as a prison, and worked by the convicts; not, however, to much profit. In 1830 it came into possession of a company, but was only worked for a short time afterward. On the same geological range, but lying chiefly in the gneiss rocks, the most productive of these mines was opened in

1836, in Bristol, Conn. It was vigorously worked from 1847 to 1857, and produced larger amounts of rich vitreous and pyritous ores than have been obtained from any other mine in the United States. No expense was spared in prosecuting the mining, and in furnishing the most efficient machinery for dressing the ores. It is stated that full 1,800 tons of ore were sent to market, which produced over $200,000, the yield ranging from 18 to 50 per cent. of copper. The mine was finally abandoned in 1857.

The New Jersey mines have all failed, from insufficient supply of the ores. The Schuyler mine, at Belleville, produced rich vitreous copper and chrysocolla, disseminated through a stratum of light brown sandstone, of 20 to 30 feet in thickness, and dipping at an angle of 12°. During the periods of its being worked in the last century, the excavations reached the depth of 200 feet, and were carried to great distances on the course of the metalliferous stratum. The mine was then so highly valued that an offer of £500,000, made for it by an English company, was refused by the proprietor, Mr. Schuyler. In 1857–58 attempts were made by a New York company to work the mine again, but the enterprise soon failed. Among the other mines which have been worked to considerable extent in New Jersey are the Flemington mine, which resembled in the character of its ore the Schuyler mine, and the Bridgewater mine, near Somerville, at which native copper in some quantity was found in the last century; two pieces met with in 1754 weighing together, it was reported, 1,900 lbs. A mine near New Brunswick also furnished many lumps of native copper, and thin sheets of the metal were found included in the sandstone. At different times this mine has been thoroughly explored, to the loss of those engaged in the enterprise. In Somerset county, the Franklin mine, near Griggstown, has been worked to the depth of 100 feet. Carbonate and red oxide of copper were found in the shales near the trap, but not in quantity sufficient to pay expenses. In Pennsylvania, near the Schuylkill river, in Montgomery and Chester counties, many mines have been worked for copper and lead at the junction of the red sandstone and gneiss. Those veins included wholly in the shales of the red sandstone group were found to produce copper chiefly, while those in the gneiss were productive in lead ores. At the Perkiomen and Ecton mines—both upon the same lode—extensive mining operations have been carried on; a shaft upon the latter having reached in 1853 the depth of 396 feet. The sales of copper ores during the three years the mines were actively worked amounted to over $40,500; but the product was not sufficient to meet the expenditures.

The mines in Frederick county, Maryland, in the neighborhood of Liberty, were near the red sandstone formation, though included in argillaceous and talcose slates. A number of them have been worked at different times up to the year 1853, when they were finally given up as unprofitable.

A more newly discovered and richer copper district in Maryland is near Sykesville, on the Baltimore and Ohio railroad, 32 miles from Baltimore, in a region of micaceous, talcose, and chloritic slates. A large bed of specular iron ore lying between the slates was found to contain, at some depth below the surface, carbonates and silicates of copper, and still further down copper pyrites. In the twelve months preceding April 1, 1857, 300 tons had been mined and sent to market, the value of which was $17,896.92, and the mine was reported as improving. The ore sent to the smelting works at Baltimore, in December of that year, yielded 16.03 per cent. of copper. Within seven miles of Baltimore the Bare Hill mine has produced considerable copper, associated with the chromic iron of that region.

Like the last two named, all the other localities of copper ores of any importance along the Appalachian chain and east of it are remote from the range of the red sandstone, and belong to older rock formations. In the granites of New Hampshire, pyritous copper has been found in many places, but has nowhere been mined to any extent. In Vermont, mining operations have been carried on to some extent upon a large and very promising lode of pyritous copper, which is traced several miles through Vershire and Corinth. At Strafford, pyritous ores were worked in 1829 and afterward, both for copperas and copper. In New York, excellent pyritous ores were produced at the Ulster lead mine in 1853. Among other sales of similar qualities of ore, one lot of 50 tons produced 24.3 per cent. of copper.

In Virginia, rich ores of red oxide of copper, associated with native copper and pyritous copper, are found in the metamorphic slates at Manasses Gap, and also in many other places further south along the Blue

Ridge. The very promising appearance of the ores, and their numerous localities, would encourage one to believe that this will prove to be a copper region, were it not that, when explored, the ores do not seem to lie in any regular form of vein. In the southern part of the state, in Carroll, Floyd, and Grayson counties, copper was discovered in 1852, and mines were soon after opened in a district of metamorphic slates, near their junction with the lower silurian limestones. The copper was met with in the form of pyritous ore, red oxide, and black copper, beneath large outcropping masses of hematite iron ore, or gossan. Some of the shipments are said to have yielded over 20 per cent. of copper. The amount of ores sent east, over the Virginia and Tennessee railroad, in 1855, was 1,931,403 lbs.; in 1856, 1,972,834 lbs.; and in the nine months ending June 30, 1857, 1,085,997 lbs.; 1858, 688,418 lbs.; 1859, 1,151,132 lbs.; and 1860, 2,679,673 lbs. Copper ores are very generally met with in the gold mines of this state, and further south, but the only one of them that has been worked expressly for copper is that of the North Carolina Copper Company, in Guilford county. From this a considerable amount of pyritous copper ores were sent to the north in 1852 and 1853.

In Tennessee, an important copper region lies along the southern line of Polk county, and extends into Gilmer county, Georgia. The ore was first found in 1847, associated with masses of hematite iron ores, which formed great outcropping ledges, traceable for miles from south-west to north-east along the range of the micaceous and talcose slates. An examination of the ores, made to ascertain the cause of their working badly in the furnace, was the means of corroborating or giving importance to the discovery of the copper. In 1851 copper mining was commenced, and afterward prosecuted with great activity by a number of companies. The ore was found in seven or eight parallel lodes of the ferruginous matters, all within a belt of a mile in width. At the surface there was no appearance of it, but as the explorations reached the depth of seventy-five or one hundred feet below the surface of the hills, it was met with in various forms, resulting from the decomposition of pyritous copper, and much mixed with the ochreous matters derived from a similar source. In a soft black mass, easily worked by the pick, and of extraordinary dimensions, were found intermixed different oxides and other ores of copper, yielding various proportions of metal, and much of it producing 20 per cent. and more, fit to be barrelled up at once for transportation. This ore spread out in a sheet, varying in width at the different mines; at the Eureka mine it was 50 feet wide, and at the Hiwassee 45 feet, while at the Isabella mine the excavations have been extended between two walls 250 feet apart. In depth this ore is limited to a few feet only, except as it forms bunches running up into the gossan or ochreous ores. Below the black ore is the undecomposed lode, consisting of quartz, more or less charged with pyritous copper, red oxide, green carbonate, and gray sulphuret of copper; and it is upon these the permanent success of the mines must depend. About 14 mining companies have been engaged in this district, and the production of the most successful of them was as follows, up to the year 1858: Isabella, 2,500 tons; Calloway, 200; Mary's, 1,500; Polk county, 2,100; Tennessee, 2,200; Hiwassee, 2,500; Hancock, 2,000—making a total of 13,000 tons, yielding from 15 to 40 per cent. of copper, and worth $100 per ton, or $1,300,000. In addition to this, the products of the London mine, yielding an average of 45 per cent. of copper, amounted to over $200,000 in value; and the products of the Eureka mine were rated for 1855 at $86,000; for 1856 at $123,000; and for 1857 at $136,000. The value of the ores remaining at the mines too poor to transport, but valuable to smelt in furnaces on the spot, was estimated at $200,000 more. Furnaces for smelting, on the German plan, were in operation in 1857, and produced the next year 850 tons of matt, or regulus. At the Eureka mine, in 1858, there were 4 reverberatory furnaces, 2 blast, and 2 calcining furnaces. The fuel employed is wood and charcoal. By the introduction of smelting operations, ores of .5 to 6 per cent. are now advantageously reduced.

In 1857 the mines of a large portion of this district were incorporated into the so-called Union Consolidated Mining Company, and most of the other mines were taken up by the Burra Burra Company and the Polk County Company. The principal interests in the last two are held in New Orleans. The first named own 11 mines, of which they are working three only, with a monthly production of 750 to 800 tons of 12 per cent. copper, besides 5 or 6 tons of precipitate copper. This is metallic copper, precipitated from the waters of the mine by means of scrap iron thrown into the vats in which these waters are collected. The iron being taken up by the acids which hold the copper in solution, the latter is set free, and deposited in fine metallic powder. The ore is smelted in furnaces constructed on the German plan, and being put through twice, produce a regulus of 55 per cent. As soon as the proper furnaces and refineries can be constructed, it is intended to make ingot copper, and by working more of the mines belonging to the company it is expected the monthly production will soon be raised to 2,000 tons of 10 to 12 per cent. ore.

The two other companies have erected extensive smelting works; and the mines of the Burra Burra are producing 450 to 500 tons per month of 14 per cent. ore, and those of the Polk County Company about 300 tons of 15 per cent. ore. Both companies will soon be able to make ingot copper. The report of the Union Consolidated Company for the first year of their operations presents, against expenditures amounting to $307,182.77, receipts of $457,803.73, leaving a profit of $150,620.96. A large portion of the regulus is shipped to England for sale.

The profits of these mines were greatly reduced the first few years of their operation by the necessity of transporting the ores 40 miles to a railroad, and thence more than 1,000 miles by land and water to the northern smelting works. The establishment of furnaces at the mines not only reduces this source of loss, but renders the great body of poorer ores available, which they were not before. A railroad is now in process of construction to connect the mines with the Georgia railroads.

West of the Alleghanies, the only copper mines, besides those of Lake Superior, are in the lead region of Wisconsin, Iowa, and Missouri. A considerable number of them have been worked to limited extent, and small blast furnaces have been in operation smelting the ores. These were found only near the surface, in the crevices that contained the lead ores; and in Missouri, in horizontal beds in the limestone, along the line of contact of the granite. The ores were mixed pyritous copper and carbonate, always in very limited quantity. The amount of copper produced has been unimportant, and it is not likely that any considerable increase in the supply of the metal will be derived from this source.

The existence of native copper on the shores of Lake Superior, is noticed in the reports of the Jesuit missionaries of 1659 and 1666. Pieces of the metal 10 to 20 lbs. in weight were seen, which it is said the Indians reverenced as sacred; similar reports were brought by Father Dablou in 1670, and by Charlevoix in 1744. An attempt was made in 1771 by an Englishman, named Alexander Henry, to open a mine near the forks of the Ontonagon, on the bank of the river, where a large mass of the metal lay exposed. He had visited the region in 1763, and returned with a party prepared for more thoroughly exploring its resources. They, however, found no more copper besides the loose mass, which they were unable to remove. They then went over to the north shore of the lake, but met with no better success there. General Cass and Mr. H. R. Schoolcraft visited the region in 1819, and reported on the great mass upon the Ontonagon. Major Long, also, in 1823, bore witness to the occurrence of the metal along the shores of the lake. The country, till the ratification of the treaty with the Chippewa Indians in 1842, was scarcely ever visited except by hunters and fur-traders, and was only accessible by a tedious voyage in canoes from Mackinaw. The fur companies discouraged, and could exclude from the territory, all explorers not going there under their auspices. Dr. Douglass Houghton, the state geologist of Michigan, in the territory of which these Indian lands were included, made the first scientific examination of the country in 1841, and his reports first drew public attention to its great resources in copper. His explorations were continued both under the state and general government until they were suddenly terminated with his life by the unfortunate swamping of his boat in the lake, near Eagle river, October 13, 1845.

In 1844 adventurers from the eastern states began to pour into the country, and mining operations were commenced at various places near the shore, on Keweenaw Point. The companies took possession under permits from the general land office, in anticipation of the regular surveys, when the tracts could be properly designated for sale. Nearly one thousand tracts, of one mile square each, were selected—the greater part of them at random, and afterward explored and abandoned. In 1846 a geological survey of the region was authorized by Congress, which was commenced under Dr. C. T. Jackson, and completed by Messrs. Foster and Whitney in 1850. At this time many mines were in full operation, and titles to them had been acquired at the government sales.

The copper region, as indicated by Dr. Houghton, was found to be nearly limited to the range of trap hills, which are traced from the termination of Keweenaw Point toward the south-west in a belt of not more than two miles in width, gradually receding from the lake shore. The upper portion of the hills is of trap rock, lying in beds which dip toward the lake, and pass in this direction under others of sandstone, the outcrop of which is along the northern flanks of the hills. Isle Royale, near the north shore of the lake, is made up of similar formations, which dip toward the south. These rocks thus appear to form the basin in which the portion of Lake Superior lying between is held. The trap hills are traced from Keweenaw Point in two or three parallel ridges of 500 to 1,000 feet elevation, crossing Portage lake not far from the shore of Lake Superior, and the Ontonagon river about 13 miles from its mouth. They thence reach further back into the country beyond Agogebic lake, full 120 miles from the north-eastern termination. Another group of trap hills, known as the Porcupine mountains, comes out to the lake shore some 20 miles above the mouth of the Ontonagon, and this also contains veins of copper, which have been little developed until the explorations commenced near Carp lake in these mountains in 1859. These have resulted in a shipment of over 20 tons of rough copper in 1860, and give encouragement to this proving a copper-producing district. The formations upon Isle Royale, which is within the boundary of the United States, although they are similar to those of the south shore, and contain copper veins upon which explorations were vigorously prosecuted, have not proved of importance, and no mines are now worked there. The productive mines are comprised in three districts along the main range of the trap hills. The first is on Keweenaw Point, the second about Portage lake, and the third near the Ontonagon river. All the veins are remarkable for producing native copper alone, the only ores of the metal being chiefly of vitreous copper found in a range of hills on the south side of Keweenaw Point, and nowhere in quantities to justify the continuation of mining operations that were commenced upon them. The veins on Keweenaw Point cross the ridges nearly at right angles, penetrating almost vertically through the trap and the sandstones. Their productiveness is, for the most part, limited to certain amygdaloidal belts of the trap, which alternate with other unproductive beds of gray compact trap, and the mining explorations follow the former down their slope of 40°, more or less, toward the north. The thickness of the veins is very variable, and also their richness, even in the amygdaloid. The copper is found interspersed in pieces of all sizes through the quartz vein stones and among the calcareous spar, laumonite, prehnite, and other minerals associated with the quartz. These being extracted, piles are made of the poorer sorts, in which the metal is not sufficiently clear of stone for shipment, and these are roasted by firing the wood intermixed through the heaps. By this process the stone entangled among the copper is more readily broken and removed. The lumps that will go into barrels are called "barrel work," and are packed in this way for shipment. Larger ones, called "masses," some of which are huge, irregular-shaped blocks of clean copper, are cut into pieces that can be conveniently transported, as of one to three tons weight each. This is done by means of a long chisel with a bit three-fourths of an inch wide, which is held by one man and struck in turns by two others with a hammer weighing 7 or 8 lbs. A groove is thus cut across the narrowest part of the mass, turning out long chips of copper one-fourth of an inch thick, and with each succeeding cut the groove is deepened to the same extent until it reaches through the mass. The process is slow and tedious, a single cut sometimes occupying the continual labor of three men for as many weeks, or even longer. This work is done in great part before the masses can be got out of the mine. The masses are found in working the vein, often occupying the whole space between the walls of trap rock, standing upon their edges, and shut in as solidly as if all were one material. To remove one of the very large masses is a work of many months. It is first laid bare along one side by extending the level or drift of the mine through the trap rock. The excavation is carried high enough to expose its upper edge and down to its lower line; but on account of irregular shape and projecting arms of copper, which often stretch forward, and up and down, connecting with other masses, it requires long and tedious mining operations to determine its dimensions. When it is supposed to be nearly freed along one side, very heavy charges of powder are introduced in the rock behind the mass, with the view of starting it from its bed. When cracks are produced by these, heavier charges are introduced in the form of sand-blasts, and these are repeated until the mass is thrown partly over on its side as well as the space excavated will admit. In speaking further of the Minesota mine, the enormous sizes of some of the masses, and the amount of powder consumed in loosening them, will be more particularly noticed.

To separate the finer particles of copper from the stones in which they are contained, these, after being roasted, are crushed under heavy stamps to the condition of fine sand, and this is then washed after the usual method of washing fine ores, until the earthy matters are removed and the metallic particles are left behind. This is shovelled into small casks for shipment, and is known as stamp copper. The stamping and crushing machinery, such as have long been used at the mining establishments of other countries, were found to be entirely too slow for the requirements of these mines, and they have been replaced by new apparatus of American contrivance, which is far more efficient than any thing of the kind ever before applied to such operations. The stamps heretofore in use have been of 100 lbs. to 300 lbs. weight, and at the California mines were first introduced of 800 lbs. to 1,000 lbs. weight. At Lake Superior they are in use on the plan of the steam hammer, weighing, with the rod or stamp-leg, 2,500 lbs. and making 90 to 100 strokes in a minute. The capacity of each stamp is to crush over one ton of hard trap rock every hour. It falls upon a large mortar that rests upon springs of vulcanized rubber, and the force of its fall is increased by the pressure of steam applied above the piston to throw it more suddenly down. The stamp-head covers about one-fourth of the face of the mortar, and with every succeeding stroke it moves to the adjoining quarter, covering the whole face in four strokes.

The only other metal found with the copper is silver, and this does not occur as an alloy, but the two are as if welded together, and neither, when assayed, gives more than a trace of the other. It is evident from this that they cannot have been in a fused state in contact. The quantity of silver is small; the largest piece ever found weighing a little more than 8 lbs. troy. This was met with at the mines near the mouth of Eagle river, where a considerable number of loose pieces, together with loose masses of copper, were obtained in exploring deep under the bed of the stream an ancient deposit of rounded boulders of sandstone and trap. The veins of even the trap rocks themselves of this locality exhibited so much silver that in the early operations of the mines a very high value was set upon them on this account. But at none of the Lake Superior mines has the silver collected paid the proprietors for the loss it has occasioned by distracting the attention of the miners, and leading them to seek for it with the purpose of appropriating it to their own use. Probably they have carried away much the greater part of this metal; at least until the stamp mills were in operation.

The principal mine of this district is the Cliff mine of the Pittsburg and Boston Company, opened in 1845, and steadily worked ever since. In 1858 the extent of the horizontal workings on the vein had amounted to 12,368 feet, besides 831 feet in cross-cuts. Five shafts had been sunk, one of which was 817 feet deep, 587 feet being below the adit level, and 230 feet being from this level to the summit of the ridge. The shaft of least depth was sunk 422 feet.

The production of the mine from the year 1853 is exhibited in the following table:—

Year.	Mineral produced. lbs.	Refined copper. lbs.	Yield per cent.	Price per lb. deducting cost of smelting.	Value realized.
1853,	2,263,182	1,071,288	47.33	cts. 27.32	$292,647 05
1854,	2,832,614	1,315,308	56.35	:4.38	320,783 01
1855,	2,995,837	1,874,197	62.56	25 33	475,911 26
1856,	3,291,239	2,220,934	67.48	24.12	535,843 67
1857,	8,363,557	2,563,850	70.28	20.44	497,870 47
1858,	8,183,085	2,331,964	71.00	21.03	475,321 89
1859,	2,139,632	1,415,007	64.35	20.50	290,097 97
1860	2,805,442	..	..	..	..
	22,374,588	..	..	..	..
Product from accumulated slags....		71,580, exclusive of slags.			

The quantities of the different sorts for the year 1857 are as follows:—

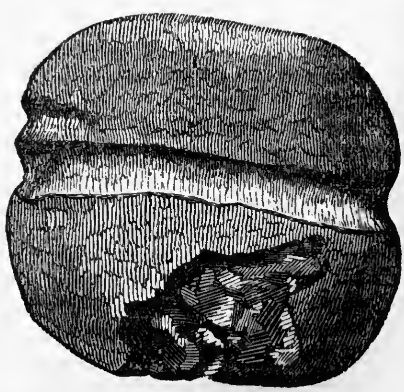
941	masses	1,958,181 lbs.
869	bbls. of barrel work	613,781 "
1,020	" of stampings	791,645 "
	Total	3,363,557 "

The Portage lake mining district is from twenty to twenty-five miles west from the

Cliff mine on the same range of hills. This region is of more recent development, the explorations having been attended with little success previous to 1854. The veins are here found productive in a gray variety of trap as well as the amygdaloidal, and instead of lying across the ridges, follow the same course with them, and dip in general with the slope of the strata. Some of the larger veins consist in great part of epidote, and the copper in these is much less dense than in the quartz veins, forming tangled masses which are rarely of any considerable size. On the eastern side of this lake are worked, among other mines, the Quincy, Pewabic, and Franklin, and on the opposite side the Isle Royale, Portage, and Columbian mines. The most successful of these has been the Pewabic. Operations were commenced here in 1855 upon an unimproved tract, requiring the construction of roads and buildings, clearing of land, etc. etc., all involving for several years a continued heavy outlay. The immediate and rapid production of the mine required the construction of costly mills, without which a large proportion of the copper would be unavailable for the market. The first three years the assessments were $50,000, and the shipments of barrel and mass copper were in 1856 $97\frac{856}{2000}$ tons; in 1857, $209\frac{329}{2000}$ tons; in 1858, 402 tons; in 1859, $813\frac{778}{2000}$ tons. The proceeds from the sales up to this time paid off all the expenditures, and left besides a considerable surplus. The Franklin Company, working the same lode upon the adjoining location, commenced operations in July, 1857, and that year shipped 20 tons of copper, the next year 110 tons, and in 1859, 218 tons; the total amount in capital furnished by assessments was $10,000. These two mines have been the most rapidly developed of any of the Lake Superior mines.

The Ontonagon river crosses the trap hills about forty miles south-west from Portage lake, and the mines worked in the Ontonagon district are scattered along the hills north-east from the river for a distance of nearly twenty miles. The outlet for the greater number of them is by a road through the woods to the village at the mouth of the river. The veins of this district also lie along the course of the ridges, and dip with the trap rocks toward the lake. As they are worked, however, they are found occasionally to cut across the strata, and neighboring veins to run into each other. In some places copper occurs in masses scattered through the trap rock with no sign of a vein, not even a seam or crevice connecting one mass with another. They appear, however, to be ranged on the general course of the strata. At the Adventure mine they were so abundant, that it has been found profitable to collect them, and the cliffs of the trap rock present a curious appearance, studded over with numerous dark cavities in apparently inaccessible places leading into the solid face of the mountain.

The great mine of this district is the Minesota, two miles east from the Ontonagon river. The attention of the explorers in this region in the winter of 1847–48 was attracted by parallel lines of trenches, extending for miles along the trap hills, evidently made by man at some distant period. They were so well marked, as to be noticed even under a cover of three feet depth of snow. On examination they proved to be on the course of veins of copper, and the excavations were found to extend down into the solid rock, portions of which were sometimes left standing over the workings. When these pits were afterward explored, there were found in them large quantities of rude hammers, made of the hardest kind of greenstone, from the trap rocks of the neighborhood. These were of all sizes, ranging from four to forty pounds weight, and of the same general shape—one end being rounded off for the end of the hammer, and the other shaped like a wedge. Around the middle was a groove—the large hammers had two—evidently intended for securing the handle by



STONE HAMMER.

which they were wielded. In every instance the hammers were more or less broken, evidently in service. One of them brought from the mine by the writer, and now in the collection of the Cooper Union of New York, is represented in the accompanying sketch. It measures 6½ inches in length, the same in breadth, and 2½ inches in thickness.

The quantity of hammers found in these old workings was so great that they were collected by cart-loads. How they could have been made with such tools as the ancient miners had, is unaccountable, for the stone itself is the hardest material they could find. And it is not any more clear, how they applied such clumsy tools to excavating solid rock nearly as hard as the hammers themselves. Every hammer is broken on the edge, as if worn out in service. The only tools found besides these were a copper gad or wedge, a copper chisel with a socket head, and a wooden bowl. The great extent of the ancient mining operations indicates that the country must have been long occupied by an industrious people, possessed of more mechanical skill than the present race of Indians. They must also have spread over the whole of the copper region, for similar evidences of their occupancy are found about all the copper mines, and even upon Isle Royale. It is not inprobable that they belonged to the race of the mound builders of the western states, among the vestiges of whom, found in the mounds, various utensils of copper have been met with. But of the period when they lived, the copper mines afford no more evidence than the mounds. Some of the trenches at the Minesota mine, originally excavated to the depth of more than twenty-five feet, have since filled up with gravel and rubbish to within a few feet of the surface, a work which in this region would seem to require centuries; and upon the surface of this material large trees are now standing, and stumps of much older ones are seen, that have long been rotting. In clearing out the pits a mass of copper was discovered, buried in the gravel nearly twenty feet below the surface, which the ancients had entirely separated from the vein. They had supported it upon blocks of wood, and, probably by means of fire and their hammers, had removed from it all the adhering stone and projecting points of copper. Under it were quantities of ashes and charred wood. The weight of the mass, after all their attempts to reduce it, appears to have been too great for them to raise; and when it was finally taken out in 1848, it was found to weigh over six tons. It was about ten feet long, three feet wide, and nearly two feet thick. Beneath this spot the vein afterward proved extremely rich, affording many masses of great size.

The veins worked by the Minesota Company all lie along the southern slope of the northern trap ridge, not far below the summit. Three veins have been discovered which lie nearly parallel to each other. The lowest one is along the contact of the gray trap of the upper part of the hill and a stratum of conglomerate which underlies this. It dips with the slope of this rock toward the north-north-west at an angle of about 46° with the horizon. The next upper vein outcropping, 80 or 90 feet further up the hill, dips about 61°, and falls into the lower vein along a very irregular line. Both veins are worked, and the greatest yield of the mine has been near their line of meeting.

The position of the veins along the range of the rocks, instead of across them, gives to the mines of this character a great advantage, as their productiveness is not limited to the thickness of any one belt which proves favorable for the occurrence of the metal; and the outcrop of the vein can be traced a great distance along the surface, affording convenient opportunities for sinking directly upon it at any point.

The Minesota Company, having abundant room, have been able to sink a large number of shafts along a line of outcrop of 1,800 feet, and several of the levels below extend considerably further than this entire length. In 1858 nine shafts were in operation, and ten levels were driven on the vein, the deepest at 535 feet down the slope. The ten fathom level at that time was 1,960 feet in length. This mine is remarkable for the enormous size and great number of its masses. The largest one of these, taken out during the year 1857, after being uncovered along its side, refused to give way, though 1,450 pounds of powder had been exploded behind it in five successive sand-blasts. A charge of 625 pounds being then fired beneath it, the mass was so much loosened that by a succeeding blast of 750 pounds it was torn off from the masses with which it connected, and thrown over in one immense piece. It measured forty-five feet in length, and its greatest thickness was over eight feet. Its weight was estimated at about 500 tons. What it proved to be is not certain, as no account was preserved of the pieces into which it was cut, but it is known to have exceeded 400 tons. Other masses have been taken out which presented a thickness of over five feet solid copper. The value of the silver picked out from among the copper has amounted in one year to about $1,000.

The reports of the company present the following statistics of the mine from its earliest operations:—

Years.	No. of men employed.	Expenditure.	Mineral product. Tons.	Per-centage	Value of Copper.	Assessments paid.	Dividends.
1848,	20	$14,000	6½	..	$1,700	$10,500	..
1849,	60	28,000	52	..	14,000	16,500	..
1850,	90	58,000	103	..	29,000	36,000	..
1851,	175	88,000	307½	..	90,000	3,000	..
1852,	212	108,000	520	..	196,000	..	$30,000
1853,	280	168,000	523	..	210,000	..	60,000
1854,	392	218,000	763	..	290,000	..	90,000
1855,	471	280,933	1,434	71	549,876	..	200,000
1856,	537	356,541	1,859	72.5	701,906	..	300,000
1857,	615	402,538	2,058	74	736,000	..	300,000
1858,	713	384,827	1,833	70.1	595,000	..	180,000
1859,	718	384,394	1,626	71	515,786	..	120,000
1860,	8 months to Sept. 1……		1,431				
	Estimate, for the year….		2,250				

In consequence of recent discoveries of masses of copper running into the sandstone off from the vein itself, the product of the year 1860 will considerably exceed that of any other year; the profits, however, are not proportionally large, owing to the low price of copper. To this the diminished profits of 1858 and 1859 are partly to be attributed. The product for 1857, 1858, and 1859 was divided as follows:—

Years.	Masses. lbs.	Barrel work. lbs.	Stamp work. lbs.
1857,	3,015,581	819,900	280,512
1858,	2,429,989	903,871	333,352
1859,	2,040,454	929,571	282,092

Besides the dividends named, the original stockholders have derived large profits from the sale of portions of the extensive territory, three miles square, which belonged to the company, and the organization upon these tracts of new companies.

Before the completion of the St. Mary's Canal, no exact records were preserved of the amount of copper sent from Lake Superior. But up to the close of navigation in 1854 it is supposed the total shipments from the commencement of mining in 1845 had been about 7642 tons of pure copper.

Since that time, the annual product of rough copper has been as follows:—

Districts.	1855.	1856.	1857.	1858.	1859.	1860.
Keweenaw	2,245	2,128	2,200	2,125	1,910.3	1,910.8
Portage	315	462	704	1,116	1,533.1	3,064.8
Ontonagon	1,984	2,767	3,190	2,655	2,597.6	3,588.7
Porcupine, Mo., etc.	..	..	..	..	..	28.1
Total	4,544	5,357	6,094	5,896	6,041.0	8,543.4

The condition of the Lake Superior mines at the close of the year 1860 is well presented in the business circular of Messrs. Dupee, Beck, & Sayles, of Boston, received since the preceding pages passed through the hands of the printer and stereotyper. From this we introduce the following additional matter. The depreciation in the price of copper from a maximum of 29½ cents a pound of the few preceding years to a maximum of 24½ cents and a minimum of 19 cents, had induced increased economy and care in the administration of the mines, the good effects of which were already beginning to be experienced:—

"Freights to and from the mines from May to September were 25 per cent. less than in 1859. The transportation of a ton of copper from the lake shore to Boston, cost, after the opening of St. Mary's Canal, 1855, $20; in 1860, to Boston, $11, and to New York, $9. The substitution of bituminous coal for wood, which has been delivered during the past summer at the wharves of Portage Lake for $3.25 per ton, will save much money and leave the forests of the country for building materials and for timbering of the mines. With the wants of a rapidly increasing population, new and cheaper sources of supply are constantly opening in the region itself. Many agricultural products, hitherto sent up at great cost from Lower Michigan, are now raised in the neighborhood of the mines, and at the new settlements on the south-western shores of the lake, cheaply and abundantly. At Portage Lake, a machine shop, an iron foundry, and a manufactory of doors, sashes, blinds, etc., have been put in operation during 1860. The smelting works of the Portage Lake Company are now successfully refining the products of that district. These works consist of four reverberatory and two cupola furnaces, capable of refining 6000 tons per annum. The buildings are of the most thorough and substantial character, and the location of the works accessible, at a very small cost of transportation, to all the mines now wrought, or likely to be wrought for many years hence, in that neighborhood. Hitherto, to save cost of transportation to the smelting companies in other states, it has been necessary to dress the rough copper to an average probably of 70 per cent. Now, by the proximity of the furnaces to the mines, a dressing of 50 per cent. will answer the same purpose, while the refined copper, hitherto rarely ready for the market before the 1st to 15th July, will be sent directly from the lake to New York or Boston, arriving there in ordinary seasons by the 1st of June. Further, there will be added the new facility of obtaining cash advances through the winter on the warehouse receipts of the smelting company.

"The opening of the entry into Portage Lake during the past season has been one of the greatest improvements in the navigation of the Lake Superior region since the completion of the ship canal around the falls of St. Mary's river. At the comparatively small cost of $50,000, steamers of the largest class able to pass through the St. Mary's Canal may now enter Portage Lake, and discharge their cargoes at the docks of the several companies located on its shores. Besides avoiding the loss of time and expense of transhipment hitherto necessary, the opening of Portage Lake has provided one of the most capacious and safest harbors in the world.

"In the Ontonagon district, a plank road has been completed recently, facilitating to a very great extent the transportation to and from the Minesota, National, Rockland, and Superior mines.

"The iron interests of Lake Superior are rapidly attaining great importance. The amount brought down to Marquette, the port of shipment, in 1860, was: of iron ore from the Jackson Company, 62,980 tons; Cleveland Company, 47,889; Lake Superior Company, 39,394; total, 150,263. Of pig iron, Pioneer Company, 3050 tons; S. R. Gay, 1800; Northern Company, 650; total, 6500. Ore valued at $3; pig at $25; aggregate value, $588,289."

The following statistics are presented of the principal mines:—

COMPARATIVE TABLE OF SHIPMENTS OF ROUGH COPPER FROM LAKE SUPERIOR DURING THE SEASONS OF 1859 AND 1860.

The weights of the barrels have been deducted, and the results are given in tons (2000 lbs.) and tenths.

	1859.	1860.
KEWEENAW DISTRICT.		
Central	172.3	78.6
Clark	5.6	7.2
Connecticut	24.	5.3
Copper Falls	329.4	328.
Eagle River	6.	..
North American	8.7	..
Northwest	73.8	103.5
Phœnix	32.	31.2
Pittsburg and Boston	1,254.5	1,357.
Summit	4.	..
	1,910.3	1,910.8
PORTAGE DISTRICT.		
C. C. Douglass	..	24.
Isle Royale	241.3	458.6
Franklin	204.7	267.
Hancock	..	7.2
Huron	7.4	78.
Mesnard	.6	..
Pewabic	734.4	1,363.8
Portage	8.7	..
Quincy	336.	866.2
	1,533.1	3,064.8
ONTONAGON DISTRICT.		
Adventure	139,4	29.7
Aztec	15.3	4.9
Bohemian	3.	..
Evergreen Bluff	27.	41.9
Hamilton	.7	7.9
Mass	12.3	..
Minesota	1,623 6	2,183.4
National	323.2	727.8
Nebraska	9.8	26.4
Norwich	22.	..
Ogima	35.4	..
Ridge	27.8	..
Rockland	347.	552.7
Superior	1.7	14.
Toltec	9.4	..
	2,597.6	3,588 7
Keweenaw District	1,910.3	1,910.8
Portage	1,533.1	3,050 8
Ontonagon	2,597.6	3,553.7
Porcupine Mountain	..	20.5
Sundry mines	..	7.6
	6,041.0	8,543.4

Franklin: the product for the year ending November 30 has been 112 masses, weighing 72,166 lbs.; 721 barrels of barrel work, 469,116 lbs.; and 67 barrels stamp work, 63,816 lbs. Total, 605,098 lbs., equal to $180\frac{7}{10}$ tons refined copper. The actual shipments were about 267 tons rough, or 158 tons ingot copper. The stamps are Ball's, consisting of two pairs of two heads each. They did not commence work till November 19.

Huron: total shipments this year, $65\frac{4}{10}$ tons of $64\frac{1}{2}$ per cent. barrel work, and 12,311 lbs. of refined copper, smelted at the Portage Lake works. There is ready for the stamps an amount equivalent, at a fair estimate, to the quantity shipped this season.

Isle Royale: total shipments this season $458\frac{6}{10}$ tons, averaging over 70 per cent. Preparations have been made for opening a large amount of ground during the winter, with a view to large shipments at the opening of navigation.

Minesota: November returns, 150 tons. The total shipments in 1860 were 1992 masses, and 2127 barrels of barrel and stamp work. Net weight, 4,366,718 lbs. This is the largest shipment made in one year by any mine at the lake. The promise for future production is as great, at least, as the result for this year.

Pewabic: November product, $304\frac{8}{10}$ tons. The actual shipments for the season have been 2,727,632 lbs. The product for one year to November 30 was as follows: 467 masses, weighing 348,658 lbs.; 2294 barrels kiln or barrel work, weighing net, 1,450,778 lbs.; 342 barrels No. 1, stamp, 379,718 lbs.; 399 barrels No. 2, stamp, 389,973 lbs.; 401 barrels No. 3, stamp, 346,912 lbs.; add on tributers' account, 27,428. Total, 2,943,467 lbs.

The smelting returns are not yet all made, but on an estimate based on past experience, the result will not vary much from 2,030,992 lbs., or about 1000 tons of ingot copper.

During the year there have been shipped 1533 ounces of silver.

Pittsburg and Boston: November product, 114 tons. Total shipments, 1357 tons. Total product for the year, 1402 tons. The annual report recently published gives the result of the year ending December 1, 1859. The product for that year was $1,099\frac{8}{10}$ tons, yielding $64\frac{35}{100}$ per cent., or $707\frac{5}{10}$ tons ingot copper. The receipts, including $2,405 17 from sales of silver, were $292,503 14. The expenditures were $272,175 75, leaving net profit, $20,327 39.

COPPER SMELTING

The ores of copper, unlike those of most of the other metals, are not in general reduced at the mines; but after being concentrated by mechanical processes called dressing—which consist in assorting the piles according to their qualities, and crushing, jigging, and otherwise washing the poorer sorts —they are sold to the smelters, whose establishments may be at great distances off, even on the other side of the globe. The richer ores, worth per ton three or four times as many dollars as the figures that represent their percentage of metal, well repay the cost of transportation, and are conveniently reduced at smelting works situated on the coast near the markets for copper, and where the fuel required for their reduction is cheap. At Swansea, in South Wales, there are eight great smelting establishments, to which all the ores from Cornwall and Devon are carried, and which receive other ores from almost all parts of the world. It is stated that in this district there are nearly 600 furnaces employed, which consume about 500,000 tons of coal per annum, and give employment to about 4,000 persons besides colliers. The amount of copper they supply is more than half of that consumed by all nations. The total product of fine copper produced by all the smelting establishments of Great Britain for 1857 is stated to be 18,238 tons, worth £2,079,323.

The copper smelting works of the United States are those upon the coast, depending chiefly upon foreign supplies of ores, and those of the interior for melting and refining the Lake Superior copper. There are also the furnaces at the Tennessee mines, which have been already noticed. The former are situated at the following localities: At Point Shirley, in Boston harbor, are the furnaces of the Revere Copper Company, which also has rolling mills and other works connected with the manufacture of copper at Canton, on the Boston and Providence railroad. At Taunton, Mass., a similar establishment to that at Canton is owned by the Messrs. Crocker, of that town. There are smelting furnaces at New Haven, Conn.; at Bergen Point, in New York harbor; and at Baltimore, on a point in the outer harbor.

The furnaces established for working the Lake Superior copper are at Detroit, Cleveland, and Pittsburg. At the last named are two separate establishments, with each of which is connected a rolling mill, at which the ingot copper is converted into sheets for home consumption and the eastern market. A furnace was also built at Portage lake, Lake Superior, in 1860, of capacity equal to melting 6000 tons of copper annually. The details and extent of the operations carried on by the smelting works appear to have been carefully kept from publication. In a work on "Copper and Copper Smelting," by A. Snowdon Piggott, M. D., who had charge of the chemical assays, etc., for the Baltimore Company, published in 1858, while the English processes are fully described, no information is given as to the methods adopted at the American works; and of their production all the information is contained in the two closing sentences of the appendix, as follows: "Of the copper-smelting establishments of the United States I have no statistics. Baltimore turns out about 8,000,000 pounds of refined copper annually." Applications which have been made by the writer to the proprietors of several of the establishments for information as to the business, have been entirely unsuccessful. The total production of copper in 1858 was supposed to be about 13,000 tons per annum; and of this about 7000 tons were required by the rolling mills for making sheet copper, sheet brass, and yellow metal.

The French treatise on Metallurgy by Professor Rivot contains the only published description of the American method of smelting copper. By the English process, the separation of the metal from its ores is a long and tedious series of alternate roastings or calcinations, and fusions in reverberatory furnaces. The system is particularly applicable to the treatment of poor, sulphurous ores contaminated with other metals, as iron, arsenic, etc., and can only be conducted to advantage where fuel is very cheap, the consumption of this being at the rate of about 20 tons to the ton of copper obtained. The process employed in Germany is much more simple, and the methods in use at the American smelting works are more upon the plan of these. Blast or cupola furnaces supply at some of them the place of reverberatories, and the separation of the metal is completed in great part by one or two smeltings. The treatment of the Lake Superior copper is comparatively an easy operation. For this large reverberatory furnaces are employed, through the roof of which is an opening large enough to admit masses of 3 to 3½ tons weight, which are raised by cranes and lowered into the furnace. The barrels of barrel work are introduced in the same way, and left in the furnace without unpacking. When the furnace is charged, the opening in the top is securely closed by fire-proof masonry, and the fire of bituminous coal is started, the flame from which plays over the bridge, and, reflected from the roof, strikes upon the copper, causing it gradually to sink down and at last flow in a liquid mass. A small portion of the copper by the oxidizing action of the heated gases is converted into a suboxide, which is partially reduced again, and in part goes into the slags in the condition of a silicate of copper, the metal of which is not entirely recovered. The mixture of quartz, calcareous spar, and epidote accompanying the copper, is sometimes such as to melt and form a good cinder without addition of any other substance, but usually some limestone or other suitable material is added as a flux. Complete fusion is effected in 12 to 15 hours according to the size of the masses, and this is kept up for about an hour in order that the fine particles of copper may find their way through the fluid slag, which floats upon the metal. Working tools called rabbles are then introduced through the side-doors of the furnace, and the charge is stirred up and the slag is drawn out through the door. It falls upon the ground, and is taken when sufficiently cool to the cupola or slag furnaces where it is chilled with water to render it easy to break up. Those portions which contain as much as one fourth per cent. of copper are reserved to be passed through the slag furnace. The total amount of slag is usually less than 20 per cent. of the whole charge. In the melting the copper absorbs carbon, which if allowed to remain would render it brittle and unfit for use. To remove it the fire is so arranged that the gases pass through with much unconsumed air; this playing on the surface of the copper produces a suboxide of the metal, which in the course of half an hour is quite taken up by the copper, and coming in contact with the particles of carbon the oxygen combines with this, and removes it in the form of carbonic acid gas.

It now remains to remove the excess of oxygen introduced, which is effected by the ordinary method of refining. A large proportion of fuel is employed on the grate for the amount of air admitted through it, so that the flames as they pass over the bridge convey little free oxygen, and the surface of the metal is covered with fine charcoal. After a little time a pole of green wood is thrust into the melted copper and stirred about so long as gases escape from the surface. It is then taken out, and if on testing the copper some suboxide still remains, the refining is cautiously continued with charcoal, and just when, as appears by the tests, all the oxide is reduced, the work of dipping out the metal is commenced. This is done by large iron ladles, the whole set of men employed at two furnaces, to the number of about 12, coming to this work and taking turns in the severe task. They protect themselves from the intense heat by wet cloths about their arms, and as quickly as possible bale out a ladle full of copper and empty it into one or more of the ingot moulds, of which 36 are arranged in front of the furnace-door upon three parallel bars over a trough of water. As the metal becomes solid in each mould, this is upset, letting the ingot fall into the water. The weight of the ingot being 20 pounds, the filling of them all removes 720 pounds of copper from the furnace. The metal that remains is then tested, and according to its condition the discharging may be continued or it may be necessary to oxidize the copper again and repeat the refining, or merely to throw more charcoal upon the surface and increase the heat. The time required to ladle out the whole charge is from four to six hours. When this is completed the sole of the furnace is repaired, by stopping the cracks with sand and smoothing the surface to get all ready for the next charge; and at the same time the second furnace has reached the refining stage of the process. One charge to a furnace is made every evening, and as in the night it is necessary only to keep up the fires, the great labor of the process comes wholly in the day time.

The following is the estimated cost at Detroit of the smelting, on a basis of two furnaces, each of which is charged with four and a half to five tons of mass copper, consuming two and a half tons of coal, and producing from three to three and a half tons of ingots:—

Labor, 15 hands, at $1.50	$22.50
Bituminous coal, 5 tons, at $5	25.00
Wood and charcoal	1.25
Repairs to furnace, average for the season	2.00
	$50.75

To this should be added, for superintendence, office, and general expenses, perhaps ten dollars more, which would make the cost for six or seven tons of ingot copper, $60.75, or $9 to $10 per ton. At Pittsburg the rate charged has been $11 per ton; and fuel is there afforded at about one third the amount allowed in the above estimate.

The cupola furnaces for treating the slags are of very simple plan and construction. They are of cylindrical form, about ten feet high, and three feet diameter inside. Their walls, the thickness of a single length of fire brick, are incased in boiler-plate iron, and stand upon a cast-iron ring, which is itself supported upon four cast-iron columns about three feet above the ground. Transverse iron bars support a circular plate, and upon this the refractory sand for the sole of the furnace is placed, and well beaten down to the thickness of a foot, with a sharp slope toward the tapping hole. A low chimney conveys away the gaseous products of combustion, and through the base of it the workmen introduce the charges. The blast is introduced by three tuyeres a foot above the sole; but before it enters the furnace it is heated by passing through a channel around the furnace. A steady current is obtained by the use of three double acting blowing cylinders, which give a pressure equal to about three and a half inches of mercury.

The hands employed at the Detroit establishment, besides the superintendent and head smelter, are eighteen furnace men and from five to ten workmen, according to the arrivals of copper during the season of navigation. After the stock thus received is worked up, the furnaces remain idle during the remainder of the winter.

USEFUL APPLICATIONS OF COPPER.

The uses of copper are so numerous and important that the metal must rank next in value to iron. In ancient times, indeed, it was the more useful metal of the two, being abundant among many nations to whom iron was not known. In the ancient Scandinavian tumuli recently opened in Denmark, among the various implements of stone were found swords, daggers, and knives, the blades of which were, in some instances, of copper, and in some of gold, while the cutting edges were formed of iron, showing that this was more rare and valuable than either copper or gold. It has been supposed that several of the ancient nations, as the Egyptians, Greeks, etc., possessed the art of hardening copper, so as to make it serve the purposes of steel. That they employed it for such uses as those to which we now apply tools of steel is certain, and also that the specimens of some of their copper tools are considerably harder than any we make of the same metal. These are found, on analysis, to contain about one part in ten of tin, which, it is known, increases, when added in small proportions, the hardness of copper, and this was probably still further added to by hammering.

Among the most important uses of the metal at present is that of sheathing the bottoms of ships in order to protect the timbers from the ravages of marine animals, and present a smooth surface for the easy passage of the vessel through the water. The metal is well adapted, from its softness and tenacity, for rolling into sheets, and these were first prepared for this use for the Alarm frigate of the royal navy, in 1761. Sheet lead had been in use before this time, but was soon after given up for copper. On account of the rapid deterioration of the copper by the action of the sea-water, the naval department of the British government applied, in 1823, to the Royal Society for some method of preserving the metal. This was furnished by Sir Humphry Davy, who recommended applying strips of cast iron under the copper sheets, which, by the galvanic current excited, would be corroded instead of the copper. The application answered the purpose intended, but soon had to be given up, for the copper, protected from chemical action, it was found, became covered with barnacles and other shell-fish, so as seriously to impair the sailing qualities of the vessels, and for this reason it has been found necessary to submit to the natural wasting of the metal, and replace the sheets as fast as they become corroded.

Various alloys have been proposed as substitutes for copper. That known as yellow metal, or Muntz's, has been the most successful and has been very generally introduced. It consists of copper alloyed with about 40 per cent. of zinc, and is prepared by plunging cakes of zinc into a bath of melted copper contained in a reverberatory furnace. The volatilization of the zinc and oxidation of the metals is guarded against by a covering of fine charcoal kept upon the melted surface. The bolts, nails, and other fastenings for the sheathing, and for various other parts of the ship, are made also of copper and of yellow metal; and to secure the greatest strength, they should be cast at once in the forms in which they are to be used. The manufacture of all these articles is extensively carried on at the different copper establishments in Massachusetts, Connecticut, and Baltimore.

Sheet copper is also applied to many other very important uses, as for copper boilers and pipes, for large stills and condensers, the vacuum pans of sugar refineries, and a multitude of utensils for domestic purposes, and for employment in the different arts. For engraving upon it is prepared of the purest quality and of different thicknesses, according to the kind of engraving for which it is to be used. The engraver cuts it to the size he requires, planishes it, and gives to it the dead smooth surface peculiar to engraving plates. The smaller utensils of sheet copper, as urns, vases, etc., are very ingeniously hammered out from a flat circular sheet. As the hammering is first applied to the central portion, this spreads and takes the form of a bowl. As the metal becomes harder and brittle by the operation, its softness and ductility are restored by annealing, a process that must often be repeated as the hammering is continued, and toward the last, when the metal has become more susceptible to the change induced by the application of the hammer, the annealing must be very carefully attended to, and the whole process be conducted with much skill and judgment acquired by long experience.

For larger and more common hollow articles, the sheet copper is folded around, and lapped by various sorts of joints, some of which are secured by rivets, and some by a double lap, the two edges locking into each other, and made close by hammering. The edges are also soldered either with soft or hard solder. For the latter an alloy is made for the purpose, by melting in a crucible a quantity of brass, and then stirring in one-half or one-third as much zinc, until the blue flame disappears. The mixture is then turned out into a shallow pan, and when cold the plate is heated nearly red hot, and beaten on an anvil or in a mortar. This is the hard solder of the braziers.

A still more important application of the copper is in the manufacture of the alloy known as brass; and that called bronze also serves many useful purposes. The former is composed of copper and zinc, the latter of copper and tin. It is a curious fact in metallurgy that brass was extensively manufactured, and used more commonly than any single metal or other alloy, many centuries before the existence of such a metal as zinc was known. It was prepared by melting copper and introducing fragments of the *lapis calaminaris*, an ore of zinc, in which the oxide of the metal is combined with carbonic acid. Charcoal was also added to the mixture, and by the reaction with this the zinc ore was reduced to the metallic state, and at once united with the copper, without appearing as a distinct metal. This process is still in use for making brass, but the more common method is to introduce slips of copper into melted zinc, or to plunge beneath melted copper lumps of zinc held in iron tongs. The proportion of the two metals is always uncertain, owing to the unknown quantity of zinc that is consumed and escapes in fumes. This is prevented as much as possible by covering the melted metal with fine charcoal, and by throwing in pieces of glass, which melt and cover the mixture with a thin protecting layer. Old brass is much used in making new, and the addition of quantities of this to the pot containing the other ingredients, adds to the uncertainty of the composition. The best proportion of the two metals is believed to be two parts of copper to one of zinc, which is expressed by the term "eight-ounce brass," meaning eight ounces of zinc to sixteen of copper. Sixteen-ounce brass—the two metals being equal—is a beautiful golden yellow alloy, called prince's metal. But all brass of more than ten ounces of zinc to the pound of copper is whitish, crystalline, hard, and brittle; of less than ten ounces it is malleable, soft, and ductile. The alloys known as pinchbeck, Manheim gold, bath metal, etc., formerly much in use as imitations of gold, are about three to four ounce brass.

Brass combines a great number of excellent qualities, which render it adapted for a multitude of uses. Its compactness, durability, strength, and softness, render it an excellent material for fine work, and nothing, except tin, perhaps, is a more agreeable substance for shaping in the lathe. In use it is not liable to rust by exposure, is easily kept clean, and takes a polish almost as beautiful as that of gold. It is hence a favorite material for the works of watches and clocks, almost all sorts of instruments in which great hardness is not essential, and for various household utensils, and ornaments upon furniture. In thin plates it is stamped and embossed in figures, and is thus cheaply applied to many useful and ornamental purposes. Its ductility is such, that those sorts containing little zinc can be beaten out, as will be described in the account of gold-beating, almost like gold-leaf itself, so as to be used as a cheap substitute for this in gilding in some cases. It is also drawn out into wire, often of great fineness; and of the suitable sizes of this there is a very large consumption in the manufacture of pins, and hooks and eyes. The consumption of copper alone for these articles at the factories at Waterbury, Connecticut, has amounted for some years past to more than a ton a day. By ingenious machinery the brass wires are clipped to their proper length for pins, pointed, headed, and after being tinned, are stuck in paper, with very little attention from the workmen. This manufacture used often to be cited as an example of the economical division of labor, showing the great number of workmen through whose hands a single pin passed before it was completed. It serves better now to exemplify the perfection of machinery, and some of the most admirable of this, particularly that by which the finished pins are stuck in their papers, is a peculiarly American invention, and worth, to the manufacturers at Waterbury alone, many thousand dollars annually. The solid-headed pin, made somewhat after the manner in which cut nails are headed, was invented by two citizens of Rhode Island, Mr. Slocum and Mr. S. G. Reynolds. This was before the year 1840. The covering of the brass pins and hooks and eyes with the slight coating of tin is effected by placing a quantity of them in a scouring barrel, together with about twice their weight of tin in grains, several ounces of cream of tartar, and several gallons of warm water. The barrel is then made to revolve upon its axis, until the pins or other articles are perfectly clean. After this they are boiled in a similar mixture.

Much of the brass of the ancients was properly bronze—that is, a compound of copper and tin. This alloy, in different proportions of its ingredients, is still of very great service. Gun metal—the material of the so-called brass cannon—is composed of copper

96 to 108 parts, and tin 11 parts. The compound resists wear extremely well, but its strength is only about one-half that of wrought iron. Statues, and hard castings for machinery, are formed of this alloy, and the former have very commonly been cast from cannon captured in the victories of the commander in whose honor the statues were made. One of the most noted foundries for the casting of cannon, statues, and bronze ornaments in the United States is that of the Messrs. Ames, at Chicopee, Mass. The equestrian statue of Washington, in Union square, New York, is one of their most successful productions. The French bronze contains 2 parts of tin, 1 of lead, 6 of zinc, and 91 of copper. Bell-metal is a bronze usually consisting of 7 parts of copper and 22 of tin. Their manufacture has been carried on at different copper foundries in the United States for many years. The largest bell in the country, that upon the City Hall, in New York, weighs 23,000 pounds, and was cast in Boston. The largest number of bells is probably produced at the foundry of the Messrs. Meneely, at Troy, N. Y. The Chinese gong is now an American manufacture, composed of bell-metal, which, after being cast, is forged under the hammer, between two disks of iron. The casting is made malleable by plunging, while hot, into cold water.

As with zinc copper forms an alloy made to imitate gold, so with tin and nickel it is made to form a combination resembling silver, and known as German silver. The proportions of the metals are 8 parts of copper to either 3 or 4 each of the two other metals. This is a very useful alloy, answering as a cheap substitute for silver in spoons, forks, and other utensils, and for brass in various instruments. It takes the place of the old-fashioned pewter, and, being cheaply electro-plated with silver, is made as beautiful as the genuine articles of the richer metal.

Another alloy of the copper and tin is the telescope or speculum metal, which consists of about one-third tin and two-thirds copper. It is of a steel-white color, very hard and brittle, and susceptible of a high polish, which is not soon tarnished, qualities that cause it to be used for the mirrors of telescopes.

In coinage copper is largely employed —in the old cent unalloyed, and in the new combined with 12 parts in 100 of nickel.

CHAPTER III.

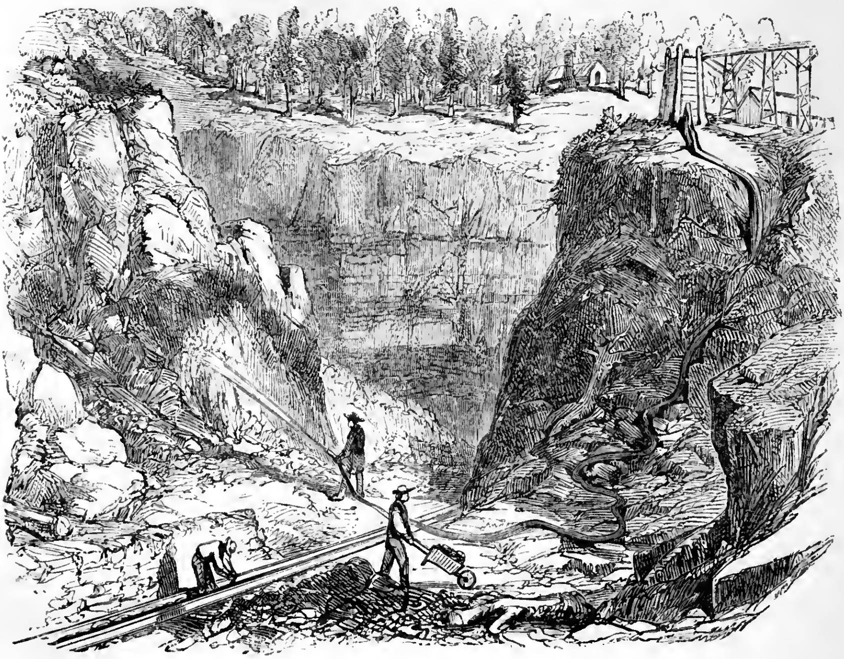
GOLD.

Although the discovery of gold mines was the chief motive that led to the settlement of the American continent, those of the United States appear to have escaped notice until the present century. The only exception to this may be in the discovery made by some Europeans of the gold region of northern Georgia at a period long antecedent to the occupation of this district by the whites. Of this fact no written record is preserved; but in working the deposit mines of the Nacoochee valley, in Habersham county, there were discovered, about the year 1842, various utensils and vestiges of huts, which evidently had been constructed by civilized men, and had been buried there several centuries. It is supposed they belonged to De Soto's party, which passed through this region in the sixteenth century on their exploring expedition from Florida to the Mississippi river. The earlier historians hardly mention gold as even being supposed to exist in the colonies. Salmon, in the third volume of his "Modern History," 1746, merely alludes to a gold mine in Virginia, which of late "had made much noise," but does not even name the locality, and evidently attaches no importance to it. In Jefferson's "Notes on Virginia" mention is made of the discovery of a piece of gold of 17 dwts. near the Rappahannock. In 1799, as mentioned by Wheeler in his "History of North Carolina," a son of Conrad Reed picked up a piece of gold as large as a small smoothing iron from the bed of a brook on his father's farm, in Cabarrus county, and its value not being known it was kept for several years in the house to hold the door open, and was then sold to a silversmith for $3.50. In Drayton's "View of South Carolina," 1802, the metal is stated to have been found on Paris Mountain, in Greenville district. About this time it began to be met with in considerable lumps in Cabarrus county, N. C., and not long afterward in Montgomery and Anson counties. At Reed's mine, in Cabarrus, the discovery by a negro of a lump weighing 28 lbs. avoirdupois, near the same stream already referred to, led to increased activity in exploring the gravelly deposits along the courses of the brooks and rivers of this region, and numerous new localities of the metal were rapidly discovered. A much larger proportion of gold was collected, during these earlier workings, in coarse lumps than in the operations of later times—pieces of metal of one to several pounds weight being often found. Before the year 1820, as stated in *Bruce's Mineralogical Journal* (vol. i., p. 125), the quantity of American gold received at the mint at Philadelphia amounted to $43,689. All of this was from North Carolina. In 1827 there had been received from the same source $110,000. But besides this amount, a considerable proportion of the gold product was consumed by jewellers, who paid a better price than was received from the mint, and was retained by the banks, in which it was deposited. It also circulated to some extent as a medium of exchange in the mining region, being carried about in quills, and received by the merchants usually at the rate of ninety cents a dwt. The total product of the mines must, therefore, have been much larger than appears from the mint returns. In 1829, Virginia and South Carolina began to appear as gold-producing states—there being deposited in the mint from the former gold to the value of $2,500, and from the latter of $3,500. The same year the rich gold deposits of northern Georgia were discovered, and suddenly became very productive, so that the receipts at the mint from this state for the year 1830 amounted to $212,000. Gold mining had now become an established branch of the productive industry of the states, and as its importance increased, the necessity was felt of the establishment of branch mints in the mining region. One was constructed by act of Congress at Dahlonega, Lumpkin county, Georgia, and another at Charlotte, Mecklenburg county, N. C.; and both commenced coining gold in 1838. From the irregular manner in which the gold deposits were worked, and their uncertain yield, the annual production of the mines was very variable. In a single year the mint at Dahlonega received and coined gold to the value of $600,000; and until the discovery of the California gold mines, the American production was estimated to average annually about $100,000. It was, however, gradually declining in importance from the year 1845; and of late years has dwindled away, so as not to amount to enough for the support of the branch mints, the abolition of which by act of Congress was generally looked for in 1857 and 1858. The late introduction at the mines of North Carolina and Georgia of the hydraulic and sluice washing, which has proved highly successful in California, gives encouragement that these mines may again soon became as productive as before.

The rock formations of the United States, in which gold mines are worked, follow the range of the Appalachians, and are productive chiefly along their eastern side in a belt of country sometimes attaining a width of 75 miles, as along the southern part of North Carolina, and in Georgia in two distinct belts which are separated by a district of formations unproductive in gold. The extreme northern gold mines on this range are in Canada East, upon the Chaudiere river and its tributaries, the Du Loup and the Touffe des Pins. In 1851 and 1852, deposits were worked upon these streams, and about 1,900 dwts. were collected — found among the gravel which lay in the crevices formed by the ragged edges of the upturned argillaceous and talcose slates. The pieces were all small, only one weighing as much as 4 ounces. The returns were not sufficient to cover the outlays, and the working was consequently abandoned.

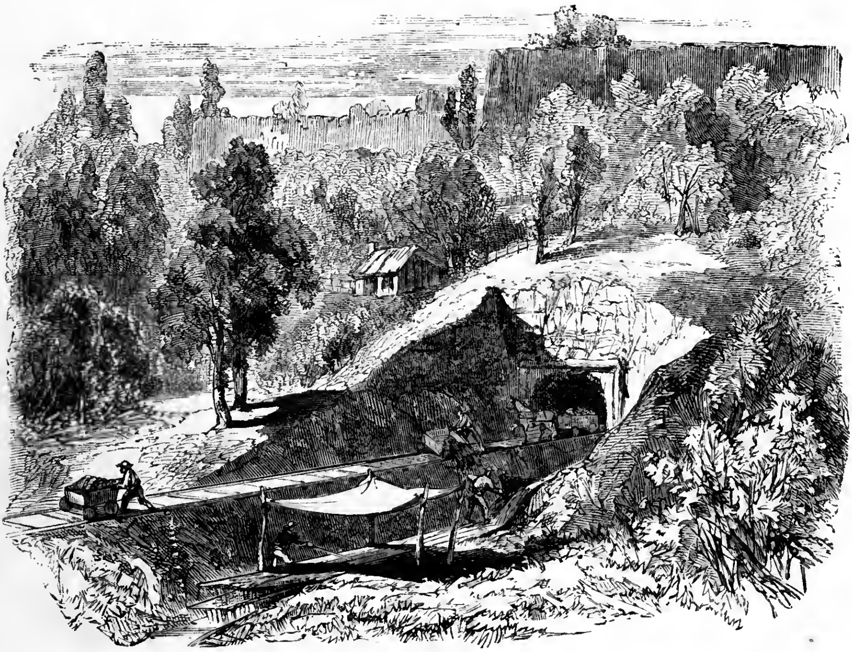
The next localities on the range toward the south which have furnished gold are in Vermont, on the western border of Windsor county, in the towns of Bridgewater and Plymouth. At Newfane, in Windham county, a piece of gold was found in 1826, which weighed 8½ oz.; but the only successful attempts to work the deposits were commenced in 1859, in Windsor county, and have since been prosecuted to limited extent. At Bridgewater, the gold has been found in place, in a quartz vein, associated with galena, and pyritous copper, and iron. It has not proved sufficiently rich to work. Through western Massachusetts and Connecticut, and the south-east part of New York, and through New Jersey and Pennsylvania, the talcose and argillaceous slates, and the other rocks of the gold belt, appear to be unproductive in this metal, a little gold only having been met with in some of the ores worked for lead and copper in Lancaster county, near the borders of Maryland. Specimens of quartz rich in gold have been found in Montgomery county, in the last-named state; but no mine has been worked there.

In Virginia the deposit mines of Louisa county especially were very productive even in 1833, and they had not been worked long before rich veins were found, and operations



HYDRAULIC MINING.

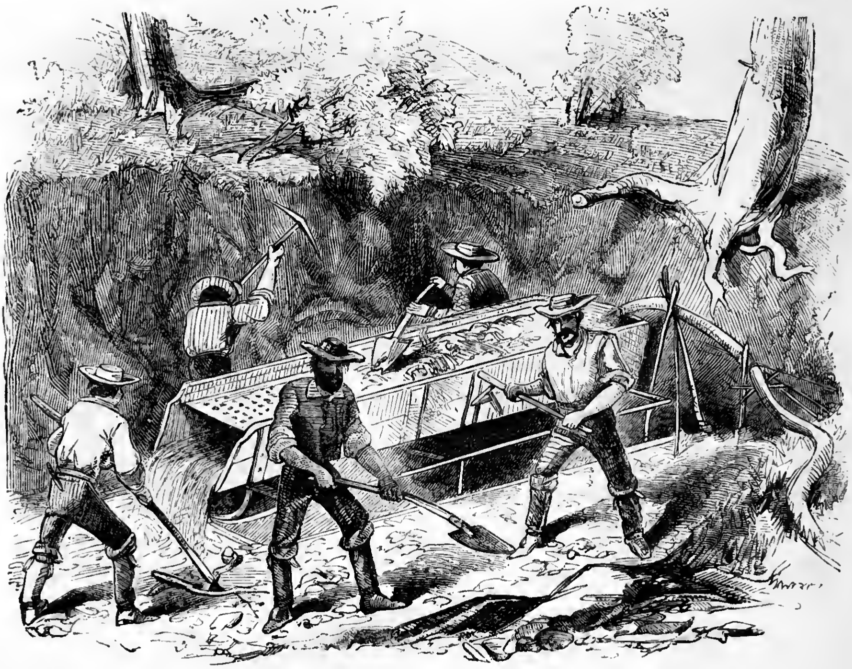
By this operation, as described in the text, hills of loose materials or of decomposed slates and other rocks containing gold, are washed down, and the earthy matters are swept away through the sluices made either of wooden troughs or by excavating channels in the bed-rock. In these the coarse gold is caught against the bars placed at intervals across the sluices. This is a purely Californian method, and has proved so effectual in collecting the little gold buried in large bodies of earth, that it is now generally adopted in other gold regions in which the conditions are favorable for its practice.



TUNNELLING AT TABLE MOUNTAIN, CALIFORNIA.

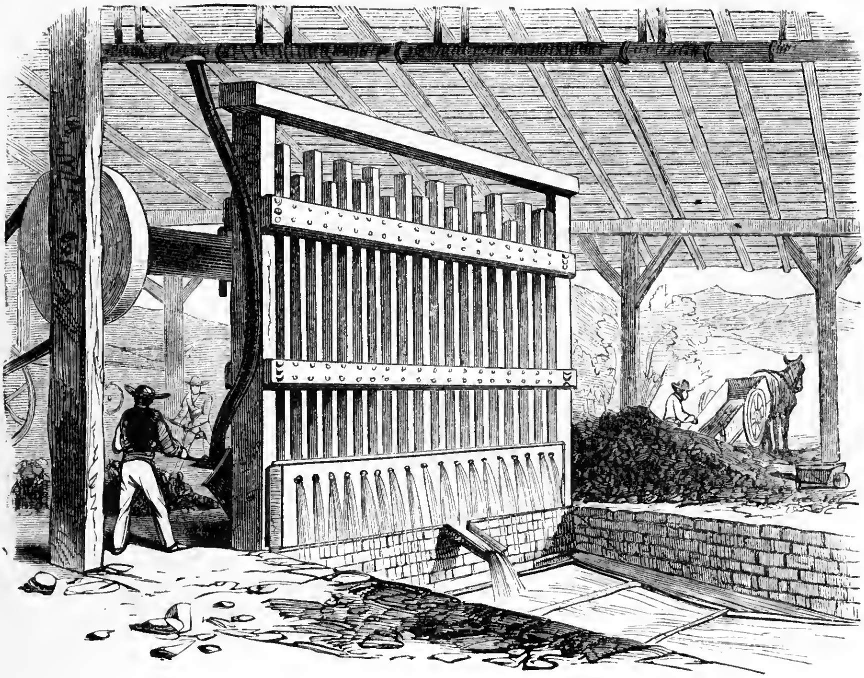
This represents a common method of reaching beds of rich ores that lie at considerable depths below the surface, by which the labor of removing the superficial deposits is avoided. Veins of ores, whether lying at a steep or gentle inclination, are often explored by such tunnels driven in upon their course. The sides and roof may be protected or not, as the ground is soft or solid, by timbering.

At the outside of the tunnel below the railroad track is the machine called the "long tom," a shallow trough, ten to twenty feet long, and about sixteen inches wide. The lower end, which turns up gently from the plane of the bottom, is shod with iron and perforated with holes. The water from the mine is turned on the upper end, and flows up this slope and through the holes, carrying with it the finer mud and sand which are continually thrown into the tom. One man at the lower end keeps the mud in motion and removes the coarse lumps. Under the lower end of the tom is placed a "riffle box," in which mercury may be used to advantage if the gold is in fine particles.



LARGE ROCKER USED IN CALIFORNIA WITH QUICKSILVER.

The above cut represents a rocker of unusual dimensions, which has been introduced in some places in California, and is employed particularly for auriferous deposits in which the gold is in too fine particles to be caught in the long tom. It is slightly inclined, and is rocked by one man while the others collect the gravel and throw it upon the perforated iron plate. Across the bottom of the trough are placed "riffle bars," and behind each one of these some mercury. The fine particles of gold coming in contact with this are caught and retained in the form of amalgam. The coarse gravel falls off the lower end of the plate, while the fine mud and sand are washed by the water through the holes in the plate.



STAMPS FOR CRUSHING GOLD ORES.

This cut represents a common form of stamps, such as are used for pulverizing auriferous quartz or other ores. They are variously arranged at different mills; sometimes four or five running in one set, and several sets being placed on the same line, but separate from each other. This arrangement is more convenient for stopping a portion at a time as may be required for repairs or for collecting the very coarse gold under the stamps which cannot pass through the grating or the plates, perforated with many holes, that are usually employed in front of the stamps.

upon these had been carried on to considerable extent previous to 1836, principally in the counties of Spottsylvania, Orange, Louisa, Fluvanna, and Buckingham. Some of the mines produced at times very rich returns, but their yield was, for the most part, exceedingly irregular, the gold occurring in rich pockets or nests, very unequally scattered in the vein. The occasional richness of the veins caused the attention of wealthy capitalists in this country and in England to be directed to this region, and large outlays were made, in providing powerful engines and other suitable machinery for working the ores, and in opening the mines. But, although the operations have been directed by the best mining skill, supported by abundant capital, the enterprise, on the whole, has not proved successful, and since 1853 the business has greatly declined in importance.

In North Carolina numerous quartz veins have been worked during the last 30 years, and operations are still carried on with moderate success at several mines in Guilford, Davidson, Montgomery, Cabarrus, Rowan, and Mecklenburg counties. Deposit mines have been worked with great success, also, in Burke, Rutherford, and McDowell counties. At a single time, it is stated, there might have been seen, from one point of view in McDowell county, no less than 3,000 persons engaged in washing the deposits. In this district sluice-washing has recently been successfully introduced by Dr. Van Dyke, who is also engaged in the same process in Georgia. The most important group of mines is at Gold Hill, on the southern line of Rowan and Cabarrus counties. Mining operations were begun here in 1843, and for 10 years the annual product averaged about $100,000; the last four years of this period more than one-third of all the gold coined at the Charlotte mint was from Gold Hill. In 1853 the property was purchased by a New York company, by which it has since been worked, but with greatly reduced profits, although the mines have been furnished with the most efficient machinery. These are the deepest gold mines in the Atlantic states, one of the shafts having now reached the depth of 680 feet. The ore is pyritous iron, containing gold in particles rarely visible, and probably chemically combined with the iron and sulphur in the form of a double sulphuret. It is separated with difficulty, and very imperfectly, by the processes of crushing and amalgamating; and the immense heaps of tailings collected below the mines, amounting probably to over two million bushels, still retain quantities of gold worth from fifty cents to two dollars the bushel. In Davidson county a mine was opened in 1839, which produced in the three succeeding years about $7,000 worth of gold, when the ore was proved to be more valuable for silver than for gold. These metals were associated with a variety of metallic ores, among which the sulphuret, carbonate, and phosphate of lead were especially abundant. Furnaces were constructed for reducing these, and separating the silver obtained with the lead. This is the only mine east of the Rocky Mountains which has furnished any considerable amount of silver to the mint. It is now known as the Washington mine.

Although many gold mines have been worked in South Carolina, the only one of much note is the Dorn mine, in Abbeville district. In 1850 this mine, then quite new, produced gold to the value of $19,000, and in 1852 the production rose to $202,216, although the mine was provided with very imperfect machinery and worked in a very rude manner. This large yield was, however, of short duration, the gold occurring in great quantity only in streaks or pockets upon a short portion of the vein.

The Georgia gold mines, first worked in the north-east part of the state in 1829, were soon found to extend south-west into the country beyond the Chestatee river, which was then possessed by the Cherokee Indians. In 1830 the borders of this territory were overrun by a reckless set of adventurers, notwithstanding the attempts made, first by a force of United States troops stationed for the protection of the Indians, and afterward by Georgia troops, when the state extended her laws in 1830 over the Cherokee country. On the removal of the Indians, their lands were distributed in 40 acre lots, by lottery, among the inhabitants of the state, and thus titles were obtained to the gold mines. The deposit mines yielded richly for a few years, and the whole product of gold for the first ten years of their working is supposed to have amounted to $16,000,000, a large portion of which never reached the United States mints, but was distributed in barter throughout the neighboring states and worked up in jewelry. From 1839 to 1849 the production did not probably exceed $4,000,000. A number of quartz veins were opened in Habersham, Lumpkin, Cherokee, Carroll, Columbia, and other counties, and considerable amounts of gold were obtained from these. They were, however, generally abandoned when the workings reached a depth at which machinery would be required for draining the mines. In Columbia county, about 20 miles from Augusta, the McCormack mine has been worked without interruption for about 20 years steadily, producing very fair profits. The gold is found in small particles in a honey-combed quartz, which contains but little pyrites and some galena. Nearly all the gold was obtained within 70 feet of the surface.

In Lumpkin county the gold is found in immense beds of decomposed micaceous and talcose slates, which, too poor to be worked by the slow process of crushing the whole material in mills and then washing away the earthy matter, will probably well repay the more thorough system of operations according to the California hydraulic process. After these beds had remained neglected for many years, Dr. H. M. Van Dyke, who had gained experience in California, and already applied it in introducing the system into North California, found in Boston, Mass., capitalists who agreed to furnish the money required for securing the richest tracts in the vicinity of Dahlonega, and conveying to them the water for washing down the hills on the plan, which will be more particularly noticed in speaking of the California mines. In 1858 he commenced operations, which have since been actively conducted; taking the water of the Yahoola river at a point about 13 miles above the spot where it will be first used, and conveying it by a canal or ditch over the more elevated portion of the country, crossing the valleys by means of sluices supported upon trestle-work, the height of which gradually increases with the descent of the streams, until at the crossing of the Yahoola near Dahlonega the high trestle now in construction is at the level of 240 feet above the bed of the river, with a span between the hills of 1,400 feet. Beyond this crossing the canal is to be extended two miles further, to reach the rich deposits upon which the hose washing will be first applied. It is expected that the arrangements will be completed early in 1861, and that from the numerous localities controlled by the company, at which the water can be used to advantage, the proceeds will revive the reputation of the Georgia gold mines.

Another association was formed in Boston in 1857, called the Nacoochee Hydraulic Mining Company, for the purpose of applying the same system to the high grounds in White county, recently a part of Habersham, in which are the mines of the Nacoochee valley and its vicinity, at one period highly productive, and where many deposits exist at so great an elevation, that no water has heretofore been brought to bear upon them. By damming the Nacoochee river, this company can carry water to these points; and their arrangements are already nearly completed. In some experimental trials they have, by the use of a current of water that would flow through a six-inch pipe, obtained several hundred dollars per week with the labor of two miners. From one spot more than 1,500 dwts. were washed out in small nuggets, several of about 100 dwts. each, and one of 387 dwts. The value of these is $1 the dwt., and of the gold dust 97 cents. The auriferous belt of rocks consists of alternating beds of micaceous, hornblende, and talcose slates and gneiss, which stand nearly vertically, and contain between their layers bands of quartz. The gold is found in the quartz and in the auriferous pyrites accompanying it, and to some extent in the slates also. Detached or "free" gold is also met with, derived, no doubt, from pyrites which has decomposed and disappeared. From the general disintegration of the edges of these strata, gold has been distributed in the deposits around.

From Georgia, the gold-bearing rocks are traced into eastern Tennessee, where they have been worked along the range of the Coweta and Smoky Mountains; and from the south side of the Blue Ridge, in Georgia, they have proved productive in a south-west direction, through Carroll county, into Alabama; but the formation is soon lost in the last-named state.

The gold regions along both slopes of the Rocky Mountains are, however, the most remarkable yet discovered on this continent. In Colorado, "the whole range of mountains seems crowded with veins of rich mineral ore. They run into and through the hill sides like the bars of a gridiron—every hundred feet, every fifty feet, every twenty feet." The first and largest development of these mines lies along and up the Clear Creek and centres around its sources. The principal mining villages of this section are Central City, Black Hawk and Nevada. Another centre of productive mining interests is in the South Park. The gold in Colorado is combined with sulphur and forms a sort of pyrites. This renders its extraction more difficult; but processes have lately been devised which, without increasing materially the expense, will raise the production of gold per cord of ore to three or five-fold what it has hitherto been. There are also large deposits of gold in New Mexico and Utah, which are not yet developed to any considerable extent.

IDAHO and MONTANA are also immensely rich in gold mines and placers. The Boise Basin, in Idaho, has yielded, and still yields to the placer miner in many parts a fair return for his labor, and possesses, beside, many valuable gold-bearing quartz leads. The South Boise has also many valuable leads. The Owyhee mines, sixty miles south of Boise City. They are almost entirely silver-producing, though some gold is extracted from the silver. In Montana, the placer diggings are yet paying largely, and the quartz leads are richer in gold than in any section yet discovered; and the two localities which have been thus far principally worked, Alder Gulch, and the vicinity of Helena, about one hundred and fifty miles apart, are yielding both gold and silver in great profusion.

Still another region rich in gold, richer perhaps than either of the others, though as yet developed with difficulty, on account of the hostile and treacherous Indians who roam over it, is the Territory of Arizona. Its gulches and cañons abound in the precious metal, and it cannot be long before they yield in profusion their long hidden wealth. The completion of the Pacific railroad will soon make this wealth available.

The most important gold region of the United States and of the world is that of California. Its development has not only largely multiplied the previous gold production of the globe, but it has been the means of rapidly bringing into the use of civilized nations large territories of productive lands, which before were an unprofitable wilderness, founding new states, enlarging the commerce of the world, and bringing into closer intercourse nations which before were the most widely separated. At the period when the wealth of the gold mines of California began to be realized, the annual production of gold throughout the world had gradually fallen to about $20,000,000, and more than half of this was furnished by Russia alone. In 1853, only five years later, California produced an amount estimated at $70,000,000, and the total production, through the supplies, nearly as large, furnished at the same time by Australia, had increased to almost double this amount. Little was known of California previous to the discovery of gold at Sutter's mill, on the American fork of the Sacramento, in February, 1848; yet its being a country containing gold was made known by Hakluyt in his account of Drake's expedition of 1577–9, and by Cavello, a Jesuit priest of San José, Bay of Francisco, who published a work on the country in Spain in 1690. Reports from later travellers confirmed these statements at various times, and in *Hunt's Merchants' Magazine* for April, 1847, a report is presented by Mr. Sloat, which speaks in very decided terms of the richness of the gold placers of the country, as noticed by him during his observations of the two preceding years. The Rev. C. S. Lyman, in a letter written to the editor of the *American Journal of Science* from San José, in March 1848, notices the discovery of the preceding month as very promising. In August of that year it was reported that four thousand men were engaged in working the deposits on the American fork, and were taking out from $30,000 to $40,000 a day. This comprised a large portion of the population of California. San Francisco was almost deserted, and people were pouring in from distant regions. The next year the emigration commenced in the United States, both by sea around Cape Horn, and across the plains and Rocky Mountains in large parties. By the close of the year 1849 the number of persons engaged in mining was estimated at from 40,000 to 50,000 Americans, and about 5,000 foreigners: the total product of gold at about $40,000,000. The mining district was traced up the valley of the Sacramento toward the north, and the continuation of the same formations up that of the San Joaquin in the opposite direction was also beginning to be understood. Along the valleys of the streams, which flowed into these rivers from the Sierra Nevada range to the east, gold was almost everywhere found, and upon the hills and elevated plains it was met with beneath the sands and clays which covered the surface to the depth of fifteen to thirty feet or more; all the materials, earthy and metallic, appearing either to have been derived from the superficial disintegration of the slaty formations, or to have been deposited by ancient rivers, which have since been diverted in other directions. Deposits of this character were called dry diggings, and, except in the wet season, were worked to great disadvantage for the want of water to separate the earthy matters from the gold. In the bottoms of the streams the deposits contained much coarse gold, derived from the wearing down of the slate formations through which they had made their way in their rapid descent from the Sierra Nevada mountains. By the excavation of the vast gulches or ravines of these streams, some of which presented precipitous walls of about 3,000 feet in height, an immense amount of gold must have been removed from its original beds, which, as the lighter earthy matters were swept down the rivers, remained behind, forming the riches of the auriferous deposits. The country of this peculiar character was found to extend along the western slopes of the Sierra Nevada for 400 or 500 miles, and the gold-bearing slates to spread over a width of from forty to sixty miles.

Whether or no the natural processes by which the gold had been collected from its original beds suggested to the California miner an improved method of washing the auriferous formations upon a gigantic scale, it was soon found that the richness of the deposits would justify, especially in the dry diggings, large outlays in conveying water from great distances by canals or ditches, and applying this, either under the pressure of a great head, to tear up the material from its bed and wash away the earthy portions, or to wash the auriferous gravels as these were carried to the water sluices and thrown into them for this purpose. On this plan hydraulic operations were soon laid out of extraordinary extent. Currents were diverted well up the slope of the Sierra Nevada mountains, and conveyed in canals along the sides of the hills, and in sluices, supported upon trestle-work, from one hill to another, sometimes at a height of more than 200 feet above the bottoms. On the hills where the water was required for "hose washing," it was taken from the canal or sluice in a large and strong canvas hose, to the lower end of which a nozzle, like that of a fire engine, was attached. The least head for efficient service was about 60 feet, and a head of 100 feet was used where it could be had and the hose would bear it. Large hose and nozzles proved much more efficient than several smaller ones of equal or even greater capacity. As estimated by Mr. Wm. P. Blake, with a pipe of an inch and a half or two inches aperture, and a pressure of 90 feet head, a boy can excavate and wash as much auriferous earth as 10 or 15 men by the ordinary methods. In suitable places, where the waste water can flow rapidly away though the sluices made for its channel and for catching the gold, the jet of water is directed against the side of a hill, which it rapidly excavates, sweeping off the earthy portions, undermining the trees, and rolling down the loose stones, and, where the ground is favorable for the operation, cutting every thing away, it may be to a depth of 100 feet from the top to the bottom of the excavation, leaving behind barren acres of loose stone in unsightly piles—a perfect picture of desolation. At the close of the year 1858 it was estimated that the artificial water-courses already constructed for mining purposes in California amounted to 5,726 miles in length, and their cost to $13,575,400; and besides these there were branches not enumerated, and others in construction, to the extent of about 1,000 miles more. Among the principal of these canals are the Columbia and Stanislaus, in Tuolumne county, which is 80 miles long, and cost $600,000; the Butte, in Amador county, 50 miles long, cost $400,000; that of the Union Water Company, in Calaveras county, 78 miles long, cost $320,000; and that of the Tuolumne Hydraulic Company, 60 miles long, cost $300,000. Notwithstanding the cost of these enterprises, they have proved in general highly profitable, paying, after deducting the expenses of keeping them up, from one to more than five per cent. a month. The water is sold to the miners by the canal companies at so much per inch of the discharge—this being from a horizontal aperture, one inch high, at the bottom of a box in which the water is kept six inches deep. The length of the aperture is regulated by a slide. The price has fallen from $3.00 an inch per day in 1851, to 50 cents in 1854, and is now still less.

Sluice-washing, which is a necessary part of the hydraulic or hose process, is also carried on independently of it, and by a method which was first adopted in California. Channels are made sometimes upon the surface of the slaty beds in place, the ragged edges of which are very favorable for catching the gold, or sometimes of boards, in the form of an open trough, a foot or 15 inches in width, and 8 or ten inches deep, which are extended to several hundred feet in length. These are set at a suitable slope, usually about one in twelve, and "riffle" bars are laid across to obstruct the flow of the heavy metallic particles which sweep along the bottom, while the muddy portions and stones are carried over with the flow of the water, and discharged at the lower end. Fresh gravel is continually shovelled into the sluices, and once a day, or oftener, these are cleaned up to collect the gold from the riffles and pools, which are sometimes used at the head of one joint of the sluice to receive the discharge from the next one above. Where the descent is rapid enough to keep the pool "in a boil," a considerable portion of the gold may be caught in it, especially if mercury be introduced.

In 1851 attention began to be turned to the quartz veins, or "ledges," as they were called, and numerous companies were soon established in the United States and in England for carrying on regular mining operations upon these. Within five years after, many deep shafts had been sunk upon veins in different parts of the country, and mills were in operation, furnished with the most efficient machinery for crushing and washing the ore. The uncertain supply of water, and the great expense attending the procuring it by canals from a distance, have operated strongly against the success of these works. They have, however, added considerably to the production of gold, and are still vigorously prosecuted. Upon the estate of Col. Fremont, in Mariposa county, several veins are worked to considerable extent on the northern ridge of Mount Bullion, and the quartz is transported to the Benton Mills, on Bear River, and to the steam mills at Bear Valley, Ophir, Guadaloupe, and Agua Fria. The principal vein, called the Pine Tree, has been traced about 20 miles from Mount Ophir, through Bear Valley, and along Mount Bullion to Merced River, with an average thickness of 30 feet. Among its contents are found oxides and carbonates of copper, and its ores are often exceedingly rich in gold. Those of the neighboring vein, called the Josephine, are variously valued at from $50 to $2,000 per ton. On account of the precipitous character of the hills, the transportation of the ore was almost impracticable until Col. Fremont had constructed a railroad, 3¾ miles long, down the steep slopes, in zigzag lines, upon grades varying from 2 to 7½ feet in 100, and with 17 curves of radii, varying from 53 to 84 feet. The width of the track is 36 inches, and the rails are of iron bars set on edge. The cars carry each 2½ tons of rock, and are run down in 45 minutes, their movement being regulated by a brake. By the construction of this road and the completion of new mills, furnished with powerful stamping machinery, and with inexhaustible supplies of ore at command, Col. Fremont is now in a position to thoroughly test the question as to the dependence that may be placed upon quartz mining in California as a permanent business.

The total production of the mines of California, as nearly as can be made up from the official returns, has been presented in the following values, in pounds sterling, for the years named:—

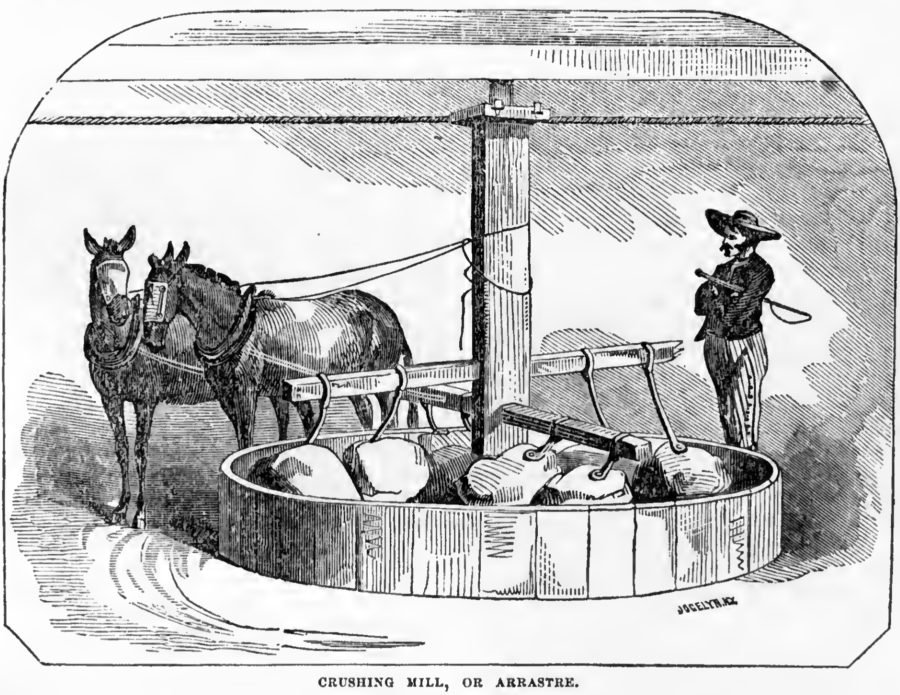
1848......	£11,700	1853......	£12,500,000
1849......	1,612,000	1854......	14,100,000
1850......	5,000,000	1855......	13,400,000
1851......	8,250,000	1856......	14,000,000
1852......	11,700,000	1857......	13,110,000

The quantities deposited in the mints of the United States will be given, together with those from other states, in the course of this article.

Gold is almost universally found native, or uncombined with other substances, and the processes for separating it from the stony matters with which it is associated may be, and commonly are, wholly mechanical. It occurs in the alluvial deposits, mixed with their lowest beds of sand and gravel; also in veins, usually of quartz, which often contain various metallic ores besides the gold; and it is disseminated through the mass of great beds of slate, which are frequently in a more or less decomposed condition. From such beds it is often distributed in fine particles through the soil in their vicinity. Not subject to be chemically affected by any of the ordinary agents of change, the particles of gold, large or small, remain unaltered in the soil, always seeking by their great weight the lowest level; and they may at any time be collected by washing away the earthy matters. New localities are tested by trying the earth in different places, by washing it in an iron pan or upon the blade of a shovel, an experienced hand readily throwing the heavy particles by themselves, while the lighter are allowed to flow away. This method is one of the means in use for collecting gold upon a small scale, and the Mexicans of the gold regions, by long practice, are particularly expert in it. If a vein is to be tested, the quartz is finely crushed, and the powder is then washed in the same manner. Gold may be thus brought to view when none was visible in the stones, however closely examined. By placing a little mercury or quicksilver in the pan, the gold will be more perfectly secured, as, by coming in contact with each other, these metals instantly unite to form a heavy amalgam, and the mercury thus holds the finest particles of gold so that they cannot escape. The mixture, separated from the sand, is squeezed in a piece of thick linen or deerskin, through which the excess of mercury escapes, leaving the amalgam. This may then be heated on a shovel, when the mercury goes off in vapor, and the gold is left in its original-shaped particles, cohering together in a cake. If the quantity of amalgam is considerable, it is distilled in a retort, and the mercury is condensed to be used again. This amalgamation fails entirely if the slightest quantity of any greasy substance is present, as a film of the grease coats every portion of the mercury, and effectually prevents its contact with the gold. These processes contain the principles of nearly all the methods in use for separating gold. A great variety of machines have been based upon them, the simplest of which have proved the most valuable. The Burke rocker has always been a favorite machine in the southern states, and has been largely used in California by small companies of miners, and in localities where operations were not carried on upon a very extensive scale. It is a cradle-shaped trough, about six feet long, set on two rockers, the upper end a few inches higher than the lower, and placed so as to receive at its head a current of water from the end of a leading trough above. This falls upon a perforated iron plate, set as a shelf in the machine, and upon this the auriferous gravel is thrown. The finer particles fall through as the rocker is kept in motion by hand, and the coarse gravel rolls down to the lower end, and falls off upon the ground. Across the bottom of the rocker are placed, at intervals of 6 or 8 inches, low bars or partitions which catch the heavy sands, and prevent their being washed out of the lower end with the water and mud. This lower portion is sometimes arranged as a drawer, which can be secured by a lock, so that the gold which falls into it is safe against robbery. The drawer is called the "riffle box." Some rockers are mere open troughs without a shelf. The "tom" is often preferred to the rocker, which it resembles, except in its being a trough without rockers, on the plan of the sluices already described. Both it and the rocker are of convenient size for moving about from one place to another, as the working of the deposit advances.

BURKE ROCKER.

Vein mining requires more efficient machinery, and stamping mills are constructed as near as may be to the mines, for reducing the stony materials to powder, and the sands from the stamps are passed through a variety of machines designed to catch the gold. Stamps are solid blocks of the heaviest cast iron attached to the end of a wooden or iron rod called the leg, to which the lifting cam is applied for raising them. They commonly weigh about 300 lbs. each, though in California they are made of twice and even three times this weight. Several of them are set together in a frame side by side, and are lifted in succession by the cams upon a horizontal shaft, which revolves in front of them. The bed in which they stand, and into which the ore to be crushed is thrown, is sometimes a massive anvil, hollow in the top, firmly imbedded in a heavy stick of timber, or is formed of stones, beaten by the stamps themselves into a solid bed. Water is usually supplied in small currents to the stamps, and sometimes mercury also is poured into the bed. The only exit for the crushed materials is through small holes punched in a sheet of copper, of which the side of the boxing around the stamps is formed, opposite to that at which the ore is fed. Through these holes the mud and water are projected with every blow into a capacious box, the floor of which inclines gently back toward the stamp, and contains along this edge a quantity of mercury, in which a considerable portion of the gold is caught. From the box a spout leads the current into the other machines, often through an inclined trough, in the bottom of which baize or blanket stuff is laid for the purpose of entangling in its fibres the particles of gold that are swept along. These are frequently taken up and cleaned. Much of the gold, however, always escapes them, and the current is variously treated before it is finally allowed to flow away. The sands require to be more finely pulverized, and the current first flows into mills of some sort, as the Chilian mill, arrastre, etc. The former consists of a pair of heavy wheels of granite, from four to six feet in diameter when new, set in a horizontal frame, one on each side of an upright shaft, and carried around with the shaft as it revolves upon its axis. The stones They revolve in a water-tight box or tub upon a granite floor. Sometimes they are used in the place of stamps for breaking up the coarse ore; and worked at the rate of eight to twelve revolutions a minute, they should crush to fine sand from one to two tons of quartz in twelve hours. The water, which flows in one side the tub, passes out over the opposite edge with the light slime and fine mud, while much of the gold remains in the bottom, caught by the mercury placed there to secure it. The arrastre is something like the Chilian mill, only instead of revolving stones, heavy flat ones are dragged round with the shaft by chains, secured to the horizontal arms. These machines in Mexico are worked by horses or mules, but in this country by water or steam power. The slowness of their operation is not regarded as an objectionable feature, but on the contrary is favorable for effectually securing the gold. Among the simplest and best contrivances employed below the Chilian mill are the "shaking tables." These are platforms seven or eight feet long, of plank in a single piece, as wide as can be procured.



CRUSHING MILL, OR ARRASTRE.

being as close as possible to the shaft, have a twisting motion which acts powerfully to grind the particles crushed by their weight. The planks, of two inches thickness, are worked down from a line across the middle to a thin edge at one end, and from the other end they are made to diminish to half an inch thickness at the line across the middle. Each one is furnished with sides, and a strip across the thin end of six inches in height, the joining made perfectly tight, and is then swung between four posts in a horizontal position by four rods or chains, which should be at least eight feet long. Mercury is poured into the two divisions, until they are more than half filled. The sands are made to flow in upon the thin end, and are received upon the face of the mercury; and the table is made to swing forward and back by the revolution of a crank. By the motion the sands are mixed in with the mercury, and swept along in successive waves, and falling over the middle ridge are treated in the same manner in the succeeding division. The mercury is retained by its weight in the depressed portions of the table, and the water and sands are discharged over the open end. Many machines designed for effecting the amalgamation of the gold in the most thorough manner have been patented within the last few years, and have been introduced at the mines under various names; few of them, however, involve any new principles, but are merely modified forms of the old contrivances. The use of hot water was found several years ago to hasten the amalgamation, and the employment of steam engines provided a cheap way of obtaining it in the large quantities required. Prof. A. K. Eaton, of New York, found that amalgamated metallic surfaces could be made to collect most completely the very fine particles of gold, which by all other processes it has been found impossible to secure. The use of copper, brass, or zinc proved troublesome and impracticable from the rapidity with which they were dissolved in the mercury, adulterating the amalgam. An amalgamated iron surface proved to be free from this objection, and the following description of apparatus was finally decided on as the most efficient: A circular plate of wrought iron is amalgamated over what is intended to be its inferior surface, and an open tube is fixed in its centre, rising three or four feet high, and furnished at the top with a bowl or funnel. This tube and disk are supported upon a surface of mercury contained in a shallow tub of larger diameter than the disk, a frame-work being attached to the tub for this purpose. A pulley is fixed upon the hollow shaft, so that a belt may be attached for causing the disk to rotate upon the mercury. The sands are fed with water into the funnel at the top of the tube, and the pressure caused by the height of the column carries them down upon the mercurial surface, and, by reason of this pressure and the centrifugal action of the revolving disk, they gradually work outward between this surface and the amalgamated surface above, being pressed and rubbed between them till they escape round the circumference of the disk, and flow over the edge of the tub. Hot water, as in all other modes of amalgamating, is preferable to cold. By this process all free gold, however fine the particles, must come in contact with the amalgamated surface, and be taken up by the mercury. It perfectly separates the gold that in other machines floats off in the fine slime, for the reason that simply pressed into the mercury and left to themselves, the impalpable particles immediately rise upon its surface, without coming into actual contact with the fluid metal. In gold ores, especially those of sulphurous character, much of the gold is so fine that it remains suspended a long time in water, and is entirely lost. The important feature of this invention is the use of an inferior amalgamated surface, against which these floating particles are pressed. The pressure is secured by any desired depth of the mercury, but in practice less than an inch above the lower edge of the plate is found to be sufficient. The efficiency of the machine was fully tested in November, 1860, at the Gold Hill mine, in North Carolina, where better results were obtained with it than by any other machine ever before applied to the separation of the gold from its pyritous sands. In the same month it was tried at the United States assay office, in New York city, upon the tailings of the sweeps from which all the gold had been extracted that could be removed by the amalgamating machines in use, and from these it readily separated the remaining portion.

As remarked in the mention made of the Gold Hill mines, when gold is associated with iron and copper pyrites it is held very tenaciously, as if combined itself with the sulphur, like the other metals. However finely such ores are pulverized, every microscopic particle of pyrites appears to retain a portion of gold, and prevent its uniting with the mercury. This portion of the gold, consequently, escapes in the tailings; and if these are kept in refuse heaps, exposed to the weather, the pyrites slowly decompose, and more gold is continually set free. Thus it is the heaps may be washed over with profit for many successive years. Artificial roasting of the ores is recommended by high authorities as a sure method of freeing the gold at once, the effect of it being to break up the sulphurets, causing the sulphur to escape in vapor, and the iron to crumble down in the state of an oxide, or an ochreous powder, from which the gold is readily separated by the ordinary methods. This is objected to by others, who assert that it involves a great loss of gold, which is volatilized or carried off mechanically in the sulphur fumes. In California complete separation is sought to be attained by long-continued and most thorough pulverization of the ores, the heavy sands of the first concentration being received into Chilian or other mills, and repeatedly ground to the extreme of fineness, and always in the presence of mercury. Various chemical processes have been devised for the treatment of these ores, and in Russia it has been proposed to smelt the sands after they had been concentrated, and cause the gold to be taken up by iron reduced by the same smelting operation from its ores. The mechanical and amalgamating treatment, however, appears to be the only one in successful use.

The great value of gold renders it profitable to work deposits and ores which contain an exceedingly small per-centage of metal. In the "branch mining" of the southern states, deposits worked by the rocker are regarded as profitable which pay a pennyweight or nearly one dollar per day to the hand employed. The yield is always uncertain, and sometimes runs up, for a short time, to very large amounts; but it has, for the most part, ceased to be followed as a regular pursuit. The production of the ores is quite as uncertain as that of the deposits, and their value depends upon a variety of circumstances: as the hardness of the material, the tenacity with which it holds the fine gold when crushed, the convenience of the locality to mills, and the expenses attending the working of the mines. The great beds of decomposed slates of Georgia can be worked to profit when they yield from four to five cents worth of gold to the bushel of stuff, or about 100 lbs. weight; but the mill for crushing and washing it must then be close at hand. The proportion of the gold, in this case, is less than 2 parts in 1,000,000. The hard quartz ores must contain nearly or quite 20 cents worth of gold in the bushel, especially if they are pyritiferous.

Although the gold is obtained in a metallic state, it differs very much in value in different localities. That of the deposits is the proper representative of the character of the gold of any district, and always brings a higher price at the mint than the imperfectly cleaned gold derived from the veins of the same locality. It has peculiarities in its appearance by which its source may often be recognized. This is commonly owing to the different proportions of silver with which it is alloyed. Deposit gold from the vicinity of Dahlonega, in Georgia, is worth 93 cents the pennyweight; that of Hart county, in the same state, 98 cents; of Carroll county, Georgia, and Chesterfield district, South Carolina, $1.02; of Union county, Georgia, or the Tennessee line, 72 cents; Charlotte, North Carolina, $1.00; and that of Burke county, North Carolina, only 50 cents. The value appears to decrease toward the western margin of the gold region. The average fineness of California gold is found to be from 875 to 885 parts in 1,000, which is very near that of our gold coin, viz., 900 in 1,000. The native gold from Australia has from 960 to 966 parts in 1,000 pure gold, and some from the Chaudiere, in Canada, 877.3 pure gold, and 122.3 silver; another specimen 892.4, silver 107.6. The specific gravity of the metal has been increased by casting from 14.6 in the native state to 17.48.

At the mint and branch mints of the United States, records are preserved of the source whence the gold offered for coinage is obtained, and tables are thus prepared, copies of which are given on the succeeding pages. These are interesting for reference, although they can hardly be regarded as presenting even an approximate estimate of the amount of gold derived from the mines of the United States. As already stated, considerable portions of this never reach the mints; and from California particularly large quantities have been carried to Europe in the form of gold dust. The product of its mines is more nearly presented in the tables accompanying the description of the gold-mining operations of that region. Gold has been coined at private mints in California and at Pike's Peak; but this coinage, not recognized by the government, after circulating for a time, finds its way to the government mint, and the gold is credited in the accounts as the production of the region where it was converted into coin.

1.—MINT OF THE UNITED STATES, PHILADELPHIA.

Period.	Virginia.	North Carolina.	South Carolina.	Georgia.	Tennessee.	Alabama.	New Mexico.	California.	Oregon.	Kansas.	Other sources.	Total.
1804 to 1827..	..	$110,000 00	..	..	..	..	..	..	..	..	..	$110,000 00
1828 to 1837..	$427,000 00	2,519,500 00	$327 500	$1,763,900 00	$12,400	..	..	..	..	..	$13,200	5,063,500 00
1838 to 1847..	518,294 00	1,303,636 00	152,366	566,316 00	16,499	$45,493	..	..	..	..	21,037	2,623,641 00
1848.........	57,886 00	109,034 00	19,228	3,370 00	3,497	3,670	$682	$44,177 00	..	..	..	241,544 00
1849.........	129,382 00	102,688 00	4,309	10,525 00	2,739	2,977	32,889	5,481,439 00	..	..	144	5,767,092 00
1850.........	65,991 00	43,734 00	759	5,114 00	307	1,178	5,392	31,667,505 00	..	..	326	31,790,306 00
1851.........	69,052 00	49,440 00	12,338	2,490 00	126	817	890	46,939,367 00	..	..	..	47,074,520 00
1852.........	83,626 00	65,248 00	4,505	3,420 00	..	254	814	49,663,623 00	..	..	..	49,821,490 00
1853.........	52,200 00	45,690 00	3,522	1,912 00	..	..	3,632	52,732,227 00	13,535	..	5,213	52,857,931 00
1854.........	23,347 00	9,062 00	1,220	7,561 00	..	245	738	35,671,185 00	..	..	..	35,713,358 00
1855.........	28,895 50	22,626 00	1,200	1,733 50	..	310	900	2,634,297 63	..	..	1,535	2,691,497 63
1856.........	21,607 00	12,910 00	5,980	4,910 00	..	..	2,460	1,440,134 58	40,750	..	..	1,528,751 58
1857.........	2,505 00	6,805 00	2,565	3,542 00	..	..	..	565,566 41	..	..	..	580,983 41
1858.........	18,377 00	15,175 00	300	18,365 00	..	..	..	1,372,506 07	3,600	..	..	1,428,323 07
1859.........	15,720 00	9,305 00	4,675	20,190 00	240	..	275	959,191 79	2,960	$145	..	1,012,701 79
Total.......	$1,513,882 50	4,424,853 00	540,467	2,413,348 50	35,808	54,944	48,672	229,171,219 48	60,845	145	41,455	238,305,639 48

2.—BRANCH MINT, SAN FRANCISCO.

Period.	California.	Period.	California.	Period.	California.
1854	$10,842,281 23	1856	29,209,218 24	1858	19,104,369 99
1855	20,860,437 20	1857	12,526,826 93	1859	14,098,564 14
		Total			$106,641,697 73

3.—BRANCH MINT, NEW ORLEANS.

Period.	North Carolina.	South Carolina.	Georgia.	Tennessee.	Alabama.	California.	Other sources.	Total.
1838 to 1847	$741	$14,306	$37,364	$1,772 00	$61,903	..	$3,613	$119,699 00
1848	..	1,488	2,317	947 00	6,717	$1,124 00	..	12,593 00
1849	..	423	..	..	4,062	669,921 00	2,733	677,189 00
1850	..	..	..	..	3,560	4,575,576 00	894	4,580,030 00
1851	..	..	..	..	1,040	8,764,682 00	..	8,770,772 00
1852	..	..	..	..	..	3,777,784 00	..	3,777,784 00
1853	..	..	..	..	..	2,006,673 00	..	2,006,673 00
1854	..	..	..	..	..	981,511 00	..	981,511 00
1855	..	..	..	..	..	411,517 24	..	411,517 24
1856	..	..	..	..	..	283,344 91	..	283,344 91
1857	..	..	..	..	..	129,328 39	..	129,328 39
1858	..	..	1,560	164 12	..	448,439 84	..	450,163 96
1859	..	..	..	..	..	93,272 41	..	93,272 41
Total	$741	16,217	41,241	2,883 12	77,282	22,148,173 79	7,290	22,293,827 91

4. BRANCH MINT, CHARLOTTE, NORTH CAROLINA.

Period.	N. Carolina.	S. Carolina.	California.	Total.
1838 to 1847	$1,529,777 00	$143,941 00	..	$1,673,718 00
1848	359,075 00	11,710 00	..	370,785 00
1849	378,223 00	12,509 00	..	390,732 00
1850	307,289 00	13,000 00	..	320,289 00
1851	275,742 00	25,478 00	$15,111 00	316,061 00
1852	337,604 00	64,934 00	28,362 00	430,900 00
1853	227,847 00	61,845 00	15,465 00	305,157 00
1854	$188,277 00	$19,006 00	$6,328 00	$213,606 00
1855	196,894 03	14,277 17	5,817 66	216,988 86
1856	157,355 18	..	16,237 35	173,592 53
1857	170,560 33	5,807 16	..	176,067 49
1858	75,376 47	..	..	75,376 47
1859	182,489 61	22,762 71	..	205,252 32
Total	$4,386,239 62	$394,965 04	$87,321 01	$4,868,525 67

5. BRANCH MINT, DAHLONEGA, GEORGIA.

Period.	N. Carolina.	S. Carolina.	Georgia.	Tennessee.	Alabama.	California.	Kansas.	Other sources.	Total.
1838 to 1847	$64,851 00	$95,427 00	$2,978,353 00	$82,175 00	$47,711 00	..	..	..	$3,218,017 00
1848	5,434 00	8,151 00	251,376 00	2,717 00	4,075 00	..	..	..	271,753 00
1849	4,882 00	7,323 00	225,824 00	2,441 00	3,661 00	..	..	..	244,131 00
1850	4,500 00	5,700 00	204,473 00	1,200 00	1,800 00	$30,025 00	..	..	247,698 00
1851	1,971 00	3,236 00	154,723 00	2,251 00	2,105 00	214,072 00	..	$951 00	379,809 00
1852	443 00	57,543 00	93,122 00	750 00	..	324,931 00	..	..	476,789 00
1853	2,085 00	33,950 00	56,984 00	149 00	..	359,122 00	..	..	452,290 00
1854	5,818 00	15,988 00	47,027 00	223 00	..	211,169 00	..	..	280,225 00
1855	3,145 82	9,113 27	56,686 36	..	277 92	47,428 70	..	..	116,652 07
1856	..	25,723 75	44,107 99	106 42	..	31,467 10	..	..	101,405 26
1857	..	8,083 89	25,097 63	..	..	6,498 42	..	..	39,679 54
1858	..	32,322 28	57,891 45	107 33	..	5,293 52	..	..	95,614 58
1859	2,656 88	4,310 85	57,023 12	..	..	699 19	$82 70	..	65,072 24
Total	$95,286 70	$307,171 54	$4,252,688 55	$42,119 75	$59,629 92	$1,230,705 53	$82 70	$951 00	$5,988,635 69

6. ASSAY OFFICE, NEW YORK.

Period.	Virginia.	N. Carolina.	S. Carolina.	Georgia.	Alabama.	California.	Kansas.	Oregon.	Other sources.	Total.
1854	$167 00	$3,916 00	$395 00	$1,242 00	..	$9,221,457 00	..	..	..	$9,227,177 00
1855	2,370 00	3,750 00	7,620 00	13,100 00	$350 00	25,025,896 11	..	..	$1,600 00	25,054,686 11
1856	6,928 00	805 07	4,052 29	41,101 28	283 62	16,259,008 90	..	..	..	16,582,129 16
1857	1,531 00	1,689 00	2,663 00	10,451 00	1,545 00	9,899,957 00	..	..	..	9,917,836 00
1858	501 00	7,007 00	6,354 00	12,951 00	2,181 00	19,660,551 46	..	$5,581 00	27,523 00	19,722,629 46
1859	436 00	20,122 00	700 00	14,756 00	593 00	11,694,872 25	$3,944 00	2,866 00	405 00	11,738,694 25
Total	$11,933 00	$37,289 07	$21,784 29	$93,601 28	$4,902 62	$92,031,722 72	$3,944 00	$8,447 00	$29,528 00	$92,243,151 98

7. SUMMARY EXHIBIT OF THE ENTIRE DEPOSITS OF DOMESTIC GOLD AT THE UNITED STATES MINT AND BRANCTES, TO JUNE 30, 1859.

Mints.	Virginia.	N. Carolina.	S. Carolina.	Georgia.	Tennessee.	Alabama.	New Mexico.	California.	Kansas.	Oregon.	Other sources.	Total.
Philadelphia	$1,513,582 50	$4,424,853 00	$540,467 00	$2,413,348 50	$35,808 00	$54,944 00	$48,672 00	$229,171,219 48	$145 00	$60,845 00	$41,455 00	$238,305,639 48
San Francisco	..	..	..	..	..	..	..	106,641,697 73	..	..	..	106,640,697 73
New Orleans	..	741 00	16,217 00	41,241 00	2,883 12	77,282 00	..	22,148,173 79	..	..	7,290 00	22,293,827 91
Charlotte	..	4,386,239 62	394,965 04	..	..	..	..	87,321 01	..	..	..	4,868,525 67
Dahlonega	..	95,286 70	307,171 54	4,252,688 55	42,119 75	59,629 92	..	1,230,705 53	82 70	..	951 00	5,988,635 69
Assay Office	11,933 00	37,289 07	21,784 29	93,601 28	..	4,902 62	..	92,031,722 72	3,944 00	8,447 00	29,528 00	92,243,151 98
Total	$1,525,515 50	$8,944,409 39	$1,280,604 87	$6,800,879 33	$80,810 87	$196,758 54	$48,672 00	$451,310,840 26	$4,171 70	$69,292 00	$79,224 00	$470,840,478 46

The most important use of gold is as a medium of exchange. For this purpose it is converted into coin at the mints, and into bars or bullion at the government assay office. In this form a large portion of the receipts from California is immediately exported from New York to make up the balance of foreign trade. Each bar is stamped with marks, representing its fineness and weight, and may continue to be thus used, or when received at foreign mints, is converted into coin. A large amount of gold is consumed in jewelry, trinkets, watches, and plate, and still more in the form of gold-leaf. This last being worn out in the using, or being distributed in too small quantities together to pay for recovering it, is altogether lost to the community, after the articles have served the purpose intended. This loss in the time of James I. was considered so serious, that a special act was passed, restricting the use of gold and silver-leaf, except for specified objects, which, singularly enough, were chiefly for military accoutrements. Gold employed in the recently invented process of electrotyping, in which large quantities are consumed, is similarly lost in the using.

Besides the use of gold-leaf in gilding, it is employed quite largely by dentists as the best material for filling teeth. They also use much gold plate and wire for securing the artificial sets in the mouth. In book-binding, gold is consumed to considerable extent for lettering and ornamenting the backs of the books. The manufacture of gold-leaf is carried on in various places, both in the cities and country. It is a simple process, known in ancient times, but only of late years carried to a high degree of perfection. The ingots, moulded for the purpose, and annealed in hot ashes, are rolled between rollers of polished steel, until the sheet is reduced from its original thickness of half an inch to a little more than $\frac{1}{800}$ of an inch, an ounce weight making a strip ten feet long and $1\frac{1}{2}$ inches wide. This is annealed and cut into pieces an inch square, each weighing about six grains. A pile is then made of 150 of these pieces, alternating with leaves of fine calf-skin vellum, each one of which is four inches square, and a number of extra leaves of the vellum are added at the top and bottom of the pile. The heap, called a tool or kutch, is slipped into a parchment case open at the two ends, and this into a similar one, so that each side of the pack is protected by one of the case. It is placed upon a block of marble, and then beaten with a hammer weighing sixteen pounds, and furnished with a convex face, the effect of which is to cause the gold to spread more rapidly. The workman wields this with great dexterity, shifting it from one hand to the other, without interfering with the regularity of the blow. The pack is occasionally turned over, and is bent and rolled in the hands to cause the gold to extend freely between the leaves, as it is expanded. The gold-leaves are also interchanged to expose them all equally to the beating. When they have attained the full size of the vellum, which is done in about twenty minutes, they are taken apart, and cut each one into four pieces, making 600 of the original 150. These are packed in gold-beater's skin, and the pack is beaten as before, but with a lighter hammer, until they are extended again to sixteen square inches. This occupies about two hours. The gold-leaves are then taken out, and spread singly upon a leather cushion, where they are cut into four squares by two sharp edges of cane, arranged in the form of a cross. To any other kind of a knife the gold would adhere. These leaves are again packed, 800 together, in the finest kind of gold-beater's skin, and expanded till each leaf is from 3 to $3\frac{1}{2}$ inches square. The aggregate surface is about 192 times larger than that of the original sheet, and the thickness is reduced to about the $\frac{1}{150000}$ of an inch. The beating is sometimes carried further than this, especially by the French, so that an ounce of gold is extended over 160 square feet, and its thickness is reduced to $\frac{1}{234000}$ of an inch, or even to $\frac{1}{250000}$. When the pack is opened, the leaves are carefully lifted by a pair of wooden pliers, spread upon a leather cushion by the aid of the breath, and cut into four squares of about $3\frac{1}{4}$ inches each, which are immediately transferred one by one between the leaves of a little book of smooth paper, which are prevented from adhering to the gold-leaves by an application of red ochre or red chalk. Twenty-five leaves are put into each book, and when filled, it is pressed hard, and all projecting edges of the gold are wiped away with a bit of linen. The books are then put up in packages of a dozen together for sale.

An imitation gold-leaf, called Dutch gold-leaf, is used to some extent. It is prepared from sheets of brass, which are gilded, and beaten down in the manner already described. When new it appears like genuine gold-leaf, but soon becomes tarnished in use. Party gold-leaf is formed of leaves of gold and of silver, laid together and made to unite by beating and hammering. It is then beaten down like gold-leaf.

The gold-beater's skin used in this manufacture is a peculiar preparation made from the .cæcum of the ox. The membrane is doubled together, the two mucous surfaces face to face, in which state they unite firmly. It is then treated with preparations of alum, isinglass, whites of eggs, etc., sometimes with creosote, and after being beaten between folds of paper to expel the grease, is pressed and dried. In this way leaves are obtained $5\frac{1}{8}$ inches square, of which moulds are made up, containing each 850 leaves. After being used for a considerable time, the leaves become dry and stiff, so that the gold cannot spread freely between them. To remedy this, they are moistened with wine or with vinegar and water, laid between parchment, and thoroughly beaten. They are then dusted over with calcined selenite or gypsum, reduced to a fine powder. The vellum, which is used before the gold-beater's skin, is selected from the finest varieties, and this, too, after being well washed and dried under a press, is brushed over with pulverized gypsum.

In the great exhibition at London in 1851, machines were exhibited from the United States, and also from Paris, which were designed for gold-beating, and it was supposed they would take the place of the hand process. They have been put into operation at Hartford, in Connecticut, but after being tried, they have been laid aside for the old method.

CHAPTER IV.

LEAD.

Lead is met with in a great number of combinations, and has also been found in small quantity, at a few localities in Europe, in a native state. The common ore, from which nearly all the lead of commerce is obtained, is the sulphuret, called galena, a combination of 86.55 per cent. of lead and 13.45 of sulphur. It is a steel gray mineral of brilliant metallic lustre when freshly broken, and is often obtained in large cubical crystals: the fragments of these are all in cubical forms. The ore is also sometimes in masses of granular structure. Very frequently galena contains silver in the form of sulphuret of that metal, and gold, too, has often been detected in it. The quantity of silver is estimated by the number of ounces to the ton, and this may amount to 100 or 200, or even more; but when lead contains three ounces of silver to the ton this may be profitably separated. Ores of this character are known as argentiferous galena; if the silver is more valuable than the lead they are more properly called silver ores. In Mexico and Germany such are worked, but not in the United States. Galena is easily melted, and in contact with charcoal the sulphur is expelled and the lead obtained. The ore is found in veins in rocks of different geological formations, as in the metamorphic rocks of New England, the lower silurian rocks of Iowa, Wisconsin, and Missouri, in limestones and sandstones of later age in New York and the middle states, belonging to higher groups of the Appalachian system of rocks, and in the new red sandstone of Pennsylvania at its contact with the gneiss.

Carbonate of lead is another ore often associated with galena, though usually in small quantity. It is of light color, whitish or grayish, commonly crystallized, and in an impure form is sometimes obtained in an earthy powder. At St. Lawrence county, New York, large quantities of it have been collected for smelting, and were called lead ashes. The ore may escape notice from its unmetallic appearance, and at the Missouri mines large quantities were formerly thrown aside as worthless. It contains 77.5 per cent. of lead combined with 6 per cent. of oxygen, and this compound with 16.5 per cent. of carbonic acid. Beautiful crystals of the ore, some transparent, have been obtained at the mines on the Schuylkill, near Phœnixville, Pennsylvania; the Washington mine, Davidson county, North Carolina; and Mine La Motte, Missouri.

Another ore, the phosphate or pyromorphite, has been known only as a rare mineral until it was produced at the Phœnixville mines so abundantly as to constitute much the larger portion of the ores smelted. It is obtained in masses of small crystals of a green color, and sometimes of other shades, as yellow, orange, brown, etc., derived from the minute portions of chrome in combination. With these a variety of other compounds of lead are mixed, together with phosphate of lime and fluoride of calcium, so that the percentage of the metal is variable. The compounds of lead met with at these mines are the sulphuret, sulphate, carbonate, phosphate, arseniate, molybdate, chromate, chromo-molybdate, arsenio-phosphate, and antimonial argentiferous. Besides all these, a single vein contained native silver, native copper, and native sulphur, three compounds of zinc, four of copper, four of iron, black oxide of manganese, sulphate of barytes, and quartz.

The eastern portion of the United States is supplied with lead almost exclusively from Spain and Great Britain, but the western states are furnished with this metal from mines in Iowa, Wisconsin, and Missouri. The lead veins of the eastern and southern states are of little importance. In Maine the ores are found in Cobscook Bay, near Lubec and Eastport, in limestone rocks near dikes of trap. A mine was opened in 1832, and a drift was carried in about 155 feet at the base of a rocky cliff on the course of the vein; it was then abandoned, but operations have recently been recommenced. In New Hampshire argentiferous galena is found in numerous places, but always in too small quantity to pay the expenses of extraction. At Shelburne a large quartz vein was worked from 1846 to 1849, and three shafts were sunk, one of them 275 feet in depth. The ore was found in bunches and narrow streaks, but in small quantity. Some of it was smelted on the spot, and five tons were shipped to England, which sold for £16 per ton. The richest yielded 84 ounces of silver to the ton. Another vein of argentiferous galena has been partially explored at Eaton, and this is most likely of any to prove valuable.

Massachusetts, also, contains a number of lead veins, none of which have proved profitable, though some of them have been worked to considerable extent. The most noted are those of Southampton and Easthampton. Operations were commenced at the former place in 1765 upon a great lode of quartz containing galena, blende, copper pyrites, and sulphate of barytes. It is in a coarse granitic rock near its contact with the red sandstone of the Connecticut valley. About the year 1810 an adit level was boldly laid out to be driven in from 1,100 to 1,200 feet, to intersect the vein at 140 feet below the surface. A single miner is said to have worked at it till his death, in 1828, when it had reached the length of 900 feet. At different times this adit has been pushed on, and when last abandoned, in 1854, it was supposed to be within a few feet of the vein. The rock was so excessively hard that the cost of driving the adit was about $25 per foot. Lead veins are found in Whately, Hatfield, and other towns in Hampshire county.

In Connecticut, also, several veins have been worked to some extent. That at Middletown, referred to in the introductory remarks as one of the earliest opened mines in the United States, is the most noticeable. It is unknown when this mine was first worked. In 1852 operations were renewed upon it, and a shaft sunk 120 feet below the old workings. The vein is among strata of a silicious slate, in some places quite rich, but on the whole it has proved too poor to work. The ore contained silver to the value of from $25 to $75 to the ton of lead.

Lead mines have been opened in New York, in Dutchess, Columbia, Washington, Rensselaer, Ulster, and St. Lawrence counties. In the first four of these the ore is found in veins near the junction of the metamorphic slates and limestones. The Ancram or Livingston mine, in Columbia county, has been worked at different times at considerable expense, but with no returns. A mine in Northeast, Dutchess county, was first opened by some German miners in 1740, and ore from it was exported. The Committee of Public Safety, during the revolutionary war, sought to obtain supplies of lead from it. The lead veins of this part of New York have attracted more interest, on account of their highly argentiferous character, than the quantity of ore they promise would justify; but it seems to be almost universally the case throughout the United States that the galena yielding much silver fails in quantity. The Ulster county mines are found on the west side of the Shawangunk mountain in the strata of hard grit rock which cover its western slope. At different places along this ridge veins have been found cutting across the strata in nearly vertical lines, and have produced some lead, zinc, and copper. The Montgomery mine, near Wurtsboro, in Sullivan county, was chiefly productive in zinc. Near Ellenville, Ulster county, several veins have been followed into the mountain, and one of these, which was worked in 1853, afforded for a short time considerable quantities of rich lead and copper ores. From the former there were smelted about 459,000 pounds of lead, and the sales of the latter amounted to from 60 to 70 tons, of which 50 tons yielded 24.3 per cent. of copper. Where the vein was productive it contained the rich ores unmixed with stony gangues, and sometimes presenting a thickness of five feet of pure ore; where it became poor it closed in sometimes to a mere crack in the grit rock, and then the expense of extending the workings became very great from the extreme hardness of this rock. Open fissures were met with, one of which was more than 100 feet long and deep, and in places 12 feet or more wide. It was partially filled with tough yellow clay, through which were dispersed fragments of sandstone, magnificent bunches of quartz crystals, and lumps of lead and copper ores. The walls on the sides also presented a lining in places of the same ores. A drift was run into the base of the mountain about 200 feet, and a shaft was sunk at the foot of the slope about 100 feet. The expense of working in the hard rock proved to be too great for the amount of ore obtained, and the mine was abandoned in 1854, although its production, for the extent of ground opened, has been exceeded by but few other mines in the eastern states. The most promising veins in the state are those of St. Lawrence county in the vicinity of Rossie. They occur in gneiss rock, which they cut in nearly vertical lines. One of these was opened along the summit of Coal Hill, and was worked in 1837 and 1838 by an open cut of 440 feet in length, to the depth, in some places, of 180 feet. In 1839 the mine was abandoned, after the company had realized about $241,000 by the sale of some 1,800 tons of lead they had extracted. The galena was remarkably free from blende, and from pyritous iron and copper, which (especially the first-named) are so often associated with the ore, rendering it difficult to smelt. Calcareous spar, often finely crystallized, formed the gangue of the vein. A nearly transparent crystal, weighing 165 lbs., is preserved in the cabinet of Yale College. Other attempts have been made to work the mine; and the cause of its being allowed to lie idle appears to be the difficulty of negotiating a mining right with the proprietors.

In Pennsylvania the most productive lead mines are those of Montgomery and Chester counties, found in a small district of 5 or 6 miles in length by 2 or 3 in width, at the line of contact of the gneiss, and red shale and sandstone. About 12 parallel veins have been discovered, extending north 32° to 35° east, and dipping steeply south-east. In the gneiss they are productive in lead ores, and in the red shale in copper. The gneiss is decomposed, and the vein itself is in considerable part ochreous and earthy, owing to decomposition of pyritous ores. In this material, called by the miners gossan, silver has been discovered amounting to 10 ounces to the ton. The two principal mines of this group are the Wheatley and the Chester County. The former was opened in 1851, and up to September, 1854, had produced 1,800 tons of ore, principally phosphate, estimated to yield 60 per cent. of metal. In this vein the great number of varieties of lead and other ores enumerated above were met with. The Chester County Mining Company commenced operations in 1850, and up to November, 1851, had raised and smelted 190,400 lbs. of ore, almost exclusively phosphate, which produced about 47 per cent. of lead. The silver in this ore amounted to about 1.6 ounce in 2,000 lbs.; in the galena associated with it the silver was found in quantities varying from 11.9 to 16.2 ounces; the coarser grained galena giving the most, and the fine grained the least. In connection with the furnaces for smelting the ores, was one for separating the silver by cupellation, and a considerable amount of silver was obtained before the mining operations were abandoned, in 1854.

Lead ores are found along the Blue Ridge, in Virginia, and at one point, near the central portion of its range across the state, a mine has been worked for a number of years. They are also met with in several of the gold mines, but not in workable quantities. In south-west Virginia and east Tennessee the ores are found in the silurian limestones, and a considerable number of mines have been worked to moderate extent in both states. The most important one is the Wythe lead mine, 16 miles from Wytheville, which was worked in 1754. It is in a steep hill on the border of New River, a fall upon which, near the mine, affords power for raising the water required in dressing the ores, and also for producing the blast for the furnace. Several shafts have been sunk, one of which extending down to the adit—a depth of 225 feet—is used as a shot tower. The ores are galena, with more or less carbonates intermixed. The product for 1855 is stated to have been 500 tons of lead. The transportation of lead, in pigs, bars, and shot, from the south-west part of Virginia toward the east, by the

Virginia and Tennessee railroad, for the years named, has been as follows:—

	1856.	1857.	1858.	1859.
	lbs.	lbs.	lbs.	lbs.
Pig Lead	409,649	514,878	163,405	854,695
Bar Lead	..	234,037	52,230	22,580
Shot	364,660	120,142	104,623	254,970
Total	774,309	869,057	320,258	1,132,245

In the other direction the transportation of the same articles was comparatively unimportant.

South of Virginia the only lead mine of importance is the Washington mine, Davidson county, N. C. This was opened in 1836, in the silicious and talcose slates of the gold region, and was worked for the carbonate of lead, which was found in a dull, heavy ore of earthy appearance, with which were intermixed glassy crystals of the same mineral. Some galena and phosphate of lead were also met with. After a time native silver was detected, and the lead that had been obtained was found to be rich in silver. Till 1844 the mine continued to produce ores containing much silver, and afforded the first deposits of this metal in the mint from domestic mines. The character of the ores changed, however, below the depth of 125 feet, the silver almost disappearing. The actual product of the mine is not known. That of 1844 is said to have been $24,209 in value of silver, and $7,253 of gold, obtained from 160,000 lbs. of lead—an average of 240 oz. of auriferous silver to 2,000 lbs. of metal. In 1851 the production was 56,896 lbs. of lead and 7,942.16 oz. of auriferous silver—equal to 279 oz. to the ton of metal. Zinc blende and galena became at last the prevailing ores, the silver varying from 2.5 to 195 oz. to the ton; and the workings were extended upon two parallel veins which lay near each other in the slates. In 1852 mining operations were abandoned as unprofitable, but were soon after renewed, and are still continued.

The great lead mines of the United States are the upper mines, in a district near the Mississippi, in Iowa, the south-west part of Wisconsin, and the north-west part of Illinois; and the lower mines, in Missouri. The existence of lead ores in the upper district was made known by Le Sueur, who discovered them in his voyage up the Mississippi in 1700 and 1701. They attracted no further attention, however, till a French miner, Julien Dubuque, commenced to work them in 1788; and in this employment he continued, on the spot where now stands the city in Iowa bearing his name, until his death in 1809. When the United States acquired possession of the country in 1807, the mineral lands were reserved from the sales, and leases of mining rights were authorized. These were not, however, issued until 1822, and little mining was done before 1826. From that time the production of lead rapidly increased; and the government for a time received the regular rates for the leases. But after 1834 the miners and smelters refused to pay them any longer, on account of so many sales having been made and patents granted of mineral lands in Wisconsin. In 1839 the United States government authorized a geological survey of the lead region, in order to designate precisely the mineral tracts, and this was accomplished the same year by Dr. D. D. Owen, with the aid of 139 assistants. In 1844 it was decided to abandon the leasing system, and throw all the lands into the market. The lead region, according to the report of Dr. Owen, extends over about 62 townships in Wisconsin, 10 in the north-west corner of Illinois, and 8 in Iowa—a territory altogether of about 2,880 square miles. Its western limit is about 12 miles from the Mississippi river; to the north it extends nearly to Wisconsin river; south to Apple river, in Illinois; and east to the east branch of the Pekatonica. From east to west it is 87 miles across, and from north to south 54 miles. Much of the region is a rolling prairie, with a few isolated hills, called mounds, scattered upon its surface, the highest of them rising scarcely more than 200 feet above the general level. The prevailing limestone formations give fertility to the soil, and the country is well watered by numerous small streams, which flow in valleys excavated from 100 to 150 feet below the higher levels. The limestone, of gray and yellowish gray colors, lies in nearly horizontal strata, and the portion which contains the lead veins hardly exceeds 50 feet in thickness. Beneath it is a sandstone of the age of the Potsdam sandstone, and above it are strata of limestone recognized as belonging to the Trenton limestone, so that it proves to be a formation interposed between these, quite western in character, as it is not met with east of Wisconsin. The veins occupy straight vertical fissures, and several near together sometimes extend nearly a mile in an east and west direction. They never reach downward into the sandstone, but are lost in the lower strata of the limestone, and where the upper strata of the formation appear, these cover over the veins, and are consequently known as the cap-rock. In the fissures or crevices the galena is found, sometimes in loose sheets and lumps embedded in clay and earthy oxide of iron, and sometimes attached to one or both walls. It is rarely so much as a foot thick. No other ores are found with it, except some zinc blende and calamine, and occasionally pyritous iron and copper. The lead contains but a trace of silver. The fissures, as they are followed beneath the surface, sometimes expand in width till they form what is called an "opening;" and the hollow space may go on enlarging till it becomes a cave of several hundred feet in length and 30 or 40 in width. Their dimensions are, however, usually within 40 or 50 feet in length, 4 to 8 in width, and as many in height. The walls of the openings often afford a thick incrustation of galena, besides more or less loose mineral in the clay, among the fragments of rock, with all of which the caves are partially filled. Flat sheets of ore often extend from the vertical fissures between the horizontal limestone strata; these are more apt to contain blende, and pyrites, and calcareous spar than the ore of the vertical crevices. Besides these modes of occurrence, galena is found in loose lumps in the clayey loam of the prairies. This is called float mineral, and is regarded as an evidence of productive fissures in the vicinity.

The galena occurs under a variety of singular forms in the crevices. It lines curious cavities which extend up in the cap-rock, terminating above in a point, and which are known as chimneys. Upon the roofs of the openings it is found in large bunches of cubical crystals, and the same are obtained lying in the clays of the same openings. A flat sheet of the ore was worked in Iowa that was more than 20 feet across and from 2 to 3 feet thick, each side of which turned down in a vertical sheet, gradually diminishing in thickness. It yielded 1,200,000 lbs. of rich galena, and more still remained behind in sight. The crevices near Dubuque are the most regular and productive of any in the district. One called the Langworthy, on a length of about three-fourths of a mile, has produced 10,000,000 lbs. of ore. On the main fissure there were usually three ranges of crevices one above another, widening out to 15 or 20 feet.

The smelters of this region form a distinct class from the miners, of whom the former buy the ores as these are raised, and convert them into metal in the little smelting establishments scattered through the country. The lead has been principally sent down the Mississippi river to Saint Louis and New Orleans; but a portion has always been consumed in the country, and some has been wagoned across to Milwaukee before the construction of railroads, which since 1853 have afforded increased facilities for distributing in different directions the product of the mines. The only records of the amount of lead obtained are those of the shipments down the river. The following table presents the number of pigs shipped from the earlier workings to 1857; the figures for 1841 to 1850, inclusive, being furnished to Dr. Owen's Report of 1852 by Mr. James Carter, of Galena. The pigs weigh about 70 lbs. each.

SHIPMENTS OF LEAD FROM THE UPPER MISSISSIPPI.

Years.	Pigs.	Years.	Pigs.
1821 to 1823...	4,790	1842..........	447,859
1824..........	2,503	1843..........	561,321
1825..........	9,490	1844..........	624,601
1826..........	13,700	1845..........	778,460
1827..........	74,130	1846..........	730,714
1828..........	158,655	1847..........	771,679
1829..........	190,620	1848..........	680,245
1830..........	119,060	1849..........	628,934
1831..........	91,170	1850..........	569,521
1832..........	61,164	1851..........	474,115
1833..........	113,440	1852..........	408,628
1834..........	113,648	1853..........	425,814
1835..........	158,330	1854..........	423,617
1836..........	191,750	1855..........	430,365
1837..........	219,360	1856..........	435,654
1838..........	200,465	1857..........	485,475
1839..........	357,785	1858..........	
1840..........	317,845	1859..........	
1841..........	452,814		

The lead region of Missouri was first brought into public notice by the explorations of the French adventurer, Renault, who was sent out from Paris in 1720, with a party of miners, to search for precious metals in the territory of Louisiana, under a patent granted by the French government to the famous company of John Law. Their investigations were carried on in the region lying near the Mississippi and south of the Missouri river; and here, though they failed to find the precious metals they were in search of, they discovered and opened many mines of lead ore. A large mining tract in the northern part of Madison county is still called by the name of their mineralogist, La Motte. Their operations, however, were altogether superficial, and the lead they obtained was wholly by the rude and wasteful process of smelting the ores upon open log-heaps—a practice which even of late years is followed to some extent. Up to Renault's return to France, in 1742, little progress had been made in the development of this mining district. The next step was made by one Moses Austin, of Virginia, who obtained from the Spanish government a grant of land near Potosi, and commenced in 1798 regular mining operations by sinking a shaft. He also started a reverberatory furnace and built a shot tower. Schoolcraft states in his "View of the Lead Mines of Missouri," that there were in 1819 forty-five mines in operation, giving employment to 1,100 persons. Mine á Burton and the Potosi diggings had produced from 1798 to 1816 an annual average amount exceeding 500,000 pounds; and in 1811 the production of Mine Shibboleth was 3,125,000 pounds of lead from 5,000,000 pounds of ore. At a later period, from 1834 to 1837, the several mines of the La Motte tract produced, it is estimated, 1,035,820 pounds of lead per annum. From 1840 to 1854 the total yield of all the mines is stated by Dr. Litton in the state geological report to amount to over 3,833,121 pounds annually. At the close of this period it had, however, greatly fallen off, there being at that time scarcely 200 persons engaged in mining, besides those employed at the three mines known as Perry's, Vallé's, and Skewers'. The principal mines have been in Washington, St. Francis, and other neighboring counties. The ores are found in strata of magnesian limestone of an older date than the galena limestone of Wisconsin, and supposed to lie, with the sandstones with which they alternate, on the same geological horizon as the calciferous sand rock, which is found in the eastern states overlying the Potsdam sandstone. Some of the mines are at the contact of the horizontal limestone with granite rocks, but the ores in this position are only in superficial deposits or in layers included in the limestone. In their general features the veins do not differ greatly from those of the northern mines. Some of them, however, contain a larger proportion of other ores besides galena, as well as a greater variety of them. Carbonate of lead, called by the Miners dry bone and white mineral, is more abundant, and also blende, called by them black jack, and the silicate of zinc. Iron and copper pyrites are often seen, and at Mine la Motte are found the black oxides of cobalt and manganese associated with the carbonates of lead and copper. Nearly all the mining operations have been mere superficial excavations in the clay, which were soon exhausted of the loose ore and abandoned. But to this there are some remarkable exceptions of deeper and more permanent mines than are known in the northern lead regions. Such are Vallé's and Perry's mines, both situated on the same group of veins, which form a network of fissures and openings running in every direction and spreading over an area of about 1,500 feet in length by 500 in breadth, the extension of which is from north-west to south-east. These mines have been steadily worked since 1824, and 22 shafts have been sunk upon the fissures, six of which are over 110 feet deep, one is 170 feet deep, and only two are less than 50 feet. For the first 10 to 30 feet they pass through gravel and clay, below this through a silicious magnesian limestone of light color, and then enter a very close-grained variety of the same, called by the miners the cast steel rock. A succession of openings are encountered, which are distributed with considerable regularity upon three different levels. Those of the middle series have been the most productive. Sometimes chimneys connect them with the caves of the tier above or below. The portion of these mines on the Vallé tract produced, according to the state report, from 1824 to 1834 about 10,000,000 pounds of lead, and in the succeeding 20 years about as much more; and Perry's mine from 1839 to 1854 has produced about 18,000,000 pounds.

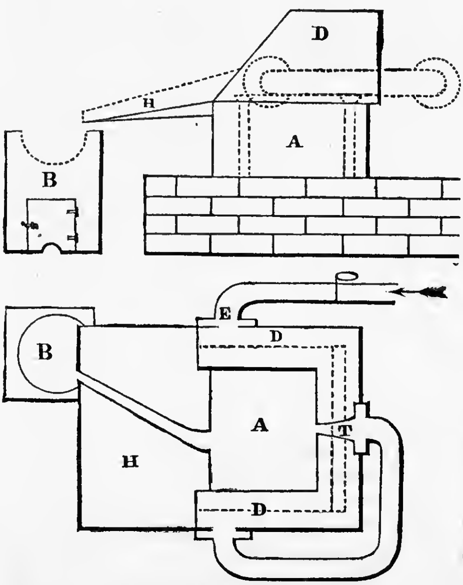
No accurate estimates have been preserved of the total production of the Missouri mines. This has always fallen far short of the yield of the northern mines. From 1832 to 1843 it is reported as running from 2,500 to 3,700 tons per annum, while that of the northern mines in the same time was from 5,500 to 14,000 tons, and in 1845 it even exceeded 24,000 tons. In 1852 Mr. J. D. Whitney estimated that the production in Missouri had fallen to 1,500 tons, or less; and from that period it has probably not advanced. As this decrease in the supply has been going on while the price of lead has risen to nearly three times what it was in 1842, the cause is probably owing to the mines themselves being in great part exhausted. The only sufficient sources known from which the increasing supplies required from year to year can be furnished, are the mines of Great Britain and Spain, though should the argentiferous lead mines of Mexico ever be worked for the lead as well as the silver they contain, they might furnish large quantities of the former metal. As the production of the United States has fallen off, that of Great Britain has increased from 64,000 tons in 1850 to 73,129 tons in 1856, and 96,266 tons in 1857, thus considerably exceeding one-half of the whole production of the globe in this metal, which in 1854 was rated at about 133,000 tons. At that time the production of Spain was rated at 30,000 tons, and of the United States at 15,000 tons. The following table, from *Hunt's Merchants' Magazine*, of July, 1859, presents several features of interest in the history of this business. The amount of domestic lead received at St. Louis and New Orleans is not, however, a true index of the production of the American mines, and the falling off of the figures in the second column for several years past, is properly accounted for to some extent by the new outlets opened from the northern mines eastward, and also by the largely increased consumption of the metal in the western states.

Years.	Pig lead from American mines received at St. Louis and New Orleans. lbs.	Pig, bar, and sheet lead imported. lbs.	Invoice value of yearly importations.	Average rate of duty per 100 lbs.	White and red lead imported lbs.	Invoice value of yearly importations.
1832	8,540,000	5,333,588	$124,311	$3.00	557,781	$30,791
1833	12,600,000	2,282,068	60,660	3.00	625,069	36,049
1834	14,140,000	4,997,293	168,811	2.77	1,024,663	57,572
1835	16,000,000	1,006,472	35,663	2.77	832,215	50,225
1836	18,000,000	919,087	35,283	2.55	908,105	62,237
1837	20,000,000	335,772	13,871	2.57	599,980	47,316
1838	20,860,000	165,844	6,573	2.34	522,681	38,683
1839	24,000,000	528,922	18,631	2.31	720,408	50,905
1840	27,000,000	519,343	18,111	2.08	643,418	41,043
1841	30,000,000	62,246	2,605	2.07	532,122	31,617
1842	33,110,000	4,689	155	3.00	479,738	28,747
1843	39,970,000	290	3	3.00	93,166	5,600
1844	44,730,000	..	..	3.00	..	..
1845	51,240,000	19,609	458	3.00	231,171	14,744
1846	54,950,000	214	6	3.00	215,434	15,685
1847	46,130,000	224,905	6,288	0.56	298,387	15,228
1848	42,420,000	2,684,700	85,387	0.64	318,781	19,703
1849	35,560,000	..	..	..	..	..
1850	40,313,910	36,997,751	1,182,597	0.64	853,463	43,756
1851	34,934,480	43,470,210	1,517,603	0.70	1,105,852	52,631
1852	28,593,180	37,544,588	1,283,331	0.70	842,521	43,365
1853	31,497,950	43,174,447	1,618,058	0.70	1,224,068	69,058
1854	21,472,990	47,714,140	2,095,039	0.90	1,865,893	102,812
1855	21,441,140	56,745,247	2,556,523	0.90	2,319,099	134,855
1856	15,347,880	55,294,256	2,528,014	0.91	3,548,409	174,125
1857	14,028,140	47,947,698	2,305,768	0.72	1,793,377	113,075
1858	21,210,420	41,230,019	1,972,243	0.72	1,785,851	109,426

For the year ending June 30, 1859, the imports of lead are given at 64,000,000 pounds, worth nearly $2,700,000. Of this about $57,000 worth were re-exported to foreign countries, besides American lead to the value of $30,000, and a small amount of manufactured lead.

Lead Smelting. The lead mines of the United States being scattered over wide territories, and their products being nowhere brought together in large quantities, the process of reducing the ores has been conducted in small establishments and by the most simple methods. The earlier operations were limited to smelting the ores in log furnaces. Upon a layer of logs placed in an inclosure of logs or stones piled up, split wood was set on end and covered with the ore, and over this small wood again. The pile was fired through an opening in front. The combustion of the small wood removed from the ore a portion of the sulphur, and the reduction was completed by the greater heat arising from the burning of the logs. The lead run down to the bottom and out in front into a basin, whence it was ladled into the moulds. The loss of metal was of course very large; but a portion was recovered by treating the residue in what was called an ash furnace. The process is still resorted to in places where no furnaces are within reach. But wherever mines are opened that promise sufficient supplies of ore, furnaces are soon constructed in their vicinity. Those in use are of two sorts: the Scotch hearth and the reverberatory. Besides these, another small furnace is often built for melting over the slags. This is little else than a crucible built in brick-work, and arranged for the blast to enter by an aperture in the back, and for the metal to flow out by another opening in front.

The Scotch hearth is a small blast furnace, but resembles the open forge or bloomary fire for iron ores. It has long been in use in Europe, and is the most common furnace at our own mines. In this country it has been greatly improved by the introduction of hot blast; and in its most perfect form is represented in the accompanying figures; figure *a* being a vertical section from front to back, and figure *b* a horizontal section.



SCOTCH HEARTH FURNACE.

A is the reservoir of lead of the furnace, consisting of a box, open at top, about two feet square and one foot deep, formed of cast iron 2 inches thick. From its upper front edge a sloping hearth, H, is fixed so as to receive the melted lead that overflows, and conduct it by the groove into the basin, B. In this it is kept in a melted state by a little fire beneath, and, as convenient, the lead is ladled out and poured into moulds. D is a hollow shell of cast iron ¾ of an inch thick, its inner and outer sides inclosing a space of 4 inches width. Into this space the blast is introduced at E, and becoming heated, passes out at F, and thence through the curved pipe into a tuyere, T, cast in the air-chest 2 inches above the level of the lead reservoir. Before commencing operations this reservoir is to be filled with lead, and is thus kept so long as the furnace is in use; the process being conducted upon the surface of the melted metal. The furnace may be kept in continual operation by adding new charges of galena every ten or fifteen minutes, and working them down after they have become roasted at the surface. The fuel employed is dry pine wood split into small pieces, and billets of these are thrown in against the tuyere just before each new charge of ore, that already in the furnace being raked forward upon the hearth to make room for the fuel, and the blast being temporarily turned off. The old charge is then thrown, together with fresh ore, upon the wood, and the blast is let on, when the heat and flame immediately spread through the materials. The sulphur in the ore serves itself as fuel, accelerating the process by its combustion, and in a few minutes the whole charge is stirred up, spread out on the hearth, and the hard, unreduced fragments are broken in pieces by blows of the shovel. Slaked lime is sometimes added in small quantity when the partially reduced ore becomes too soft and pasty by excess of heat. Its effect is to lessen this tendency rather by mechanical than chemical action. If any flux is used, it is fluor spar, blacksmith's cinders, or bits of iron. The latter hasten the reduction by the affinity of the iron for the sulphur of the ore. The cast iron of the air-chest is protected from the action of the sulphur by the cooling influence of the air blown in; and this is also advantageous by its keeping the furnace from becoming so hot, that the galena would melt before losing its sulphur, and thus form combinations of exceedingly difficult reduction. A fan, run by steam or water power, is commonly employed for raising the blast; but as this gives little pressure, it is replaced to great advantage by blowing cylinders, with an air-receiver for giving regularity to the current of air. With such an apparatus, the smelter can apply the blast with great advantage at times to help loosen up the charge and throw the flame through every part of it. The ores are prepared for smelting by separating from them all the stony and clayey particles, and as much as possible of the blende and other impurities that may accompany them. This may require a succession of mechanical processes, in which the ores are crushed to fine fragments and dressed by jigging and screening under water. Not only is the labor and cost of smelting reduced by the purity of the ore, and especially its freedom from blende and pyrites, but the quality also of the metal is thereby improved. Lead that contains iron is not adapted for the manufacture of white-lead. The American metal being generally free from this brings a higher price than Spanish or English lead. With pure ore a cord of wood may be made to produce four tons of lead; and each furnace 7,500 lbs. every 24 hours; a smelter and his assistant managing the operation for 12 hours. At Rossie large quantities of lead have thus been smelted at a daily cost for labor of $5, and for fuel of $1.50, making $1.75 per ton. In Wisconsin, before the use of the hot blast, each furnace-shift was continued from 8 to 10 hours, until 30 pigs of lead were produced of 2,100 lbs. weight, at an expense of about $4 for labor, and $1.50 for fuel.

The other form of furnace—the reverberatory—resembles others of this class employed in smelting copper ores. The sole, or hearth, upon which the ores are spread, is about 8 feet in length by 6 in breadth, and is made to incline rapidly toward an aperture on one side, or at the end under the chimney, and out of which the lead is allowed at the end of each smelting to flow into a receiver outside. The charge is supplied either through a hopper in the arched roof, or through the holes in the sides, which also serve for admitting the pokers used by the workmen to stir up the charge. Unless the galena has been previously calcined or roasted—a process necessary for poor ores only—this is the first thing to be attended to in all the smelting operations. In the large charge of 30 cwt. of ore this usually takes the first two hours of the process, and is effected in great part by the heat remaining in the furnace from the preceding operation, the doors at the sides being kept open at the same time to allow free access of air. The oxidation of the sulphur is expedited by almost constant stirring of the charge, which brings fresh portions to the surface, causing an evolution of white fumes. As these begin to diminish, the fire is started on the grate, and the heat is raised till the charge softens and the pieces of ore adhere to the rake. The doors are then closed, and the fire is urged for a quarter of an hour, when the smelter opens the door to see if the metal separates and flows down the inclined hearth. If the separation does not go on well, it is hastened by opening one of the doors, partially cooling the furnace, and stirring the charge. The fire is then again urged. If the slags which form seem to require it, he treats them with a few shovelfuls of lime and fine coal; and when, after having flowed down into the lower portion of the hearth, they are brought into a doughy consistency, the smelter pushes the slag to the opposite upper edge of the hearth, from which it is taken out through a door on that side by his assistant, while he lets off the lead into the receiver.

The separation by this method is not so perfect as by the Scotch hearth, and the expense of fuel is greater; but the reverberatory is worked without the necessity of steam or water power, which is required to raise the blast for the other process. The slags of the reverberatory contain so much lead that they are always remelted in the slag furnace. Those of the Scotch hearth, when pure ores are employed, are sufficiently clear of metal without further reduction. In Europe other sorts of furnaces are in use, which are adapted particularly for ores of poorer quality than are ever smelted in the United States.

In the Hartz mountains, at Clausthal, argentiferous silver ores containing much silica are worked in close cupola furnaces, into which only enough air is admitted to consume the fuel. The object is not to roast out the sulphur, but to cause this to combine with the granulated cast iron or with the quick-lime, either of which is mixed with the ores to flux them and form a fusible compound with the sulphur, through which the metallic lead can easily find its way to the bottom. The production of a silicate of lead is thus avoided, which is a difficult compound to reduce, and is always formed when much silica is present. This process will probably be applied to some of the silicious ores of the United States, and may be particularly suited to the Washoe ores of California.

By all the methods of reducing lead a great loss is incurred by the volatilization of a portion of the lead in white fumes, called lead ashes. These are carried up through the chimney of the furnace and fall upon the ground in the neighborhood, poisoning the vegetation and the water by the carbonate of lead, which results from the fumes. Trees even are killed, and the dogs die off, and also the cattle. In Scotland the lead has been detected in chemical examinations of the bodies of animals thus killed, and it was particularly noticeable in the spleen. For the injury thus occasioned at the furnaces of the United States no remedy has been applied, but at many of the great establishments in Europe, where the loss of lead and the damage to the neighborhood is much more serious, attempts have been made to arrest the fumes, by causing them to pass through long flues in the chimney stacks, in which the particles on cooling would settle down; and their cooling has been hastened by showers of water falling among the vapors. Flues have been extended great distances beyond the works, and have been found much more efficient than any form of condensation by sudden cooling. Some of the works constructed for this purpose are very remarkable for their great extent and the saving they have effected, and similar ones may perhaps be found well worthy of construction at some of the smelting establishments in the United States. At the works of Mr. Beaumont, in Northumberland, England, horizontal or slightly inclined galleries have been completed in stonework, 8 feet high and 6 feet wide, for an extent of 8,789 yards (nearly five miles). This is from one mill alone. The same proprietor has connected with other mills in the same district and in Durham four miles of galleries for the same purpose. The writer who gives the account of these in the recent edition of Ure's Dictionary, by Robert Hunt, remarks: "The value of the lead thus saved from being totally dissipated and dispersed, and obtained from what in common parlance might be called chimney sweepings, considerably exceeds £10,000 sterling annually, and forms a striking illustration of the importance of economizing our waste products." Not only is lead lost in the fumes, but in the working of argentiferous lead ores, a portion of the silver too is carried off and deposited with them. The fumes collected at the works of the Duke of Buccleuch yield one-third their weight of lead, and five ounces of silver to the ton. The loss of silver is of little importance in this country, where this metal is not obtained at the present time, unless it be at the Washington mine, in North Carolina, and at the Washoe mines, in California; and consequently methods of separating it from the lead possess little more than scientific interest. In the smelting of argentiferous lead ores, the silver goes with the lead, being completely dissolved and diffused throughout its substance. The usual way of separating it is founded on the principle of the lead being a metal easily oxidized and converted into the substance called litharge, in which condition it lets go the silver, which has no affinity either for the new compound of oxygen and lead, or for the oxygen alone. The change is effected by melting the lead in the shallow basins called cupels, formed of a porous earthy material, as the pulverized ashes of burned bones, kneaded with water, and mixed in a framework of iron. When dried, these are set in a reverberatory furnace, and the pigs of lead are melted upon their surface. After being thoroughly heated, a current of air is made to draw through an opening in the side of the furnace directly upon the face of the melted metal. This oxidizes the lead, and the yellow litharge with more or less red oxide, called minium, collects in a thin film upon its surface, and floats off to the edge, sinking into and incrusting the cupel and falling over its side into a receptacle placed to receive it. This process goes on, the lead gradually disappearing as the oxygen combines with it, till with the removal of the last films of oxide the melted silver suddenly presents its brilliant, perfectly unsullied face. The oxide of lead may be collected and sold for the purposes of litharge, as for a pigment, for use in the manufacture of glass, etc.; or it may be mixed with fine coal and converted back into lead, the carbon of the coal effecting this change by the greater affinity it has at a high heat for the oxygen, than the lead has to retain it. By this process, known as cupellation, lead is hardly worth treating for silver, unless it contain about 10 ounces to the ton of the precious metal; and it was therefore an important object to devise a method of saving with economy the silver lost in the large quantities of the poorer argentiferous leads. Such a method was accidentally discovered in 1829 by Mr. Pattinson, of Newcastle, and is now extensively in use in Europe for the poorer silver-leads, cupellation being preferred for the richer. He observed that when the lead containing silver forms crystals, as it is stirred while in a melted state, the crystals contain little or none of the silver, and may be removed, thus concentrating the silver in the portions left behind. This crystallizing process is applied in the large way as follows: Cast iron pots are set in brick-work side by side, capable of holding each one 4 or 5 tons of lead. The middle one is first charged, and when the lead is melted and stirred, the fire is removed under the next pot to the right; and into this crystals of lead as they form are ladled by means of a sort of cullender, which lets the fluid lead fall back. This instrument is kept hotter than the lead by frequently dipping it in a pot of lead over a separate fire. When four-fifths of the lead have been transferred to the pot to the right, the remainder, which contains all the silver, is removed to the next pot to the left, and the middle pot is then charged with fresh lead, which is treated in the same manner. The process is repeated with each pot, as it becomes full, four-fifths of its contents going to the next pot to the right, and one-fifth to the next to the left, and thus the lead is finally discharged into moulds at one end, and the argentiferous alloy, concentrated to the richness of 300 ounces of silver to the ton, is run into bars about 2 inches square. From these the silver is obtained by cupellation. At one establishment in England, that of Messrs. Walker, Parker & Co., the weekly product of silver is from 8,000 to 10,000 ounces. Whenever the lead mines of the eastern states are made to yield regular returns of lead, the separation of its silver is likely to be carried on in independent establishments, supplied like the copper-smelting works with material from various sources. Works having these objects in view were established in the fall of 1860, at Brooklyn, New York, by Messrs. Bloodgood & Ambler, and will commence operations with the smelting of the Washoe silver-lead ores from California, of which over sixty tons have been delivered at the works for reduction. Their successful treatment will no doubt be followed by the shipment of other ores of the different metals from various sources; and it is to be hoped that it will hereafter be found more advantageous to send ores to New York to be reduced, than to the smelting establishments on the other side of the Atlantic.

Useful Applications of Lead.—A considerable part of the lead product of the world is converted into the carbonate, known as white lead, and used as a paint. The principal articles of metallic lead are sheet lead, lead pipe, and shot. Sheet lead is manufactured in two ways. The melted lead is upset from a trough suspended over a perfectly level table, covered with fine sand, and furnished with a raised margin; and when the metal has spread over this, a couple of workmen, one on each side, carry along a bar supported upon the margin, pushing forward the excess of lead above that necessary for the required thickness, till it falls over the end of the table. By the other method, called milling, the lead is cast in a plate, 6 or 7 feet square, and 6 inches thick, and this being taken up by a crane, is placed upon a line of wooden rollers, which form a flooring for the length it may be of 70 or 80 feet and a width of 8 feet. Across the middle of this line are set the two heavy iron rolls by which the lead plate is compressed, as it is passed between them. The top of the lower roll is on a level with the top of the wooden rollers, and the upper roll is so arranged that it can be set nearer to or further from the lower one, as the thickness of the plate requires.

Lead pipe was formerly made by turning up sheet lead and soldering the edges; and is still prepared in this way for the large sizes, as those over six inches diameter. After this a method was contrived of casting the lead in a hollow cylindrical plug, its inner diameter of the bore required, and then drawing this down through slightly conical dies of decreasing diameter, a mandril or steel rod being inserted to retain the uniform diameter of the bore. Pipes made in this way were limited to 15 to 18 feet in length, and the metal was full of flaws. Many attempts have been made to cast long lengths of lead pipe, all of which have proved unsuccessful. In 1820 Thomas Burr, of England, first applied the hydraulic press to forcing lead, when beginning to solidify in cooling, through an annular space between a hollow ring and a solid core secured in its centre. He thus produced pipes of considerable length. The method of forcing the liquid metal through dies to form pipes was, however, first patented in 1797 by Bramah, who used a pump for this purpose. The process was introduced into this country in 1840–41 by Messrs. Tatham & Brothers, now of New York, who invented and patented an important improvement in the method of securing the die and core. In this operation the melted lead is made to flow from the furnace into a cylindrical cavity in a block of cast iron, which may be of 1800 lbs. weight, and from this, when cooled to the proper temperature, it is forced out through the die by a closely-fitting piston. By one process the piston, starting from the bottom of the cylindrical cavity, moves upward, carrying with it the slender core or rod which determines the diameter of the bore of the pipe, and pushes the melted lead before it through the die fixed in the top of the cast iron block. The pipe as it is formed passes out from the top of the machine, and is coiled around a receiving drum. By the machine contrived by Mr. Cornell of New York, the great iron block containing the lead rises by the pressure of the hydraulic machine, and the piston which is fixed above it enters the cavity. The piston in this case is hollow and the die is set in its lower end. The core is secured in the bottom of the block, and is carried upward as this rises. The pressure applied in this operation amounts to 200 to 300 tons. Dies are used of a great variety of sizes, according to the kind of pipe required. Lead wire is made in this way with a die of very small size without a core. It is used for securing vines and attaching tags to fruit trees and shrubs. The principal works in the United States engaged in the manufacture of sheet lead and lead pipe are in New York, Boston, Philadelphia, Chicago, Cincinnati, and Saint Louis.

Lead pipe is in general use as the most convenient conduit for water for domestic purposes. It is readily bent to any angle, and is made to adapt itself to any position. When water freezes within and bursts it, the damage is easily repaired; joints are also made with little trouble. The lead is not liable to become rusty like iron, and is cheaper than tin or copper. These qualities give to it a preference over other kinds of pipe, notwithstanding the very serious objection that the lead is often acted upon by the water, and produces poisonous salts of a very dangerous character. Some waters more than others have a tendency to promote the oxidation of the lead. This is particularly likely to occur with nearly all waters in pipes which are alternately exposed to the action of air and water, as when the water being drawn out, the air enters and takes its place. The oxide of lead is converted by carbonic acid gas, which is present in almost all water, into a carbonate of lead which is soluble to some extent in an excess of the gas, and is carried along, bearing no indication of its presence, while the lead pipe continues to be corroded until it may be in places eaten nearly through. The water used for drinking and for culinary purposes is thus continually introducing an insidious poison into the system, the effect of which is at last experienced in the disease known as the painters' colic, often followed by paralysis. As this occurs without a suspicion being awakened of the real source of the disease, and is produced by quantities so small as from $\frac{1}{10}$ to $\frac{1}{20}$ of a grain in the gallon, the use of lead pipe is properly regarded by scientific men as always unsafe; and some substitute for this metal in pipes and in sheets used for lining water cisterns, is highly desirable. It has been proposed to coat the pipe with some insoluble lining; but such an application necessarily increases its cost, it may perhaps be removed by hot water flowing through the pipe, and the purchaser may have no confidence in the coating being faithfully applied, or as certain to be efficient during long-continued use. Block tin is perfectly safe, but it is expensive, and is moreover likely to be alloyed with the cheaper metal lead, which in this condition is thought to be equally dangerous as when used alone. As no popular substitute for lead is provided, it is a reasonable precaution for those employing it to be always watchful and on their guard against its evil effects—using as little of it as necessary, causing the water to be occasionally tested, and, whenever opportunity offers, cutting open and examining pieces of the pipe to see whether its internal surface is corroded, and every morning before using the water that has stood in the pipes, to cause this to flow away together with enough more to thoroughly wash out the pipes and remove any salts of lead that may have formed in them during the night.

Large quantities of lead are consumed in the United States in the manufacture of shot and bullets; and one ingenious method of producing shot is an American invention.

The quality of the lead employed for this purpose is of little importance. The harder and inferior sorts, which would not answer for the white lead manufacture, are economically diverted to this object. If too brittle, from the iron and antimony combined with the lead, the metal is made to assume the right quality by mixing with it a small proportion of arsenic, which, for most kinds of lead, may amount to one per cent. To introduce this into the lead a large pot of the metal is melted, and powdered charcoal or ashes is laid around its edge. The arsenical compound, either of white arsenic or of orpiment (the sulphuret of arsenic), is then stirred into the centre of the mass, and a cover is tightly luted over the pot. In the course of a few hours, the mixture being kept hot, the combination of the lead with the arsenic is completed, and a portion of litharge floats upon the surface. This is formed from the oxygen of the white arsenic uniting with some of the lead, and it retains a portion of the arsenic. The alloy is now tried by letting a small quantity of it fall from a moderate height through a strainer into water. From the appearance of the globules the quality of the mixture is judged of. If they are lens-shaped, too much arsenic has been used; but if they are flattened on the side, or hollowed in the middle, or drag with a tail behind them, the proportion of arsenic is too small. When a proper mixture is obtained it is run into bars, and these are taken to the top of a tower, from 100 to 200 feet high, where the lead is melted and poured through cullenders, which are kept hot by being placed in a sort of chafing-dish containing burning charcoal. The lead is thus divided into drops that fall to the bottom, and are received in a vessel of water. Each cullender has holes all of the same size, which is considerably less than that of the shot produced by them. This is owing to the drop of melted lead first assuming an elongated form, which is concentrated into the globular by the air impinging equally upon all sides in the course of its descent. When it reaches the water, it is important that it should have cooled throughout, so that no solid crust be suddenly formed over a fluid interior; and hence, for large shot it is evident the height of the fall must be greater than is required for small shot. The temperature of the lead also, when it is dropped, must vary according to the size of the shot; for the largest size being so low that a straw is hardly browned when thrust into it. A portion of the lead becomes oxidized and is caught in the cullender, the bottom of which it coats, and serves a useful purpose by checking the too rapid flow of the melted lead through the holes. The holes vary in size, from $\frac{1}{50}$ of an inch for shot larger than No. 1, to $\frac{1}{360}$ of an inch for No. 9. The shot being taken out of the water and dried upon the surface of a long steam chest, are transferred to an iron cask suspended upon an axis passing through its ends, and a little plumbago being introduced with them, the cask is made to revolve until the shot are thoroughly cleaned and polished. The next operation is to separate the imperfect ones from the good. This is done by rolling them all together down a succession of inclined platforms, separated by a narrow space between each. The good shot clear these spaces and are caught below, while the bad ones fall through upon the floor. The good are then introduced into the sifters for assorting them according to their sizes. Several sieves are arranged like drawers in a case; the coarsest above, and finer ones succeeding below. The upper tier of sieves being charged, the case is set rocking, and the shot are soon assorted, and are then ready for packing in bags. Bullets and buck-shot are moulded by hand from a large pot of the metal into moulds with many receptacles.

The American process of shot-making was invented in 1848 by David Smith, of the firm of T. O. Leroy & Co., of New York, by whom it is exclusively used. Its object is to dispense with the use of the costly high towers, by substituting for them a lower fall against an ascending current of air. This current is produced by a fan-blower operating at the base of an upright hollow shaft into which the shot are dropped from a moderate height. The power required to run the fan is not much more than that ordinarily expended in raising the lead to the top of the high towers; and it is found that the lead, in consequence of its being more rapidly and equally cooled in the short descent against the current of air, may be used at a higher temperature than is practicable with that dropped from high towers; and thus it may not only be poured more rapidly, but it has not the tendency to burst in falling and form imperfect shot, as is the case with that dropped from high towers, to guard against which the lead is kept at a low temperature.

There are in New York city, besides this operation, which is carried on by Messrs. Leroy, in Water street, three shot towers, and a fourth is nearly completed on Staten Island. The ordinary capacity of these is from 3000 to 4000 tons of shot per annum. The annual shot production of St. Louis is about the same as that of New York, though there is now only one shot tower in use. There were formerly seven more on the river bluffs below the city, but these have hardly been used since 1847. In Baltimore is a tower the height of which, including ten feet constructed below the surface of the ground, is 256 feet, which exceeds by one foot the height of the famous tower in Vienna, described by Dr. Ure as the highest structure of the kind in the world, being 249 feet above the surface of the ground. Its production is stated to be about 400 tons per annum. In Philadelphia there is one tower which makes about 300 tons annually; in Wythe county, Virginia, is one formed in one of the shafts of the mine, making about 200 tons; and on the Wisconsin river, at Helena, is a small tower probably making about as much more. The actual production of the country in shot and bullets is supposed to be about 7000 tons, and to have made but little advance for many years past.

White Lead.—Before the introduction of the oxide of zinc as a paint, one of the most important uses of lead was its conversion into the carbonate or white lead. The manufacture was originally carried on almost exclusively in Holland; and it was not until near the close of the last century that it was introduced into England. In the United States it was unknown until after the late war, and being first undertaken in Philadelphia, it was afterward extended to New York and Brooklyn, and in the latter city has prospered more than in any other part of the country. Various attempts have been made to introduce new methods of manufacture, but the old Dutch process has continued in general use; the modifications of it which have raised the manufacture in this country to a higher state of perfection than in any other part of the world being merely improvements in the details, by which ingenious machinery has been made to diminish the labor expended in the process.

White lead is a combination of oxide of lead with carbonic acid, and is obtained in the form of a soft, very white, and heavy powder. It mixes readily with oil, giving to it a drying property, spreads well under the brush, and perfectly covers the surfaces to which it is applied. It is not only employed alone as the best sort of white paint, but is the general material or body of a great number of paints, the colors of which are produced by mixing suitable coloring matters with the white lead. Besides its use as a paint it is also in demand to a considerable extent as an ingredient in the so-called vulcanized india-rubber. To prepare it, the purest pig lead, such as the refined foreign lead and the metal from the upper mines of the Mississippi, is almost exclusively used. This was by the old methods made in thin sheets, and these into small rolls, to be subjected to the chemical treatment. But according to the American method devised by Mr. Augustus Graham of Brooklyn, and now generally adopted, the lead is cast into circular gratings or "buckles," which closely resemble in form the large old-fashioned shoe-buckles, from which they receive their name. They are six or eight inches in diameter, and the lead hardly exceeds one sixth of an inch in thickness. Ingenious methods of casting them are in use in the American factories, by which the lead is run upon moulds directly from the furnace, and the buckles are separated from each other and delivered without handling into the vessels for receiving them. They are then packed in earthen pots shaped like flower-pots, each of which is provided with a ledge or three projecting points in the inside, intended to keep the pieces above the bottom, in which is placed some strong vinegar or acetic acid. It is recommended that on one side the pot should be partially open above the ledge, and if made full all round, it is well to knock out a piece in order to admit a freer circulation of vapors through the lead. In large establishments an immense supply of these pots is kept on hand, the number at one of the Brooklyn works being reckoned at not less than 150,000. They continue constantly in use till accidentally broken below the ledge. Being packed with the buckles and the acid, they are set close together in rows upon a bed of spent tan, a foot to two feet thick, and thin sheets of lead are laid among and over the pots in several thicknesses, but always so as to leave open spaces among them. An area is thus covered, it may be twenty feet square or of less dimensions, and is enclosed by board partitions, which, upon suitable framework, can be carried up twenty-five feet high if required. When the pots and the interstices among them are well packed with lead, a flooring of boards is laid over them, and upon this is spread another layer of tan; and in the same manner eight or ten courses are built up, containing in all, it may be, 12,000 pots and 50 or 60 tons of lead, all of which are buried beneath an upper layer of tan. As the process of conversion requires from eight to twelve weeks, the large factories have a succession of these stacks which are charged one after another, so that when the process is completed in one, and the pots and lead have been removed and the chamber is recharged, another is ready for the same operation.

The conversion of metallic lead into carbonate is induced by the fermenting action, which commences in the tan soon after the pile is completed. The heat thus generated evaporates the vinegar, and the vapors of water and acetic acid rising among the lead oxidize its surface and convert it externally into a subacetate of lead; at the same time carbonic acid evolved from the tan circulates among the lead and transforms the acetate into carbonate of the oxide, setting the acetic acid free to renew its office upon fresh surfaces of lead. When the tan ceases to ferment the process is at an end, and the stack may then be taken to pieces. The lead is found in its original forms, but of increased bulk and weight, and more or less completely converted into the white carbonate. The thoroughness of the operation depends upon a variety of circumstances; even the weather and season of the year having an influence upon it. The pieces not entirely converted have a core of metallic or "blue" lead beneath the white carbonate crust. The separation is made by beating off the white portion, and this being done upon perforated copper shelves set in large wooden tanks and covered with water, the escape of the fine metallic dust is entirely prevented and its noxious effect upon the health of the workmen is avoided. In Europe, rolling machines closely covered are applied to the same purpose, but less effectually. The white lead thus collected is next ground with water between millstones to a thin paste, and by repeated grindings and washings this is reduced to an impalpable consistency. The water is next to be removed, and, according to the European plan, the creamy mixture is next turned into earthen pots, and these are exposed upon shelves to a temperature not exceeding 300° until perfectly dry. Instead of this laborious method, the plan is adopted in the American works of employing shallow pans of sheet copper, provided with a false bottom, beneath which steam from the exhaust-pipe of the engine is admitted to promote evaporation. These pans or "drying kilns" are sometimes 100 feet long and 6 feet broad, and several are set in the building one above another. The liquid lead paste is pumped up into large tanks, and the heavier portion settling down, is drawn off into the pans, while the thinner liquid from the surface is returned to be mixed with fresh portions of white lead. Beside pans, tile tables heated by flues in the masonry of which they are built, are also employed. From four to six days are required for thoroughly drying the white lead. This is the finishing process, after which the lead is ready for packing in small casks for the market.

The manufacture of white lead, which was formerly an unhealthy and even dangerous occupation, has been so much improved by the expedients for keeping the material wet and thus preventing the rising of the fine dust, that the peculiar lead disease now rarely attacks the workmen. The business is conducted altogether upon a large scale, and though diminishing in importance, still supports a number of extensive factories in different parts of the country. Some of these have arrangements for converting-stacks that extend under cover 200 feet in length, and their facilities for grinding and drying are proportionally extensive. These and the time required for fully completing the process and getting the white lead ready for market—which is from three to four months—involve the use of large capital and tend to keep the business in few hands.

There is still a considerable demand for pure white lead, and the competition and watchfulness of the trade insure the genuineness of the article thus warranted by the manufacturers. The large class of customers, the grinders, who form a distinct trade, can use and mix the pure article with other substances and with coloring matters to suit their purposes. The mineral, sulphate of barytes or heavy spar, is the chief article used to adulterate white lead, and for this purpose it is obtained from mines in

Connecticut and other places, and is extensively ground in mills for this use alone. When perfectly pure, the powder is absolutely white; it has about the same weight as white lead, and is quite as indestructible; it is, indeed, less acted upon or discolored by noxious vapors. It lacks, however, the body of white lead, and is not so brilliant: hence it may be used in such proportion as to materially injure the paint in those good qualities. Oxide of zinc is also largely mixed with white lead, as will be noticed more particularly in the succeeding chapter.

The principal white lead works, together with the probable amount of their annual production, in the United States are as follows:—

	No. of Works.	Tons.
Brooklyn, N. Y.	3	6000
Staten Island, N. Y.	1	1000
Hudson River (Saugerties), N. Y.	2	1000
Buffalo, N. Y.	1	1000
Philadelphia, Pa.	2	3000
Pittsburg, "	1	
Baltimore, Md.	1	600
Boston, Mass.	1	1500
Salem, "	1	
Cincinnati, O.	2	
Louisville, Ky.	1	
Chicago, Ill.	1	
St. Louis, Mo.	1	

CHAPTER V.

ZINC.

While the production of the lead mines has been falling off in the United States, that of the zinc mines has been steadily increasing since they were first worked about ten years since; and the metal is applied to many purposes for which lead has heretofore been almost exclusively used. The growing importance of this product in the United States will justify a reference to the zinc manufacture of Europe.

The metal, as mentioned in the chapter on Copper, very curiously escaped the notice of the ancients, though they obtained it from its ores in preparing brass, an alloy of copper and zinc. In the metallurgical processes it is readily sublimed by heat, and when its fumes come in contact with the air they are immediately oxidized, burning with a greenish white flame, and are then converted into the white oxide of zinc—a compound of one equivalent of the metal = 34, and one of oxygen = 8; which correspond respectively to 81 and 9 per cent. These fumes when collected are found to be a white flocculent powder, now known as the white oxide of zinc, or zinc paint. If the vapor of zinc be protected from contact of air and passed through pipes into water, it is condensed into metallic drops, and these may be melted in close vessels and poured into moulds. Cast zinc is a brittle metal of bluish white color and greater lustre than that of lead. By heating it to the temperature of 212° to 300° F. it entirely loses its brittleness, and is made malleable and ductile, so that it can be rolled out into sheets. Its melting point is 680°, while that of lead is 608°.

A variety of ores are worked for this metal; as the sulphuret, called blende; the carbonate, called smithsonite; and the silicate of zinc, or calamine. The last two usually occur associated together. The red oxide is an important ore, but found only in New Jersey. Blende almost universally accompanies galena, and in some lead mines is the prevailing ore. The miners call it black jack. When pure, it consists of zinc 67, sulphur 33. Being more difficult to reduce than the other ores, it has been comparatively little used, though the Chinese are known to have been successful in their management of it. In the United States it lies valueless in immense quantities about many of the lead mines; but it is not improbable the old refuse heaps will yet be turned to profit. At the zinc works near Swansea, in Wales, it has been worked for many years; and in England it has for a few years past come into use. In 1855, it is reported that 9620 tons of this ore from various mines were sold; while of the calamine ores, the produce of the Alston Moor mines, sales of only 182 tons were reported. More ores of each sort were no doubt smelted, but the proportion of each was probably not very different from that stated. Dr. Ure, in his Dictionary, speaks of this ore selling at Holywell for £3 per ton. In France there are now five establishments working blende; while in 1840 all the zinc consumed in the country was imported. Smithsonite resembles some yellowish or whitish limestones, and usually accompanies these rocks, being irregularly bedded among their strata. In its best condition it is obtained in large blocks of botryoidal and reniform shapes, sometimes crystallized. But usually it is in porous crumbly masses, much mixed and stained with reddish oxide of iron. The pure ore contains 65 per cent. of oxide of zinc (which is equivalent to 52 of the metal) and 35 of carbonic acid. The silicate of zinc is found intermixed with the carbonate, which it resembles in appearance. It contains, when pure, silica 25.1, water 7.5, and oxide of zinc 67.4, corresponding to 54 per cent. of the metal. The red oxide is found only at Mine Hill and Stirling Hill, near Franklin, in the extreme northern county of New Jersey. The pure oxide, of which it is almost exclusively composed, contains 80.26 per cent. of zinc and 19.74 of oxygen. The bright red color is probably derived from the small quantity of oxide of manganese present. The ore is mixed with franklinite iron ore, each being in distinct grains, one red and the other black; and with these is associated a white crystalline limestone, either in disseminated grains with the ores, or forming the ground through which they are dispersed. Two beds, consisting of the zinc and iron ores, lie in contact with each other along the south-eastern slope of the Stirling Hill, between the limestone of the valley and the gneiss of the ridge, dipping with the slope of these rocks about 40° toward the valley, and ranging north-east and south-west. The upper bed, varying from 3 to 8 feet in thickness, consists of more than 50 per cent. red oxide of zinc; and the lower bed, which is 12 feet thick and in some places more than this, is chiefly franklinite, changing to limestone below, interspersed with imperfect crystals of franklinite. At Mine Hill, 1½ miles north-east from Stirling Hill, two distinct beds are again found together, that containing the most zinc in this case being the under one of the two, lying next the gneiss. These localities have been well explored; the beds have been traced considerable distances along their line of outcrop; and at Stirling Hill the red oxide of zinc has been mined for more than ten years by the New Jersey Zinc Company. Their workings have reached to a depth of about 250 feet, and have afforded the finest specimens of zinc ore ever seen. A single mass of the red oxide was sent in 1851 to the Great Exhibition in London, which weighed 16,400 lbs., and attracted no little attention, from the purity, rarity, and extraordinary size of the specimen. The Passaic Mining and Manufacturing Company also have opened two beds of the same ore on their property at Stirling Hill, adjoining that of the New Jersey Zinc Company, and since June, 1854, have taken out about 30,000 tons of rich and lean ores. At the depth of 178 feet, the principal bed is 21 feet wide, of which about 2½ feet is rich ore, and the rest limestone sufficiently interspersed with oxide of zinc to render it worth dressing. This company have recently completed at the mines very extensive works for dressing the lean ores before they are shipped to their furnaces at Jersey City. The principal supplies of their ores for the last year have been of the smithsonite and calamine from the mines in the Saucon valley, Lehigh county, Pennsylvania, of which they have mined about 5000 tons during the year 1860. These ores are extensively worked to the north of Friedensville, both by this company and the Pennsylvania and Lehigh Zinc Company, whose furnaces are at Bethlehem, in Lehigh county. The mines of the two companies, which are near together, are known as the Saucon mine and the Lehigh Zinc Company's mine. They were first opened in 1853. The two kinds of ore are found together, as is common in the European mines, and more or less blende is interspersed among them. They form very large irregular beds in limestone of the lower Silurian period, and are penetrated by veins of quartz, which traverse both the ore and limestone. Huge masses of limestone lie interspersed among the ores. The deepest workings at the Saucon mine are about 100 feet below the surface; and from this depth galleries have been run in every direction, exposing to view more than 50,000 tons of ore. The ores of best quality are found in the lower workings.

About the same time that these mines were opened in Lehigh county, another, producing similar kinds of zinc ore, was discovered near Lancaster, in Pennsylvania; but after being explored it was found to contain so much blende and galena, that it was abandoned as worthless. Large deposits of the same varieties of zinc ore are known to exist in Tennessee; one locality at Mossy Creek, a few miles north-east of Knoxville, and another at Powell's river, a branch of the Clinch river, in Campbell county, about 40 miles north of Knoxville. These beds, examined by the writer in 1858, unquestionably contain very large quantities of excellent ore. The former, being close to the East Tennessee and Virginia railroad, is very conveniently situated; and the other is within half a mile of a river navigable at certain seasons by flat-boats. Below its junction with the Clinch river are beds of bituminous coal, and the river is thence navigable by steamboats. At Kingston it is crossed by a railroad.

Very pure ores of similar character have been found in Arkansas. The localities are in a lead mining region in Lawrence, Marion, and Independence counties; but chiefly in the first named. The ores occur in a formation of magnesian limestone, imbedded in red ferruginous clay. They are almost exclusively smithsonite, containing very small proportions of silicate of zinc. Crystals of smithsonite and of blende are found upon the lumps of pure, flesh-colored ore. The district promises to become an important one for the supply of zinc to the western states.

The following are analyses of ores from the Saucon valley mines; the first three by Prof. John Torrey, of the New York Assay Office, being of specimens, and the last two of samples of large shipments. No. 4 was made at the Assay Office, Hatton Gardens, London; and No. 5 in Paris.

No. 1.

Oxide of zinc	48.90
Carbonic acid	26 40
Peroxide of iron	3.15
Carbonate of magnesia	.62
Silica	18.50
Water	.30
Loss	2.13
	100.00
Metallic zinc	39.30

No. 2.—*Granular Sulphuret of Zinc.*

Sulphuret of zinc	73.27
Sulphuret of iron	1.49
Silica	25.50
	100.26
Metallic zinc	49.09

No. 3.—*Waxy Sulphuret of Zinc.*

Sulphuret of zinc	97.63
Sulphuret of iron	1.54
Silica	1.40
	100.57
Metallic zinc	65.41

No. 4.—*Mixture of Blende and Carbonate of Zinc.*

Zinc	61.70
Sulphur	19.82
Iron	4.76
Silica	1.00
Carbonic acid	9.90
Phosphate of lime	.88
Oxygen, water, and loss	1.94
	100.00

Contains of silver 4.15 ozs. to the ton of 20 cwt.

No. 5.

Zinc	Carbonate of zinc, 75.1	42.0
Oxygen		10.5
Carbonic acid		22.6
Protoxide of iron	Carb. of iron, 10.2	7.3
Carbonic acid		2.9
Silica		11.8
Moisture		2.9
		100.0

METALLURGIC TREATMENT AND USES.

Zinc ores are applied to practical purposes, not only to produce the metal, but also the white oxide of zinc, which is largely employed as a paint. The ancients used an ore they called *lapis calaminaris*, to make brass, by melting it with copper in crucibles, not knowing that another metal was thus formed which produced an alloy with the copper. Although the metal was discovered in the 16th century, the nature of its ores was little known before the middle of the last century. It is now prepared upon a large scale in Belgium and Silesia, and small quantities are produced in England, France, and different parts of Germany. The simple method of obtaining zinc from its ores, called distillation *per descensum*, was introduced into England about the year 1740, and was derived from the Chinese, who appear to have been acquainted with the metal long before it was known to the Europeans. As now practised in Great Britain, the ores are first calcined, the effect of which is to expel a portion of the water, carbonic acid, and sulphur they contain. They are then ground to powder, and mixed with fine charcoal, or mineral coal, and introduced into stationary earthen pots, or crucibles. When set in the furnace, an iron pipe, passing up through the bottom of the hearth, enters the crucible, and connects with an open vessel directly beneath. About six pots are set together under a low dome of brick-work, through which apertures are left for filling them. Each one has a cover, which is luted down with fire clay; and the iron tube in each is stopped with a wooden plug, which, as the operation goes on, becomes charred and porous, so as to admit through it the passage of the zinc vapors. The tubes are prevented from being clogged with depositions of the condensed zinc, by occasionally running a rod through them from the lower end. The zinc collects in the dishes under the tubes, in the form of drops and powder, a portion of which is oxidized. The whole is transferred to melting-pots, and the oxide which swims upon the surface of the melted metal is skimmed off and returned to the reducing crucibles, while the metal is run into moulds. The ingots are known in commerce as spelter.

In the United States zinc was first made by Mr. John Hitz, under the direction of Mr. Hassler, who, by order of Congress, was engaged about the year 1838 to manufacture standard weights and measures for the custom-houses. The work was done at the U. S. arsenal at Washington, the ores used being the red oxide of New Jersey. The expense exceeded the value of the metal obtained, and it has generally been supposed that we could not produce spelter so cheaply as it can be imported from Europe. The next experiments were made at the works of the New Jersey Zinc Company, 1850, on the Belgian plan. In these great difficulties were experienced for want of retorts of sufficiently refractory character to withstand the high temperature and the chemical action of the constituents of the ore. The franklinite, which always accompanies the red oxide ores, was particularly injurious by reason of the oxide of iron forming a fusible silicate with the substance of the retorts These trials consequently failed after the expenditure of large sums of money. The next important trial was made in 1856, by a Mr. Hoofstetter, who built a Silesian furnace of 20 muffles for the Pennsylvania and Lehigh Zinc Company at their mine near Friedensville. This proved a total failure, and seemed almost to establish the impracticability of producing spelter with the American ores, clays, and anthracite. About this time Mr. Joseph Wharton, the general manager of the Pennsylvania and Lehigh Zinc Company, and Mr. Samuel Wetherill, of Bethlehem, both hit upon the same plan of treating zinc ores in an open furnace, and leading the volatile products through incandescent coal, in order to reduce the zinc oxide so formed, and draw only metallic and carbonaceous vapors into the condensing apparatus. Mr. Wharton constructed his furnace in Philadelphia, and Mr. Wetherill his in Bethlehem. The former having completed his trials, filed a caveat for the process, but soon after abandoned it as economically impracticable. The latter continued his operations, patented the method, and produced some zinc, eight or ten tons of which were sold to the U. S. Assay Office in New York. The manufacture was not, however, long continued. In 1858, Mr. Wetherill recommenced the production of zinc, adopting a plan of upright retorts, somewhat like that in use in Carinthia, in Austria, and that of the English patent of James Graham. Mr. Wetherill had succeeded in procuring good mixtures of fire clays, and his retorts made of these and holding each a charge of 400 lbs. of ore, proved sufficiently refractory for the operation. The works now under his charge at Bethlehem, erected in 1858–9, and belonging to the owners of the Saucon mine, have a capacity of about two tons of metal daily.

Mr. Wharton, after abandoning the method of reduction by incandescent coals, continued his experiments on different plans, and finally decided on the Belgian furnace as the best, after having actually made spelter from silicate of zinc, with anthracite, in muffles of American clays, at a cost below its market value. These trials were made in the zinc oxide works of the Pennsylvania and Lehigh Zinc Company. Their success encouraged the company to construct a factory at Bethlehem for reducing zinc ores, and this was done under the direction of Mr. Wharton in 1860. The capacity of the works is about 2000 tons per annum, and their actual daily product in the winter of 1860–1, is over three tons. Four stacks or blocks are constructed, each containing four furnaces. To each furnace there are 56 retorts, making in all 896, working two charges in twenty-four hours. Their total capacity is about five tons of metal. Besides the ordinary spelter of this manufacture, which, as will be seen by the remarks that follow, is remarkable for its freedom from injurious mixtures, and is the best commercial zinc in the world, Mr. Wharton also prepares from selected ores a pure zinc for the use of chemists, and for purposes in which a high degree of purity is essential. This is cast in ingots of about nine pounds each, and is sold at the price of ten cents per pound. For the supply of chemists, and for the batteries employed by the telegraph companies, the American zinc of this manufacture is preferred to all others. The total annual consumption of crude spelter in the United States amounts to the value of about $600,000; and the value of sheet zinc, nails, etc., is about as much more.

The commercial zincs, it has long been known, are contaminated by various foreign substances, the existence of some of which is indicated in the finely divided black substance which remains floating or sinking in the liquid, when the metal is dissolved in dilute acids. The impurities have been stated by different chemists to consist of a great variety of substances, such as lead, cadmium, arsenic, tin, iron, manganese, carbon, etc. They injuriously affect the quality of the metal for many of its uses; and the presence of one of them, arsenic, is fatal to the highly important use of zinc by chemists, as a reagent in the detection of arsenic in other substances. Arsenic in the form of a sulphuret often accompanies the native sulphurets of zinc, and its oxide, being volatile, is readily carried over with the zinc fumes in the metallurgic treatment of blende, and may thus be introduced into the spelter. It is evidently, therefore, a matter of consequence to know the qualities of the different zincs of commerce, and the exact nature of the impurities they contain. Very thorough investigations having these objects in view have recently been made in Cambridge, Massachusetts, by Messrs. Charles W. Eliot and Frank H. Storer of Boston, and the results of these, with a full description of their methods of examination, were communicated, May 29, 1860, to the American Academy of Arts and Sciences, and published in the eighth volume of the new series of their Memoirs. Eleven varieties of zinc from different parts of Europe, and made from the ores of New Jersey, and of the Saucon valley, Pennsylvania, were experimented upon, of all of which large samples were at hand. These varieties were the following: 1, Silesian zinc; 2, Vieille Montagne zinc; 3, New Jersey zinc; 4, Pennsylvanian zinc, Bethlehem, Pennsylvania; 5, Vieille Montagne zinc, employed at the United States mint, Philadelphia; 6, zinc of MM. Rousseau, Frères, Paris, labelled and sold as *zinc pur;* 7, sheet zinc obtained in Berlin, Prussia; 8, zinc made near Wrexham, North Wales; 9, zinc from the Mines Royal, Neath, South Wales; 10, zinc from the works of Dillwyn & Co., Swansea, South Wales; 11, zinc from the works of Messrs. Vivian, Swansea. All of these, except the Pennsylvania zinc, furnished an insoluble residue, which was found to consist chiefly of metallic lead, and this proved to be the principal impurity of all the samples examined; "the carbon, tin, copper, iron, arsenic, and other impurities found in the metal by previous observers, occur either in very minute quantities, or rarely, and doubtless accidentally." The proportions of lead present in 100 parts of each of the varieties examined were respectively as follows: in No. 1, 1.46; 2, 0.292; 3, 0.079; 4, 0.000; 5, 0.494; 6, 0.106; 7, 1.297; 8, 1.192; 9, 0.823; 10, 1.661; 11, 1.516. The New Jersey zinc was found to contain a sensible quantity of tin, copper amounting to 0.1298 per cent., iron 0.2088 per cent., and an unusually large amount of arsenic. Traces of this were also detected in the white oxide prepared from the ores of the New Jersey mines, and in the red oxide ore itself; but the same ore afforded no clue as to the source whence the copper was derived, a metal of which not the slightest traces were discoverable in the other zincs. None of the samples contained sufficient arsenic to admit of its proportion being determined, and some were entirely free from it, as some of the Belgian and Pennsylvania spelter, but traces of it were met with in other samples from the same regions, indicating that the occasional use of inferior ores, such as blende, intermixed with the carbonates and silicates, might introduce this substance, or possibly it might come over only in the first part of the distillation, and the zinc collected in the latter part might be quite free from it. The Silesian zinc contained minute quantities of sulphur and arsenic; and the English zinc more arsenic than any other, except perhaps the New Jersey. The purest of all the samples was that from Bethlehem, Pennsylvania, some of it yielding no impurity, except a trace of cadmium. The source of a trace of arsenic in another sample is supposed to be in the use of the crust of oxide of zinc from the operations connected with the manufacture of white oxide of zinc, no particular care being taken in that process to reject inferior ores, and this crust being taken to the other works where the metal is prepared and mixed with the selected ores employed for this use, it has thus introduced the arsenic. As the authors of the paper remark, there seems to be no reason why zinc of uniform purity should not be obtained from the excellent ores of the Saucon valley mines.

EUROPEAN MANUFACTURE.

A large portion of the zinc of commerce is furnished by the works of the Vieille Montagne Company, established near the frontier of Belgium and Prussia, chiefly in the province of Liege of the former country. A large number of mines are worked in this region, the most important of which is that of the Vieille Montagne or Altenberg, situated in the village of Moresnet, between Aix-la-Chapelle and the town of Liege. It is said that the great body of carbonate of zinc found here was worked as long ago as the year 1435, and that for four centuries it was not known that the ore was of metallic character, but it was used as a peculiar earth adapted for converting copper into brass. The ore lies in a basin-like depression in strata of magnesian limestone, and is much mixed with beds of clay intercalated among its layers. The ore is chiefly carbonate mixed with the silicate and oxide of zinc. Some of it is red, from the oxide of iron intermixed, and this produces only about 33 per cent. of metal. The purer white ore yields about 46 per cent., and is moreover much preferred on account of its working better in the retorts. The furnaces employed in the distillation of these ores are constructed upon a very large scale, and on a different plan from those in use in Great Britain. The general character of the operations, however, is the same. The ores are first calcined, losing about one fifth of their weight. They are then ground in mills, and charges are made up of 1100 lbs. of the powdered ore mixed with 550 lbs. of fine coal. The mixture being well moistened with water, is introduced into cylindrical retorts, which are three feet 8 inches long and 6 inches diameter inside, set inclining outward, to the number of 42 in a single furnace, and 4 such furnaces are constructed in one stack. The open end of each retort connects, by means of an iron adapter 16 inches long, with a wrought-iron cone, the little end of which, projecting out from the furnace, is only an inch in diameter. After the charges have been sufficiently heated, the sublimed zinc condenses in the neck of the retort and in the adapter and cone. The last two are then removed, and the zinc and oxide are collected from them, and the liquid metal in the neck of the retorts is drawn out and caught in a large ladle, from which it is poured into moulds. The zinc thus obtained is remelted before it is rolled. Two charges are run through in twenty-four hours, each furnace producing from 2200 lbs. of ore about 620 lbs. of metal, which is about 30 per cent. From a late report of these operations it appears that there are seven large smelting establishments belonging to the Vieille Montagne Zinc Mining Company, on the borders of Belgium and Prussia, comprising 230 furnaces. The annual product of these is 29,000 tons of spelter, of which 23,000 tons are converted into sheet zinc, and about 7000 tons are rolled at mills not the property of the company. They also manufacture oxide of zinc in three establishments devoted to this operation, to the amount of about 6000 tons annually. The company also purchases spelter very largely.

The metallurgy of zinc has, within a few years past, become an important branch of industry in Upper Silesia on the borders of Poland, and not far from Cracow. In 1857 there were no less than 47 zinc works in this part of Prussia, one of which, named Lydogniahütte, at Königshütte, belonged to the government, and the remainder were owned by private companies and individuals. In that year their total production was 31,480 tons of spelter, valued at about 17,660,000 francs. Many of the establishments belong to the Silesian Company, which also owns several coal mines near their works, and a number of zinc mines. The government works are supplied with ores from their own mines, and also from all the others, being entitled to one twentieth of their product. From a description of the operations published in the sixteenth volume of the *Annales des Mines*, fifth series, 1859, it appears that the processes are the same which had been employed for full twenty years previously, and each establishment presents little else than a repetition of the works of the others. The furnace in use is a double stack, furnished along each side with horizontal ovens, into each of which three muffles or retorts are introduced. These are constructed of refractory fire clays, and are charged, like the retorts of gas furnaces, by conveying the material upon a long charger or spoon into the interior. Their dimensions are about 4 feet long, 22 inches high, and 8½ inches wide, and the weight of the charge introduced is only about 55 pounds. The ovens on each side of the stacks contain as many as 20 and sometimes 30 retorts. The same stack contains besides, 1st, an oven in which the ores belonging to it are roasted for expelling the water and a portion of the carbonic acid they contain (a process in which they lose about ⅓ their weight); 2d, an oven for baking the retorts, each establishment making its own; and 3d, a furnace for remelting and purifying the zinc obtained from the retorts. Several stacks are arranged in a large building with close walls and open along the top of the roof to allow the smoke to escape. On one side, connected with it, are the workshops in which the muffles are made and various other operations are carried on.

The principal zinc mines are in the vicinity of Beuthen, and are found in the magnesian limestones of the new red sandstone formation. They are connected with the zinc works, which are principally near Königshütte, by branch railroads connecting with the principal line of road between Tarnowitz and Kattowitz. The ores are chiefly carbonates, always mixed with much oxide of iron, which is sometimes present to the extent of 20 per cent., and with them is also associated more or less silicate of zinc, blende, galena, and cadmium. Their percentage of zinc is very variable, rarely reaching 35, and probably averaging 21 or 22 per cent. Much that is worked does not exceed 12 per cent. They lie in irregular deposits, and it is found that their yield of zinc has been gradually falling off, so that it is now only about two fifths of what it was formerly. This low yield involves a large consumption of fuel, which is 20 tons for one of zinc obtained; and if this deterioration continues, the mines must some time hence be abandoned. The coal employed in working the ores is of poor quality, burning without flame; but it leaves no cinder, and is procured from mines very near the works, and at the extraordinary low price of 6 to 7 francs the 1000 kilogrammes (about one ton). The retorts are charged every 24 hours with roasted ore reduced to the size of nuts, and mixed with oxide of zinc from previous operations, with the dross from the crucible employed in remelting, with the incrustations from the muffles and their connections outside the furnaces, and in fine with cinders that have fallen through the grates, these last making about ⅓ the bulk of the charge. The workmen having discharged a muffle of the liquid zinc and oxide remaining from the previous operation by drawing them forward, so that they fall upon an iron shelf placed below to catch them, and having repaired any cracks and holes in the muffle, they introduce the new charge in small portions at a time, and immediately adjust the outer connection, which is also of earthenware bent down at a right angle, and close up the openings in front. The zinc soon begins to distil over, and drops down upon the iron shelf, forming pieces of all shapes; and it is more or less mixed with oxide colored yellow by the oxide of cadmium. When remelted and run into moulds, the spelter is stated to have about the following composition: zinc, 97.50, cadmium, 1.00, lead, 0.20, arsenic, 0.84, sulphur, 0.05, together with traces of tin, iron, and carbon; but the character and proportion of the impurities are probably very variable. The expenses of the manufacture at the royal works amounted for the year 1856 to 48.60 francs the metrical quintal (220.47 lbs.), and in 1858 to 54.84 francs; consisting in the latter year of the following items: ore, 26.84; fuel, 14.30; labor, 7.00; materials employed, 3.70; general expenses, 3.00. The operations of the Silesian Company at their several works for the first half of the year 1858 are thus presented:—

COST OF THE SEVERAL ITEMS PER METRICAL QUINTAL OF PRODUCT.

Name of Works.	Ores treated. Met. quint.	Zinc obtained. Met. quint.	Cost of labor. Francs.	Fuel. Francs.	Ores. Francs.	Sundry expenses. Francs.	Total cost. Francs.
Gabor Silesia	112,399	19,703	4.98	10.35	11.40	4.27	31.00
Paulshütte	40,784	4,928	7.10	14.69	14.24	4.77	40.80
Thurzohütte	37,458	4,495	7.57	12.08	12.92	4.90	37.47
Friedenshütte	15,345	2,346	5.96	10.66	13.98	4.62	35.22
Stanislashütte	40,534	3,978	8.83	16.18	15.66	6.23	46.90
Carlshütte	45,918	5,723	6.06	14.80	13.23	6.91	41.00
	292,438	41,173					

The general consumption of spelter throughout the world is estimated in the report to which we have already referred, relating to the Vieille Montagne Company, to be about 67,000 tons, of which about 44,000 tons are sheet zinc applied as follows:—

	Tons.
For roofing and architectural purposes	23,000
" sheathing of ships	3,500
" lining packing cases	2,500
" domestic utensils	12,000
" stamped ornaments	1,500
" miscellaneous uses	1,500
	44,000

The estimate of 67,000 tons as the total annual production of zinc is probably too small for Europe alone. Taking the product above given of the works of the Vieille Montagne Company, viz., 29,000 tons, and that of the Silesian furnaces, 31,480 tons, there remain only 6,520 tons to be divided among the other zinc-producing countries. These are Poland, on the borders of Silesia, the annual production of which is usually given as 4000 tons; England, which has rapidly advanced from 1000 tons of spelter per annum to 6900 tons in 1858; Austria, which produces 1500 tons; Sweden, 40 tons; and the Hartz 10 tons. Zinc, it is believed, is also manufactured to some extent in Spain. The European production would, therefore, seem to exceed 73,000 tons, and for the total production of the world, that of the United States and of China should be added. Of the extent of the manufacture of the latter country we know nothing. The United States produces of oxide of zinc and spelter over 7000 tons annually.

The value of the ores at different costs of the metal is given in the following recently prepared table from one of the European houses:—

SCHEDULE OF THE COST OF ZINC ORE ON SHIPBOARD AT ANTWERP.

	Metal worth 50 francs the 100 kilogrammes.	Metal worth 55 f. the 100 kilogrammes.	Metal worth 60 f. the 100 kilogrammes.
Percentage of zinc by analysis.	Value of 100 kilogrammes. Francs.	Value of 100 kilogrammes. Francs.	Value of 100 kilogrammes. Francs.
CARBONATE OF ZINC.			
40	80.00	94.50	109.00
45	102.50	119.50	136.50
50	125.00	144.50	164.00
55	147.50	169.50	191.50
60	170.00	194.50	219.00
65	192.50	219.50	246.50
70	215.00	244.50	274.00
SILICATE OF ZINC.			
40	45.00	57.00	69.00
45	67.50	82.00	96.50
50	90.00	107.00	124.00
55	112.50	132.00	151.50
60	135.00	157.00	179.00
65	157.50	182.00	206.50
70	180.00	207.00	234.00

A kilogramme is equivalent to 2205 lbs. avoirdupois.

Fifteen years ago the quantity of zinc used for roofing did not exceed 5000 tons per annum, and no zinc was employed for sheathing ships, or lining packing cases. The stamped ornaments in this metal only came into use in 1852. In Germany zinc is now very generally used for roofing; and in Paris it has been employed for nearly every roof constructed during the last fifteen years. In laying the sheets great care is taken that the metal has sufficient room to expand and contract by change of temperature; and especially that it is fastened with zinc nails, and is allowed to come nowhere in contact with iron—even with nail heads. The purer the metal the longer it lasts. It is supposed the English do not apply it much to roofing on account of the poor success attending the use of bad metal, such as they manufacture from inferior ores.

Besides the uses named for this metal, it is employed for coating sheet iron, making what is called galvanized iron, though the use of the galvanic current is now dispensed with in its preparation; for pipes for conveying liquids; for baths, water-tanks, milk pans and pails, plates for engraving upon; for galvanic batteries; for nails, spikes, and wire, which is made of great flexibility and of all sizes. It has also been cast into statues, and made to imitate bronze. The Vieille Montagne Company sent to the Great Exhibition in London a statue of Queen Victoria, which with its pedestal of zinc was twenty-one feet high. Zinc is also an important reagent in chemical operations, and is especially employed with sulphuric acid to decompose water for obtaining hydrogen gas.

ZINC PAINT.

White oxide of zinc was first recommended as a substitute for white lead by the celebrated Guyton de Morveau about the close of the last century, during his investigations on the subject of lead poisoning; and to him it was suggested by Courtois, a manufacturer at Dijon. The high price of zinc at that time, and ignorance respecting the proper manner of using the oxide of zinc, prevented its introduction. It was many years after this that methods of producing it as cheaply as white lead were devised by M. Leclaire, a house-painter of Paris; and he also first prepared to use with it a series of yellow and green unchangeable colors, to replace those before in use having noxious bases of lead, copper, or arsenic; and also a drying oil, prepared by boiling linseed oil with about five per cent. of oxide of manganese. His process, which is still the one in general use in Europe, is based on the treatment of the metal instead of the ore, as practised in this country, and scarcely any white oxide of zinc is there made by any other method. The furnaces employed are similar to those for producing the metal, or like those of the gas works. When the retorts set in these furnaces have become very hot, they are charged with the ingots of zinc. The metal soon melts, and its vapor passes off through the outlets of the retorts, where it meets a current of air, and both together are drawn on through the condensing apparatus either by the draught of a chimney, or by an exhausting fan at the further extremity of the apparatus. The metallic vapors become oxidized by mixing with the air, and are converted into a light, flaky, white powder, which is the oxide of zinc. The arrangements for condensing and collecting this are similar in principle to those employed for the same purposes in the American process. By making use of the metal in retorts, instead of subliming it from ores contaminated with their own impurities, and mixed with the coal required for conducting the process, a much purer oxide of zinc is obtained; and by selecting the purest sorts of spelter, the beautiful article, called by the French *blanc de neige*, or "snow-white," is produced, which is employed by painters in the place of the "silver-white." With the use of other zinc, the product is fit to be substituted for the best white lead. But if the metal has been made from ores containing cadmium or iron, or if old zinc has been introduced to which any solder adheres, according to the French chemists oxides of other metals are produced, and are taken up in small quantities with the zinc vapors, imparting to the oxide a slightly yellow or greenish tint, which if not very decided may however disappear when the paint is mixed; but the experience of American manufacturers does not accord with this explanation.

The manufacture of white oxide of zinc direct from the ore is a purely American process, established by the experiments of Mr. Richard Jones of Philadelphia in the year 1850. The great bodies of the rich ores of northern New Jersey had at various times, for the past two centuries, attracted the attention of many persons interested in metallurgical operations; and of late years numerous attempts had been made to devise some method of converting them to useful purposes. Zinc, however, was a metal not much in demand, and nothing was known of the useful qualities of the white oxide. When the value of this had been demonstrated in Europe, and the practicability of producing it economically from the red oxide was shown, a company was organized in New York under the name of the New Jersey Zinc Company, for the purpose of carrying on this manufacture upon a large scale. This association was incorporated by the Legislature of New Jersey, February 15, 1849, and the report of their operations, made December 31, 1853, by their president, C. E. Detmold, Esq., showed a production, for 1852, of 2,425,506 lbs. of oxide; and for 1853, of 4,043,415 lbs.; and the total production for 10 years, ending with 1860, has amounted to above 19,500 tons. Their works were established at Newark, N. J., to which place the ores are brought by the Morris and Essex canal; and the anthracite consumed in the manufacture is also delivered by water transportation. The company has forty furnaces, that may be kept in constant operation. The character of the process is like that which will be given below, as conducted by the Passaic Mining and Manufacturing Company.

The success of the enterprise of the New Jersey Zinc Company, and the discovery in 1853 of the great beds of silicate and carbonate of zinc in the Saucon valley, Pennsylvania, led to the organization in that year of the Pennsylvania and Lehigh Zinc Company, and the erection of furnaces for making the oxide at Bethlehem, on the Lehigh river. The operations were conducted by Samuel Wetherill, Esq., by a patented process of his own invention, and at a contract price of $50 per ton; the ore being delivered by the company at the works for $1.50 per ton. About four tons are consumed to the ton of oxide. The company have mined up to the present time about 60,000 tons of ore, and are manufacturing about 320,000 lbs. of oxide of zinc per month.

A third company was established in 1855, called the Passaic Mining and Manufacturing Company, and their works, constructed at Communipaw, on the Morris canal near Jersey City, went into operation in June of that year. They obtain their ores both from the mines of red oxide in Sussex county, and from the Saucon valley mines in Pennsylvania. They employ 24 furnaces, built in 3 stacks, of 8 each, in which they are arranged like ovens, half of them opening on one side and half on the opposite side. Each one is about 6 feet in depth (from front to back), 4 feet in width, and about 3½ feet in height. The roof is arched, with an opening through it for the pipe which conveys away the vapor and products of combustion. The sole is formed of cast-iron plates, which are perforated full of small holes for admitting the blast to penetrate every portion of the charge, as the wind is driven by two large fan-blowers into the receptacle under the furnace corresponding to the ash pit. The ores are prepared by first crushing them to powder, which is done by passing them through two pairs of Cornish rolls, and then mixing them thoroughly with about half their weight of the dust of anthracite. A fire is kindled upon the grate-bars of 250 lbs. of pea coal, and when ignited to full whiteness the charge of 600 lbs. of ore, mixed with 300 of coal dust, is added, and when exhausted the charge is withdrawn, leaving only sufficient coal to ignite the next charge, thus working off 4 charges in every 24 hours. The proportion of oxide obtained from the ore is variable, as the charge is not of uniform quality; but it is usually between 30 and 40 per cent. As the coal rapidly consumes from the effect of the blast, the ores are decomposed, and metallic zinc sublimes. The vapor rises with the gaseous products of combustion, and all are carried up the pipe, which just above the roof of the stack terminates under an inverted funnel, the base of which covers the lower pipe like a hood, and the upper portion is a pipe like that below. A strong current of air is created by two exhausting fan-blowers at the other extremity of the apparatus, and the vapors are drawn up together with much air which flows in around the open base of the funnel, and causes at this point a vivid combustion of the zinc vapors, which burn with a pale blue flame, and are thus converted into oxide. The appearance presented by this combustion actively going on in full view under each hood is very striking, and is far from suggesting to an observer unacquainted with the process, the possibility that from the pale flames rushing up the pipes any valuable product can be recovered. The pipes connect above with a cylindrical sheet-iron receiver that extends over the three stacks, so as to secure the products of all the furnaces. It is a huge pipe, 6½ feet in diameter, and 130 feet long, and passes along under the roof, against a line of windows on each side, through which air is admitted for hastening the cooling of the products. The pipe discharges into a square tower in masonry, and in this the particles are washed and cooled by a continual falling sheet of water. The light flocculent oxide of zinc is not carried down by this to any great extent, but is drawn on by the exhaust through 3 large pipes to a second tower with three divisions, in which the fans are placed that create the draught. From this the current, still propelled by the fans, moves on through other pipes that connect with the system of flannel bags, which in great numbers, and of extraordinary sizes, are suspended throughout the portion of the building devoted to the final cooling of the oxide, and filtering it from the gaseous matters intermixed. Some of the bags extend the whole length of the rooms, which are 120 feet long by 64 wide, and the diameter of the largest of them is over 4 feet. They are arranged near together, and some are carried vertically from the horizontal ones up to the roof. Through the pores of the flannel the gases escape, and the oxide of zinc remains thoroughly purified. Nearly 200,000 square feet of flannel are worked into these bags; and one person is almost constantly employed with a sewing machine, and two others working by hand, in making and repairing them. Along the under side of the horizontal bags pipes of cotton cloth, ten or twelve inches in diameter, reach down nearly to the floor, and are kept tied around their lower ends. These are called the teats; and the oxide of zinc is collected by lifting up the portions of the bags where it has settled, and shaking these so as to make it fall into the teats. The ends of these are then opened, and the white zinc is received in strong bags, which being tied up are laid upon a truck, and this is run by steam power back and forth under a compressing roller. The air dispersed through it, rendering it so light and bulky, is thus expelled, and the oxide is converted into a dense, heavy powder. The last process is to grind this with bleached linseed oil, which is done in the ordinary paint mills. The paint is then transferred into small kegs for the market.

The residuum of the furnace charge, when of red oxide, consists of some unsublimed zinc ore mixed with franklinite and more or less unconsumed coal. It is raked out in the form of slags, and is accumulated in immense piles about the works. In 1853, Mr. Detmold succeeded in using this as an iron ore, and produced excellent iron which proved to be also well adapted for the manufacture of steel. The iron manufacture has been continued, and has become a profitable branch of the operations of the United States Zinc Company, producing about 2000 tons of zinc per annum. The franklinite itself had been used a year earlier for the same purposes by Mr. Edwin Post, at Stanhope, and from this he obtained both iron and steel; but when the manufacture was undertaken upon a large scale by the New Jersey Franklinite Company, at Franklin, New Jersey, it proved unsuccessful in practice.

The product of the zinc works of the Passaic Company for the year 1856, was 2,327,920 lbs. of oxide of zinc; and the monthly production for the year 1860 has been about 400,000 lbs. from 16 furnaces. With the 24 in blast their monthly capacity is from 280 to 300 tons of 2000 lbs. to the ton. The total annual product of the three establishments is from 6000 to 7000 tons of oxide; and the consumption of this large quantity in the United States is good evidence of the importance of this paint, and of the great extent to which it must have superseded the use of white lead.

The items which make up its cost are of such nature that no exact estimate can be given of this. The ores are of no definite composition, and according to their percentage, as obtained from the mine or afterward dressed, the quantity required to produce a ton of oxide must vary, while with poor ores a proportionably larger amount of fuel is consumed than that required for rich ores. These items consequently vary between considerable extremes; and then the cost of the bags, barrels for packing, and the numerous incidentals, including repairs and general expenses, can only be arrived at by a careful computation of the operations of each establishment. The market price of the oxide is from 4½ to 5½ cents per lb.

The importance of the application of white zinc to painting in the place of white lead appears to have been much more fully appreciated in France and the United States than in Great Britain. Soon after the discoveries of Leclaire that white oxide of zinc could be thus used, and produce, with the colored bases he prepared of this and other innocuous oxides, all the tints required, the French government, recognizing the importance of his inventions, conferred upon him the cross of the Legion of Honor, and adopted the paints for the public buildings. By the year 1849, over 6000 public and private buildings had been painted with his preparations, and the testimony was very strong in their favor. Not one of his workmen had been attacked by the painter's colic, though previously a dozen or more suffered every year from it. The colors were pronounced more solid and durable than the old, were made brighter by washing, and were not tarnished by sulphuretted hydrogen, as occurs to white lead. The best white paint was moreover so pure and brilliant a white, that it made the best white lead paint by its side look disagreeably yellow and gray. No difficulty was experienced in making the new colors, mixed with the prepared oil, dry rapidly without the use of the ordinary dryers of lead compound; and used in equal weight with lead, the zinc was found to cover better, and was, consequently, more economical at equal prices per lb. The English, however, found many objectionable qualities in the new paint. Its transparency, which is the cause of its brilliancy, by reflecting instead of absorbing the light, was regarded as a defect, and the painters complained that it had not the body or covering properties of the carbonate of lead. It would not dry rapidly for the second coat without the use of the patent dryers, which contain lead, and therefore it was no better than the lead. Messrs. Coates & Co., who now import into Great Britain about 1000 tons of oxide of zinc per annum, wrote to the editor of the *Lancet* in March, 1860, that the consumption of white lead is still nearly 100 to 1 of white zinc, and that in 1856 the importation of the latter amounted to only 235 tons. They ascribe the real cause of the larger consumption of white lead, to the almost entire exclusion of zinc, to the fact, that white lead can be adulterated with barytes and other cheap ingredients without the adulteration being detected by the eye, thus securing large profits to the manufacturer and contractor, which cannot be realized in the use of zinc paint, for the reason that it has little affinity for foreign substances. The experience of the manufacturers of the United States does not substantiate this statement as to the difficulty of using the oxide of zinc in mixture with other substances. It is employed not only alone, but mixed with either barytes or white lead, or with both of them; and large quantities are thus sold and give satisfaction to consumers, who would reject the paint, if they supposed it to be any thing else than white lead. As to its covering quality, it is found that the oxide of zinc varies according to the manner in which it has been prepared. The light flocculent oxide mixes readily with oil without grinding; but though pressed, it covers much less surface than the same oxide moulded when moistened with water, and dried by artificial heat. This preparation also causes any yellowish or greenish tints to disappear, and the article may be supplied to the consumer in cakes, which when ground with oil will cover more surface than the same weight of white lead. The body of the white zinc may be still further improved by calcination before grinding.

The inferior colored sorts of oxide of zinc, such as are collected in the iron receivers near the furnaces, and that made from the pulverized ores of zinc, have been largely employed for painting iron surfaces, especially on board of ships, the paint being found to possess a peculiar quality of protecting the iron it covers from rusting.

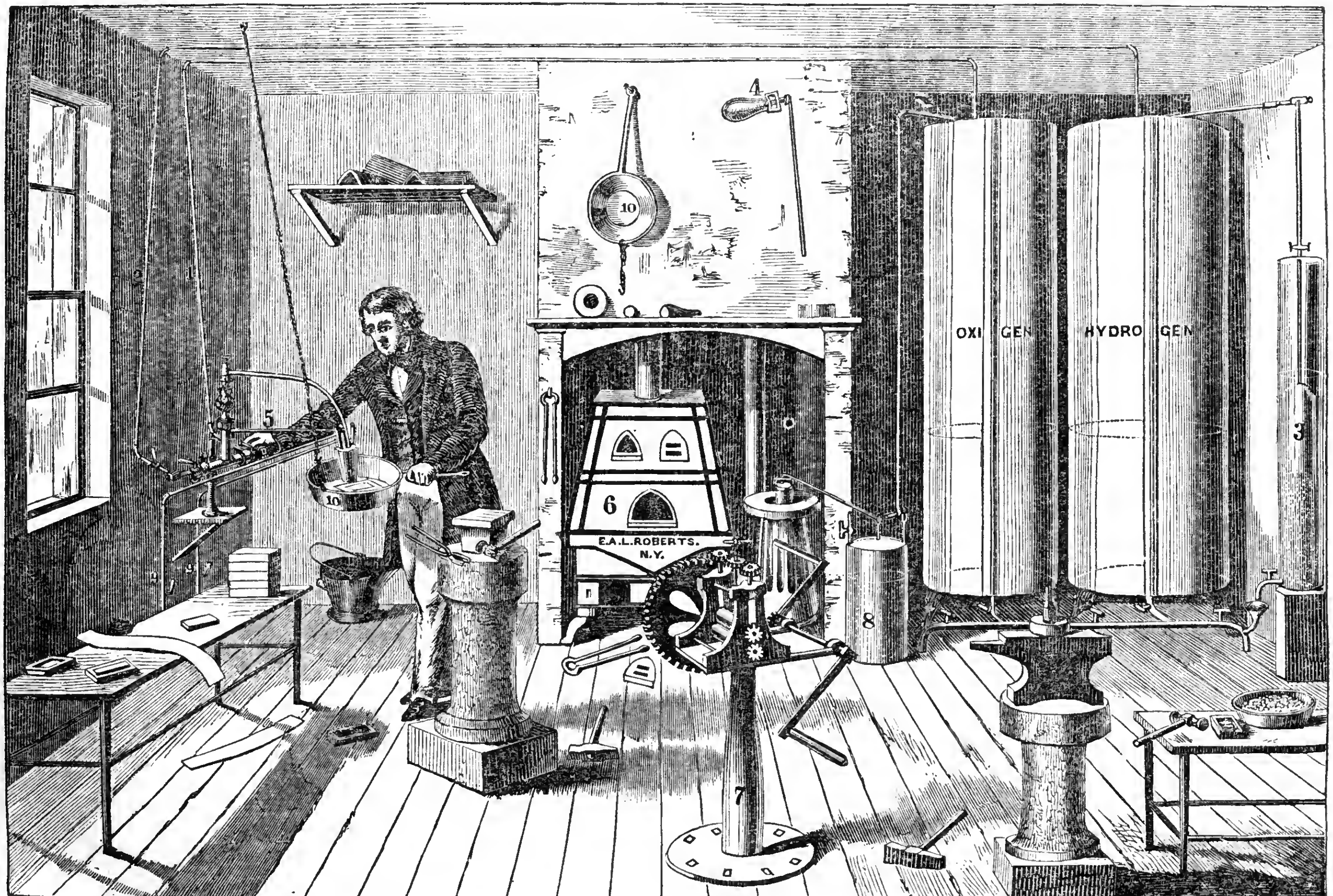
Besides its use as a paint, oxide of zinc is applied to the preparation of the mastic for rendering metallic joints tight; and to that of glazed papers and cards, for which white lead and carbonate of barytes have heretofore been used. The French use it in preparing the paste for artificial crystals instead of oxide of lead or other metallic oxides; and they have also made with it some of the finest sorts of cut glass and especially lenses. In the Great Exhibition of 1851, an award was made to specimens of zinc glass which presented a very pleasing and white appearance, and were regarded as especially suited to achromatic purposes. It was remarkable for its being purer and more pellucid than lead glass, and also of greater specific gravity.

A patent has been granted in the United States for the manufacture of flint glass with oxide of zinc, and specimens of glass were produced with it in 1860, which were remarkable for their brilliancy and beautiful surface, or "skin," as it is called. The glass is more infusible than that made with oxide of lead, and there seems to be no good reason to prevent it coming rapidly into use.

CHAPTER VI.

PLATINUM.

Although this metal is not obtained in large quantity in the United States, it is found associated with the gold in many localities in California and Oregon, and has been detected in Rutherford county, North Carolina, and in traces in the lead and copper ores of Lancaster county, Pennsylvania. From the states on the Pacific it has been supposed that it would yet be afforded as a commercial article. It is a metal of considerable interest from the extent to which it is used in the United States, and the success that has attended the attempts to work it in Philadelphia and New York. The metal is supplied to commerce from no certain source, and finds its way into the United States in a great variety of forms, as in native grains found in washing the gold deposits of Cauca on the western coast of South America, of Brazil, and Oregon, and in manufactured articles imported from Europe and chiefly from France. Russia produced between the years 1824 and 1845 many times as much platinum as all the rest of the world, and introduced the metal into her coinage; but after 1845 it was no longer coined, and the yield of the deposits in the Ural has dwindled away to almost nothing. The supply from Borneo has been very large for some years, the whole product of the island sometimes amounting to 600 lbs. a year. It is found in small grains and lumps in the sands that are washed for gold; and pieces of several pounds have been met with in Siberia, the largest weighing over 22 lbs. troy. The properties which give to the metal its great value, as its power of resisting the effects of heat and many of the most powerful chemical agents, also render it exceedingly difficult to work and to convert into useful shapes. The crude grains are generally alloyed to the amount of about 20 per cent. of their weight with the very refractory metal iridium, with osmium, rhodium, iron, and sometimes other metals also. It is separated from the chief part of these and purified by dissolving the grains in *aqua regia*, a mixture of nitric and hydrochloric acid, and causing the metal to be precipitated by sal-ammoniac. It falls in a yellowish powder, which is a compound of platinum, ammonia, and chlorine. To decompose this the compound is separated from the liquid, and being well washed and dried, is heated red hot in a cast-iron crucible. This drives off the ammonia and chlorine, and the platinum remains in the crucible in a spongy condition. This is condensed into solid metal by repeated heatings and hammerings. It has always been a matter of great difficulty to raise



OXI GEN
HYDRO GEN
E.A.L. ROBERTS.
N.Y.

sufficient heat to soften the platinum, even in quantities less than an ounce, so that it could be worked under the hammer. It used formerly to be brought into a metallic cake by making a fusible alloy of it with arsenic, and then burning out the latter as much as possible, and hammering or rolling the cake into sheets, but the arsenic remaining in the platinum always injures its quality. Dr. Robert Hare, of Philadelphia, was the first to fuse the metal for any practical purpose, and in May, 1838, he exhibited a cake of about 23 ounces, which was run together from grains and scraps by means of the intense heat produced by his oxy-hydrogen blowpipe. From a reservoir of oxygen, and from another of hydrogen, a gas-pipe conveyed the gases into one tube, in which they were mixed just back of the igniting jets; and in this the explosive mixture was kept cool by ice around the tube. Explosion was moreover guarded against by the extreme fineness of the apertures through which the gases were made to pass.

This means of working platinum has been applied very successfully by Dr. E. A. L. Roberts, of Bond street, New York, in the preparation of platinum plate and various articles in this metal employed by dentists, such as the plates and fastenings for sets of artificial teeth, and the little pins which secure each tooth in its setting. The annual consumption of these last, it is estimated, amounts throughout the United States to about $60,000 in value, which is nearly ⅓ of the annual supply of the metal. The apparatus consists of two cylindrical copper gas-holders, one for hydrogen, holding 220 gallons, and one for oxygen, holding 80 gallons. The Croton water, with a pressure of about 60 lbs. upon the square inch, is admitted into the bottom of these gas-receivers, for propelling the gases as they are required. The discharge pipes have each at their extremity a short brass tube, which is full of pieces of wire of nearly the same length as the tube, jammed in very tightly. These unite in another brass tube which is packed in a similar way, and connects by a metallic pipe of only ¼ inch bore, with the burner. This is a little platinum box, one end of which terminates in a disk of platinum or copper ½ by ¼ inch in size, perforated with 21 very minute holes in 3 rows. This box is buried in plaster of Paris mixed up with fibres of asbestus, forming a lump sufficiently large to contain around the box a receptacle into which, by means of flexible pipes, a current of water is admitted and discharged on the same principle that the water-tuyeres of iron forges and furnaces are constructed and kept cool while in use. The burner points downward, so that the jet is directed immediately upon the face of the metal held up beneath it. The method of using the apparatus is as follows: the platinum scraps being first consolidated by pressure in moulds into compact cakes of 10 to 20 ounces each, these are placed upon a plate of fire-brick, and brought to a full white heat in a powerful wind furnace. The plate with the platinum is then removed from the furnace and set in a large tin pan thickly lined with asbestus and plaster of Paris, and is brought directly under the jet, which at the same time is ignited. The platinum immediately begins to melt upon the surface, and the pieces gradually run together into one mass as the different parts of the cakes are brought successively under the jet. Though the metal melts and flows upon itself, it cools too rapidly to be cast in a mould; nor is this necessary or desirable for the uses to which it is applied. These require a soft and tough material, while the fused metal is hard and sonorous, and of crystalline texture, breaking like spelter. It is made malleable and tough by repeated heatings and hammerings. It is introduced into the muffle of the assay furnace constructed by Dr. Roberts especially for producing the high heat required in these and similar operations, and is heated so intensely that when the door of the furnace is opened the cake of metal is too dazzlingly hot to be visible. It is then taken out with tongs plated with platinum, and hammered with a perfectly clean hammer upon a clean anvil, both of which should be as hot as possible without drawing the temper of the steel. If the process is one of welding, when the platinum has cooled so as to be distinctly visible, it should be heated again, for in this condition every blow tends to shatter and shake it to pieces. The lump is forged by hammering it to a thickness of about ¼ of an inch, and then being again heated very hot, is passed instantly through the rolls. It is thus obtained in sheets, which are easily converted into the various uses to which the metal is applied.

Upon the opposite page, the apparatus employed and manner of conducting the operations are exhibited in the wood-cut;

and the articles designated by the figures are thus explained:—

1. Reservoir for oxygen.
2. " " hydrogen.
3. Hydrogen generator.
4. Oxygen "
5. Blowpipe.
6. Tuyere.
7. Rolls for converting the metal into sheets.
8. Gasometer.
9. Water pipes.
10. Pan.
11. Moulds in which the loose pieces of metal are compressed.

Crucibles for chemical use are prepared by the ingenious method called spinning. A disk of the metal is securely fixed against the end of the mandrel of a lathe, and, as it revolves rapidly, a blunt point is pressed upon its surface, causing the plate to gradually bend over and assume the desired form. The large platinum retorts used in the manufacture of sulphuric acid are imported from Paris. The whole amount of platinum brought to the United States for the year 1850 was 34,000 oz. troy, which, at the custom-house valuation of $6.10 per oz., amounts to $200,000. Probably the whole amount of native metal worked over does not exceed 1500 oz. The amount of scraps remelted by Dr. Roberts is about 1000 oz. a year.

IRIDIUM AND OSMIUM.

An alloy of these metals in fine grains of excessive hardness is found very frequently with platinum and with the gold which is refined at the mints. It is of interest from the use to which it is applied in forming the nibs of gold pens; and for this purpose the small grains are purchased by the pen-makers sometimes at the rate of $250 an ounce. From this quantity they may select from 8000 to 12,000 points of suitable size and shape for use. The alloy is known as iridosmium, and is also very generally called iridium. At some seasons it has been quite abundant in the gold presented at the New York assay office; but recently it is more rare. As it does not fuse and alloy with the gold, it appears in specks upon the bars of this metal. The method of separating it is to melt the gold with a certain portion of silver, as in the usual refining process. The alloy thus obtained being less dense than the melted gold, the particles of iridium settle in the lower portions; the upper is then ladled off, and the metals are parted. More of the impure gold is added, and the process thus goes on till a considerable amount of iridium is concentrated into the alloy of gold and silver, from which it is at last obtained by dissolving these metals. According to the statement of Dr. Thèvenet published in the *Annales des Mines* (vol. xvi., 1859), iridium is collected at the gold-washings along the sea-coast of Oregon, and is sometimes quite equal in quantity to the gold. He describes it as white, glistening, very heavy, its specific gravity being 20 to 21, very hard, and resembling sand, its angles slightly flattened and rounded by friction. It is accompanied by platinum and rhodium. After one of the storms that prevail along this coast, the miners at low tide collect the black sand and carry it to the washing and amalgamating apparatus, in which it is stirred with mercury and then treated upon the shaking tables. Though by their rude processes they probably lose ⅓ of the precious metals, they sometimes collect several ounces a day of gold to the man. Near Fort Orford, to the north of Rogue River, about 15 per cent. of iridium is found with the gold. Still further north, between Cape Blanco and Coquille, the metals collected consist of about 45 per cent. iridium and 5 per cent. platinum. Between Randolph and Cape Arago the metallic grains are very light and in extremely thin scales; they consist of 70 per cent. iridium and 6 per cent. platinum. Further north, the iridium continues almost as abundantly, but mostly in very fine particles. One piece was shown to Dr. Thèvenet as a great curiosity which was as large as a grain of rice. In sifting more than 50 lbs. of iridium, he states that he had not seen a single specimen of one quarter this size.

CHAPTER VII.

MERCURY.

This metal, which is extensively employed in the arts, especially in the treatment of gold and silver ores by amalgamation, in the combination of amalgams for coating mirrors, etc., in the construction of barometers and thermometers, and other philosophical instruments, in the manufacture of the paint called vermilion, for several medicinal preparations, and for a variety of other purposes, was not classed among the productions of the United States until after the acquisition of California, when mines of its principal ore were opened, which have been extensively worked, as will be described below. Mercury, which is the only fluid metal, is found both in a native state, dispersed in drops among the slates that contain the veins of its ores, and also occurs in combination with sulphur in the ore called cinnabar, a compound of one atom of mercury and one of sulphur, or of 86.2 per cent. of the former, and 13.8 per cent. of the latter. Some other natural compounds are known, which are not, however, of much importance. Cinnabar is almost the exclusive source of the metal. This is a very heavy, brilliant ore of different shades of red; is readily volatilized at a red heat, giving off fumes, when exposed to the air, both mercurial and sulphurous; but in tight vessels it sublimes without decomposition, and if lime or iron be introduced with the ore into retorts, the sulphur is retained in combination with the new element, and the mercury escapes in vapor, which may be condensed and recovered in the metallic state. On this principle the process for collecting mercury is based. The ores of mercury are found in almost all the geological formations, but the productive mines are only in the metamorphic or lowest stratified rocks, and in the bituminous slates of the coal measures.

In order to appreciate the importance of the mines of California, it is necessary to understand the extent of the demand for this metal, and the sources which have supplied it. From the time of the ancient Greeks and Romans, mercury has been held in high estimation, and has been furnished from the same mines, which have ever since produced the chief part of the product of the world. Pliny states that the Greeks imported red cinnabar from Almaden in Spain, 700 years before the Christian era, and in his own time it was brought to Rome from the same mines to the amount of 700,000 lbs. annually. In modern times the production amounts to 2,700,000 to 3,456,000 lbs. per annum, and is chiefly obtained from two veins, one about 2 feet, and the other 14 feet thick, which, meeting in a hill about 125 feet high, spread out to a thickness of nearly 100 feet. The ores are of small percentage, yielding about $\frac{1}{10}$ only of mercury. The greatest depth of the workings was only about 330 yards several years ago. After the metal has been extracted from the ores, it is packed in iron bottles or flasks holding 76½ lbs. each, and is taken to Cadiz for shipment. For many years past, the lessees from the Spanish government, in whom the title is vested, have been the Rothschilds and other bankers of Europe; but their contracts with the government have varied from time to time, thus affecting the price at which the product was held.*

The mines next in importance have been those of Idria in Carniola, belonging to the Austrian government. These, for some years previous to 1847, had produced an annual average of 358,281 lbs. of mercury, and since that time, the production has varied, sometimes reaching 600,000, and even over 1,000,000 lbs. per annum. The other mines of Europe do not probably produce 200,000 lbs. On the American continent many localities of the ores have been worked to some extent; but although the consumption is very great at the silver mines of Mexico, amounting, as estimated by Humboldt, to 16,000 quintals of 200 lbs. each, three fourths of the supply was then derived from the European mines. In 1782, mercury was even brought to South America from China, where it was formerly largely extracted in the province of Yunnan. Yet in the early years of the Spanish conquest Peru was a large producer of the metal, its most important mines being in the province of Huancavelica, where no less than 41 different localities of the ore have been known; but at present the whole product of the country is supposed not to exceed 200,000 lbs. A large portion of this product is from the Santa Barbara, or the "Great Mine," which has been worked since 1566. The mines of Chili and the numerous localities at which the ores have been found in Mexico supply no metal of consequence. Dumas estimated, not long since, the total annual production as follows:—

	lbs. avoirdupois.		
Almaden, Spain	2,700,000	to	3,456,000
Idria	648,000	"	1,080,000
Hungary and Transylvania	75,600	"	97,200
Deux Ponts	42,200	"	54,000
Palatinate	19,400	"	21,600
Huancavelica	..		324,000
California	..		2,000,000
Total			7,032,800

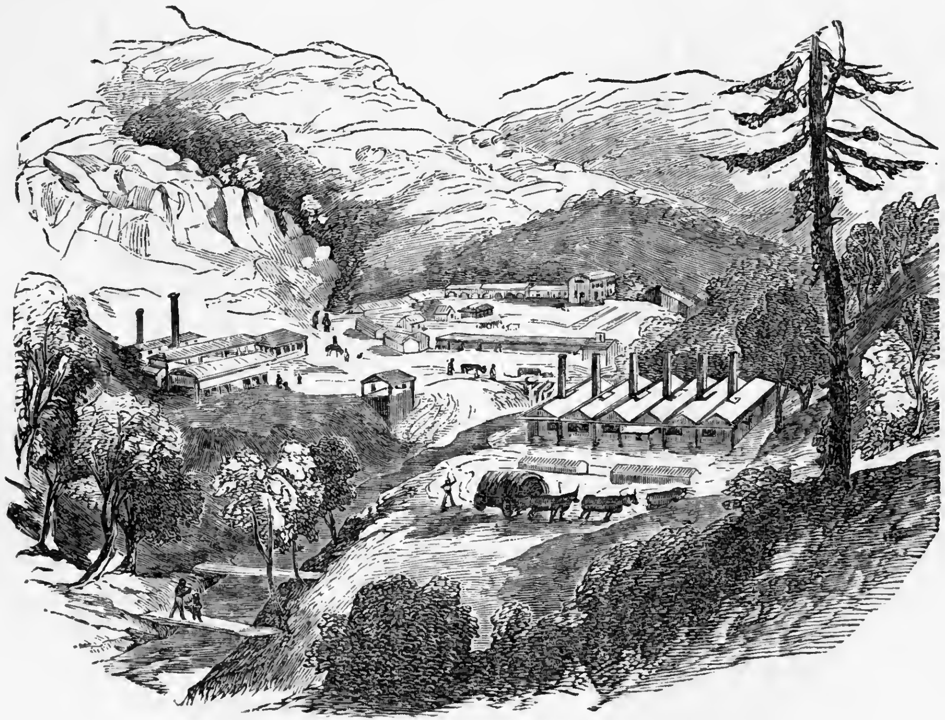
* In 1839 the royalty demanded by the government was $59 per quintal of 106 lbs., to which it had reached by successive advances from $51.25; and in 1843 it had advanced to $82.50 per quintal. The opening of the California mines soon caused this to be considerably reduced.

In California the existence of large quantities of cinnabar was known long before the real character of the ore was understood. It was found along a range of hills on the southern side of the valley of San José, about 60 miles south-east from San Francisco. For an unknown period the Indians had frequented the locality, coming to it from distant places, even from the Columbia river, to obtain the bright vermilion paint with which to ornament their persons. With rude implements, such as the stones they picked from the streams, they extracted the ore from the flinty slates and shales in which it was found, and in their search for it they excavated a passage into the mountain of about sixty feet in length. In 1824 the attention of the whites began to be directed to this curious ore, and some of the Mexicans sought to extract from it gold or silver. Other trials made of it in 1845 resulted in the discovery of its true character, and operations were thereupon commenced to work it by one Andres Castillero. Owing, however, to the disturbed state of the country, little was done until 1850, when a company of Mexicans and English engaged vigorously in the extraction and metallurgical treatment of the ore, and established the mine which they called the New Almaden. In 1858 a stop was put upon their further proceedings by an injunction issued by the United States court on the question of defective title. From the testimony presented in the trial, it appeared that the company in the course of eight years had produced full 20,000,000 lbs. of metal, and realized a profit of more than $1,000,000 annually. The Americans who claimed the mine directed their attention to the discovery of new localities of the ore, and succeeded in finding it upon the same range of hills within less than a mile of the old workings. Here they opened a new mine in December, 1858, which they named the Enrequita, and in June, 1860, a company was formed in New York for working it under the name of the "California Quicksilver Mining Association." The following are the returns of their operations to the latest dates: in September, 1859, the product of mercury was 14,400 lbs.; October, 28,650; November, 27,525; December, 28,425; January, 1860, 27,000; February, 16,950; March, 25,500; April, 33,700; May, 46,275; June, 48,750; July, 50,000; August, 79,866; September, 66,096. The increase of production, hereafter, will be limited rather by the capacity of the reducing apparatus than by that of the mine. Twenty-four retorts for distilling the mercury are now in operation, 6 of which have been started since August, 1860. From the report of October 11, 1860, it appears that a new vein has also been opened, in which 20 men are employed, working in solid cinnabar without having encountered the boundary walls of the lode. The total expenditure for mining, for machinery, etc., up to October 15, 1860, had amounted to $275,000, all of which has been paid out of the proceeds of the mine, leaving a considerable balance on hand. The company owns another mine also, called the Providencia, which has produced some cinnabar.

The operations at the Enrequita mine are carried on from the face of the hill, some 5 or 6 levels one above another being carried into the mountain up and down its slope. The most extensive of these is the adit level at the base, which is about 600 feet long. Shafts are sunk from this to the depth of about 50 feet; but the principal workings are in the upper levels for 300 feet over the adit. These are exceedingly irregular, owing to the unequal distribution of the ore through the argillaceous slates. It lies in beds included between the strata of these lower silurian rocks, dipping with them at a very steep angle, and winding with the contortions of the strata. The workings follow the bunches of ore as they lead up or down, and to the right or left. Shafts occasionally penetrate from one level to another, but no regular system of working appears to have been adopted. With the cinnabar is intermixed some arsenical iron and copper pyrites, and the ore and slates are both traversed by veins of carbonate of lime, some of which are retained in hand specimens of the cinnabar.

On the same range of hills, at its western extremity, the Santa Clara Mining Company, of Baltimore, has opened a mine called the Guadalupe, the product of which for the year 1860 was about 200,000 lbs.

The total production of the quicksilver mines, derived from the custom-house returns and the supposed consumption of 35,576 flasks in California, has been estimated to amount, from the commencement of 1853 to near the close of 1858, to about 177,578 flasks, or 13,318,350 lbs.



NEW ALMADEN QUICKSILVER MINE.

METALLURGIC TREATMENT.

From cinnabar not contaminated with strange metals, the method of obtaining the fluid mercury is very simple. In the early workings of the New Almaden mine, the clean ores were placed in the common "try pots," such as are used by the whalers, and a cover being tightly luted on, a fire was started under them, and the mercurial vapors escaped through a tube inserted in the lid and were condensed in cold vessels. Afterward furnaces were constructed in brick-work upon a large scale, each one provided with a chamber or oven 7 feet long, 4 feet wide, and 5 feet high, corresponding to the chamber of the reverberatory furnaces; and into this was introduced a charge of 10,000 lbs. of clean ore separated from the poorer portions after the whole had been broken up. With the ore was mixed a portion of lime to combine with and retain the sulphur. A partition of brick-work separated the oven from the fire-room, and the bricks in this partition were so laid as to leave open spaces for the flame from the burning wood to pass through. On the opposite side of the oven another partition separated this from a chamber of its own size, the only communication between them being by a square hole in one of the corners close to the roof. This chamber connected with another by an opening in the opposite corner near the floor, and this arrangement was extended through eight chambers. Between the last one and the tall wooden flues through which the smoke and vapors finally passed out into the open air was placed a long wooden box provided with a showering apparatus. As the cinnabar was volatilized by the flame playing over the charge, the vapors were carried through the condensing chambers, depositing in each a portion of mercury, and in the showering box they underwent their final condensation. From the bottom of each chamber the metal flowed in gutters to the main conduit which led to the great iron reservoir sunk in the ground. From this it was poured into flasks through brushes which intercepted the scum of oxide of mercury. The method proved very wasteful, from the leakage of the vapors through the brick-work; and it has been abandoned for an improved process, in which the pulverized ores mixed with quicklime are charged into large cast-iron retorts very similar in their form and setting to those employed at the gas-works. Three are set together in a bench of brick-work, and each one is furnished with an eduction pipe inserted in the end and leading down into water contained in a large cylindrical condenser of iron. This is placed along the front line of the furnace, so as to receive the vapors from all the retorts. The mercury, as it is condensed, falls down to the bottom, and is let out through a pipe by a contrivance that prevents the water flowing with it from the condenser. At the Enrequita mine each bench of three retorts requires a little over a cord of oak wood a day for heating. Four benches, in operation from September, 1859, employed 6 men in charging and discharging, working in 2 shifts of 3 men, besides 3 firemen, each working 8 hours. Two men besides these were employed in mixing the ores for the retorts. In June, 1860, the production of these furnaces, from 1000 cargas of ore of 300 lbs. each, was about 50,000 lbs., or about 17 per cent.

In conducting the furnaces, the workmen are seriously affected by inhaling the mercurial vapors. They are sometimes even salivated, and are often obliged to abandon the business for a time. The horses and mules also suffer from the noxious fumes, and many are lost in consequence. But no injurious effects are experienced among those employed in the mines, the cinnabar being always handled with impunity.

The view of the works presents their appearance in 1852, as sketched by J. R. Bartlett, Esq. It was first published in his "Personal Narrative" (New York, 1854).

USEFUL APPLICATIONS OF MERCURY.

The principal uses to which mercury is applied have already been named. The largest quantities are consumed in working gold and silver ores. The principle of the amalgamating process is explained in the account of the treatment of gold ores. In the arts amalgams are applied to many useful purposes, of which the most important is coating the backs of looking-glass plates with tin amalgam. Silver was originally employed instead of tin, and the process is still called "silvering." It is conducted at several establishments in the United States on the old Venetian plan, which has been in use for 300 years. The largest mirrors are prepared by Messrs. Roosevelt & Sons, in New York, from the French plates which they import. The process is a simple one, but is attended with some difficulties arising from the imperfections which will sometimes appear upon the coating, notwithstanding the particular care taken to avoid them. The health of the workmen also suffers, so that they cannot pursue the business more than a few years. The only precaution taken to protect them from the effects of the mercury is thorough ventilation. Frequent use of sulphur baths also is very beneficial. The method of silvering is as follows: tables are prepared of stone made perfectly smooth, with grooves sunk around the edges. These are set horizontally, but can be raised a little at one end by a screw. Each table is covered with tinfoil carefully spread out over a larger surface than the plate will cover, and slips of glass being laid around three of the sides, the mercury is poured on till it covers the foil to the depth of about ¼ of an inch. Its affinity for the tin, and the slips of glass, prevent its flowing off. The glass plate rendered perfectly clean is then slidden along the open side, the advancing edge being kept in the mercury, so that no air nor oxide of the metal can get between the plate and the amalgam. The plate, when in place, is secured and pressed down by weights laid upon it, and the table is raised a little to allow the excess of mercury to trickle off by the grooves and collect in a vessel placed on the floor to receive it. After remaining thus for several hours, the plate is taken off and turned over upon a frame. After several weeks the amalgam becomes hard, and the glass may then be set on edge.

Amalgams of the precious metals are used for what are called the water-gilding and water-silvering methods of gilding and silvering applied to buttons and various other metallic articles. These, being made chemically clean, are washed over with the amalgam contained in a large excess of mercury, and are then placed in a furnace and heated till the mercury is driven off by the heat, leaving a thin film of the precious metal, which may then be burnished.

Mercurial medicines, as calomel, (the chloride,) and blue mass, which is the metal reduced to fine particles by long-continued trituration, and incorporated with twice its weight of confection of roses and liquorice root, are very largely prepared, especially for the southern and western states and the West India islands. The labor of triturating the mercury for blue mass has led to the introduction of ingenious machinery for the purpose, invented by Mr. J. W. W. Gordon of Baltimore, and by Dr. E. R. Squibb of Brooklyn, and worked by the latter at his pharmaceutical laboratory by steam power.

CHAPTER VIII.

SILVER — COBALT — NICKEL — CHROME — MANGANESE—TIN.

But few other ores of much importance are found in the United States, besides those of which accounts have been given; and it remains to describe the occurrence and applications of the ores of those metals only which are comprised in the heading of this chapter.

SILVER.

The occurrence of this metal in the United States is chiefly limited to some of the lead ores; and in very few of these, as noted in the chapter upon lead, has it been found in sufficient quantity to justify the working of the mines and separation of the silver. The Washington mine in Davidson co., N. C., is still worked with moderate success for both metals; but the only promising silver mines are those of Arizona, near the Gila river in New Mexico, and the Washoe mines on the extreme western verge of the Utah territory.

In the territory of Arizona, especially in that portion of it ceded to the United States under the Gadsden treaty, are numerous mines productive in silver, some of which were worked when the territory belonged to old Spain. These are now attracting the attention of Americans, and in 1859 and 1860, companies were organized in Cincinnati, New York, and St. Louis, for exploring and working them. The principal mine is that of the Sonora Company, of Cincinnati. The locality is about 75 miles south of Tucson, and about 270 miles north of Guaymas, which is the chief port of the Gulf of California. Several mines in the vicinity were formerly worked by the Mexicans for silver, and abandoned in consequence of Indian depredations and political troubles. The Sonora Company commenced operations in 1858 upon a new discovery, and have produced a considerable amount of silver, reduced from the ores at their works, at Arivaca, 7 miles from the mines. Seventy miles north of Tucson, operations were commenced in 1860, in another locality, on the same mining range, by a company organized in New York, called the Maricopa Mining Company. Their mine affords rich argentiferous copper ores, samples of which have been brought to New York, and assayed by Prof. John Torrey, and other chemists. They proved to be vitreous copper, associated with carbonates, and yielded an average of over 50 per cent. of copper. The metal contained variable amounts of silver, worth from $40 to $80 per ton. Gold was also detected in it. The outlet for this is also by Guaymas, 420 miles distant, through a region easily traversed by wagons, and upon long-established routes. The cost of transportation, by contracts of Mexicans, is at the rate of 5¼ cents per lb., for the whole distance. In the vicinity of the mines, on the Gila river, it is proposed to reduce the ores. The region is on the Pacific slope of the range of the silver mining districts of Sonora and Durango, and its rock formations are granitic and metamorphic, traversed by dikes of trap, and containing beds of quartz.

On the Rio Mimbres, 240 miles east of Tucson, are the Santa Rita del Cobre and Mimbres mines, from which 333,000 lbs. of copper are reported as having been delivered in New York in 1860. The metal was smelted at the mines, transported through Texas to Port Lavacca, and thence to New York. Whether the ores contain silver or not, is not known. Besides the operations above named, others are in progress in Arizona, of which we have no details. The region is described in the "Personal Narrative" of J. R. Bartlett, Esq., and in the Congressional Pacific Railroad reports.

The Washoe ores are argentiferous galenas of richness varying between great extremes, some of the best sorts which have been shipped to New York, and thence to England, containing enough silver to give them a value of $2000 per ton. The mines are in the inferior range of hills along the eastern base of the Sierra Nevada, and are met with over an extensive territory in the valley of the upper portion of Carson's River and many miles beyond this to the north. Those of most importance are in the vicinity of several new towns, called Virginia City, Silver City, Carson City, etc., about 160 miles north-east from Sacramento. From that point the crest of the Sierra Nevada is reached in 100 miles, nearly due east, and the remaining 60 miles is down the valley of Carson's River. The discoveries of the silver ores were made the latter part of the year 1859, but it was known before this that gold existed in the valley, and that the value of this metal was deteriorated by the silver with which it was usually alloyed. The opening of permanent veins of silver ores produced a great excitement throughout California, and led to an extraordinary emigration to the new mining district, and rapid development during the year 1860 of its resources. The considerable number of mines already in operation, upon veins of unquestionable permanency, and the great richness of some of the ores, together with the variety of those already found, leave no room for doubting that this is a mining region of great importance, and must largely add to the metallic productions of the extreme western states.

The ores, on account of their complex character, are difficult to reduce with economy, and the ordinary methods of obtaining the lead fail, when applied to compounds like these, which contain a large proportion of silica, from which the galena cannot be mechanically separated. The German method of treating such ores, employed at Clausthal, is to reduce them in small blast furnaces, with a flux of granulated cast iron, or of iron turnings, admitting only air enough to keep up the combustion of the fuel. The lead and silver are set free by the sulphur of the ore combining with the iron, and the formation of infusible silicates of oxide of lead is prevented by guarding against the oxidation of lead, through too great access of air. The separation is, however, very imperfect in a single operation, and the rich slags obtained are roasted in order to convert the sulphuret of iron into oxide of iron, which, combining with the silicates of the scoriæ, forms very fusible compounds, which are then returned to the furnace mixed with fresh charges of ore. The silver goes with the lead, and is separated by cupellation.

COBALT.

The ores of this metal are of rather rare occurrence, and are applied to practical purposes not to furnish the metal but its oxide, which is of value for its property of giving a beautiful blue color to glass with which it is melted, and of producing other fine colors when mixed with some other substances. The ores are sought for all over the world for the supply of the British manufactories of porcelain, stained glass, etc. They are chiefly combinations of cobalt with arsenic, sulphur, and sometimes with nickel and iron. The compound known as smaltine, or arsenical cobalt, was obtained at Chatham, Conn., as far back as 1787, and the mine has been worked for cobalt at different times in the present century. The cobalt in the ore is associated with about an equal amount of nickel, and its proportion is said to have been less than two per cent. Cobaltine, which is a compound of sulphur 19.3 per cent., arsenic 45.2, and cobalt 35.5, is the most productive ore of this metal, but is not met with in this country. Varieties of pyritous cobalt have been found in Maryland in quantities too small for working; and also at Mine la Motte in Missouri, associated with a black earthy oxide of cobalt and black oxide of manganese. In other places, also, oxide of cobalt, in small quantity, is a frequent accompaniment of manganese ores. Mine la Motte has furnished a considerable amount of the cobalt oxide, but the beds in which it is found are not of permanent character, and are so far exhausted as to be no longer worked with profit. A similar ore, accompanied with nickel, appears to be very abundantly distributed among the talcose and quartzose slates in Gaston and Lincoln counties, North Carolina. It is thrown out with a variety of other ores, as galena, blende, titaniferous iron, etc.. in working the gold mines of this region; and it is mixed among the great beds of hematite, found in the same district, which are the product of the decomposition of beds of pyritous iron. In some places it is so abundant that the strata containing it are conspicuous where the roads pass over them, by the blackness of the gossan (decomposed ore) or wad. Prof. H. Wurtz, who describes these localities (see "American Journal of Science," 2d series, vol. xxvii., p. 24), is of opinion that the earthy oxide of cobalt is the gossan of the sulphuret of this metal, existing unaltered in the rocks below.

Oxide of cobalt, obtained in a crude state from the washed arsenical ores, is known as zaffre or saflor, and in this condition it is a commercial article. It is refined by separating the arsenic, iron, and other foreign substances, by precipitating them from the solution in hydrochloric acid; and the oxide is finally obtained by precipitating with chloride of lime, and heating the product to redness. Smalt is a preparation of cobalt largely used in the arts as a coloring material, and consists of silicate of potash and cobalt. It is in fact a potash glass colored by silicate of cobalt, and is prepared as follows: Zaffre is melted in pots, with suitable proportions of pure sand and potash and a little saltpetre. The other metals combine together and sink in a metallic mass, which is called speiss. The glass containing the oxide of cobalt is ladled out and poured into water to granulate it, and is then ground to powder. This being introduced into vats of water, the colored glass subsides in deposits, which gradually diminish in their proportions of oxide of cobalt. The first are of the deepest blue, and are called azure; but of this, and of the succeeding fainter shades, there are many varieties, distinguished by peculiar names. When finely powdered, smalt is applied to coloring wall papers, and blueing linen, besides being incorporated with porcelain to impart to it permanent blue shades. The great value of oxide of cobalt, amounting to several dollars per lb., renders it an important object to fully develop the resources of the country in its ores, as well for export as for domestic use. In 1856 there were imported into Great Britain 428 tons of cobalt ore, and 34 tons of oxide of cobalt.

NICKEL.

Nickel is a metal of some commercial importance, and is employed chiefly for producing, with copper and zinc, the alloy known as German silver. The proportions of these metals are not constant, but the most common in use are eight parts of copper to three each of nickel and zinc. The larger the proportion of copper, the more easily the plates are rolled; but if more is used than the relative amounts named, the copper soon becomes apparent in use. The new cent contains 12 parts of nickel to 88 of copper, and the manufacture of this adds somewhat to the demand. The metal has been mined at Chatham, Conn., and is met with at Mine la Motte and other localities where cobalt is found. It occurs in greatest abundance at an old mine in Lancaster county, Penn., where it is associated with copper ores. The mine was originally worked for copper, it is said, more than one hundred and thirty years ago, and was reopened for supplying nickel for the U. S. Mint, on the introduction of the new cent in 1857. The sulphuret of nickel, containing, when pure, 64.9 per cent. of nickel, and 35.1 per cent. of sulphur, is in very large quantity, in two veins of great size, one of which has been traced over 600 feet, and the other over 900 feet in length. In 1859 it was producing at the rate of 200 tons of nickel ore and ten tons of copper ore per month. A pyritous variety of nickel ore, called siegenite, is found at Mine la Motte, Missouri, and in Carroll county, Maryland. In Gaston and Lincoln counties, North Carolina, similar ore was found by Prof. Wurtz, as noticed in the remarks on cobalt, above.

CHROME OR CHROMIUM.

The ore of this metal, known as chromic iron or chromate of iron, has been mined for many years in the United States, both for exportation and domestic use. It is the source whence the chrome colors are obtained that are largely used in the arts, especially in dyeing and calico printing. The name of the metal, from a Greek word meaning color, was given in consequence of the fine colors of its compounds. It usually consists of the sesquioxide of chromium in proportion varying from 36 to 60 per cent., protoxide of iron from 20 to 37 per cent., alumina sometimes exceeding 20 per cent., and more or less silica, and sometimes magnesia. Its value consists only in the first-named ingredient. The localities of the ore are in the serpentine rocks of different parts of the United States, as in the Bare Hills, near Baltimore, and near the Maryland state line on the southern edge of Chester and Lancaster counties, Pennsylvania. In small quantities the ore is met with at Hoboken, Staten Island, and other places near New York city. It is found in several towns in Vermont, but the largest veins of it are in Jay, in the northern part of the state. The composition of this ore was found by Mr. T. S. Hunt to be 49.9 of green oxide or sesquioxide of chromium, 48.96 of protoxide of iron, and 4.14 per cent. of alumina, silica, and magnesia. Though the quantity of the ore in this region is reported to be large, the principal supplies of the country have been obtained in Maryland, and from the mines just over the state line in Pennsylvania. The ore, as recently as 1854, was found in loose fragments among the disintegrated materials of the serpentine upon the tracts called the barrens, and was gathered up from the valleys and ravines, and dug out in sinking shallow pits and trenches over the surface. The ore thus obtained was called "sand chrome," and for a time it had been worth $45 per ton, and thousands of tons had been collected and shipped, principally to Baltimore. At the period named these superficial deposits were mostly exhausted, and the value of the ore was only about $25 per ton. This, however, was sufficient to sustain regular mining operations, which were then carried on upon the veins found in the serpentine, a little west of the east branch of the Octorara Creek. Wood's chrome mine, near the Horse-shoe Ford, was at that time about 150 feet deep, and the workings had been extended north-east and south-west about 300 feet, upon an irregular vein of chrome ore, which lay at an inclination of about 45° with the horizon toward the north-west. The ore, in places, formed bunches, which attained a width of 20 feet, and then thinned away to nothing. Four men obtained from the mine 7 or 8 tons of excellent ore a day, the best of which was directly placed in barrels for the foreign market, and the poorer was dressed and washed for the Baltimore, and other home markets. The state line mine, in the same vicinity, worked to about the same depth, had produced several thousand tons. The supplies of this ore are always of uncertain continuance.

Useful Applications. — Chromate of iron is used chiefly in the production of chromate of potash, and from this the other useful chromatic salts are obtained. The object in view in the chemical treatment of the ore is to convert the sesquioxide of chromium into the peroxide or chromic acid, and cause this to combine with potash. This may be effected by various methods, as by exposing a mixture of the pulverized ore and of saltpetre (nitrate of potash) to a strong heat for some hours. The chrome is peroxidized at the expense of the oxygen of the nitric acid of the saltpetre, and the chromic acid combines with the potash; or if the ore is mixed with carbonate of potash and calcined, the peroxidation of the chrome is effected by admission of air into the furnace, and the same product is obtained as in the employment of saltpetre. The introduction of lime hastens the operation. Other mixtures also are used for the same purpose. When the calcined matter, having been drawn out from the furnace, is lixiviated with water, the chromate of potash is dissolved and washed out, and is afterward recovered in the form of yellow crystals on evaporating the water. From chromate of potash the other salts are readily produced. Chrome yellow, used as a paint, is prepared by mixing chromate of potash with a soluble salt of lead, and collecting the yellow precipitate of chromate of lead which falls. A bright red precipitate is obtained by thus employing a salt of mercury, and a deep red with salts of silver. Chrome green is produced by mixing Prussian blue with chrome yellow. Some new and very interesting compounds of the sesquioxide of chromium with different bases have been recently obtained by Prof. A. K. Eaton of New York, and in consequence of their decided colors and the extraordinary permanency of these against powerful reagents applied to remove them, the salts were employed for printing bank-notes. Though they proved to be all that was required as to the colors themselves, the steel plates were so rapidly cut by the excessively sharp and hard powders, however finely they were ground, that it was found necessary to abandon their use. The new salts were chromites—that of iron having a dark purple color; of manganese, a lighter shade of the same; of copper, a rich blueish black; of zinc, a golden brown; of alumina, a green, somewhat paler than that of the sesquioxide.

MANGANESE.

Though this is a metal of no value of itself, one of its ores, called pyrolusite, is a mineral of some commercial importance, chiefly on account of the large proportion of oxygen it contains, part of which it can be easily made to give up when simply heated in an iron retort. The composition of pyrolusite, or black oxide of manganese, is 63.4 per cent. of manganese, and 36.6 per cent. of oxygen. It is a hard, steel-gray ore, resembling some of the magnetic iron ores, and is often found accompanying iron ores, especially the hematites. In the United States it is met with in various localities along the range of the hematites, from Canada to Alabama, and has been mined to considerable extent at Chittenden and Bennington, Vermont; West Stockbridge and Sheffield, Mass.; on the Delaware river, and near Kutztown, Berks co., Penn.; and abounds in different parts of the gold region, as on Hard-labor Creek, Edgefield District, S. C. Usually the ore is found in loose pieces among the clays which fill the irregular cavities between the limestone strata; its quantity is of course very uncertain, and its mines are far from being of a permanent character. Oxide of iron is commonly mixed with the manganese ore, reducing its richness, and at the same time seriously injuring it for some of the purposes to which it is applied. As obtained from the mines, the assorted ore is packed in barrels and sent to the chemical establishments, where it is employed principally in the manufacture of chloride of lime or bleaching powder. For this purpose the pulverized black oxide of manganese is introduced into hydrochloric acid, and this being heated a double decomposition takes place, a portion of its chlorine is expelled, and the hydrogen that was combined with it unites with a part of the oxygen of the pyrolusite. The chlorine, which it was the object of the process to obtain, is then brought in contact with hydrate of lime, and uniting with the calcium base, forms the bleaching powder. A similar result is obtained by mixing the oxide of manganese with chloride of sodium (common salt), and adding sulphuric acid. By these operations a weight of oxygen equal to about one third that of the pure ore may be obtained, and this may be applied to any of the purposes for which oxygen not absolutely pure is required. Black oxide of manganese is also used to decolorize glass stained green by the presence of the protoxide of iron. Its own amethystine tint is supposed to neutralize the optical effect of the greenish hue of the iron. The market for manganese ore is as uncertain as the supply, and the price varies greatly with the quality of the ore. Pure pyrolusite, free from iron, might be shipped to profit to Liverpool, where it is worth $35 to $40 per ton, but inferior ore would involve bills of cost.

TIN.

The very useful metal, tin, is not one of the products of this country, and there is no encouragement for hoping that its ores will ever be found in workable quantity. Its presence has been recognized in a few small crystals of oxide of tin, found in Chesterfield and Goshen, Mass., and it has been detected as a mere trace in the iron ores of the Hudson, and iron and zinc ores of New Jersey; it is also associated with some of the gold ores of Virginia. In the town of Jackson, N. H., is a vein of arsenical iron, containing thin streaks of oxide of tin; and this is the only place that has afforded enough of the ore for crucible experiments. The commercial supplies are furnished chiefly from the mines of Cornwall, England, and from Banca, and other islands of the Malay archipelago. The United States is one of the largest consumers of tin of any nation, sheet tin having been applied, through the industry and ingenuity of the workers of this article in Connecticut, to the manufacture of a great variety of useful utensils, which have been widely distributed throughout the states. What is called sheet tin is really sheet iron coated with a very thin layer of tin. The sheets are prepared in England by dipping the brightened iron sheets into a bath of melted tin. The process has been applied to coating various articles made of iron, which are thus protected from rusting; and zinc is also used for similar purposes. Such are stirrups, bridle-bits, etc. Cast-iron pots and saucepans are tinned on the inside by melted tin being poured in and made to flow over the surface, which has been made chemically clean to receive the metal. The surface is then rubbed with cloth or tow. Tin is imported in blocks or ingots, and the metal is applied to the preparation of various alloys, as bronze or bell-metal, composed of copper and tin in variable proportions, commonly of 78 parts of copper, and 22 of tin; gun-metal, copper 90, and tin 10; pewter, of various proportions of tin and lead, or when designed for pewter plates, of tin 100, antimony 8, bismuth 2, and copper 2; and soft solder, consisting of tin and lead, usually of two parts of the former to one of the latter. Bismuth is sometimes added to increase the fusibility of the alloy.

CHAPTER IX.

COAL.

To the early settlers of the American colonies the beds of mineral coal they met with were of no interest. In the abundance of the forests around them, and with no manufacturing operations that involved large consumption of fuel, they attached no value to the black stony coal, the real importance of which was not in fact appreciated even in Europe until after the invention of the steam engine. The earliest use of mineral coal was probably of the anthracite of the Lehigh region, though it may be that the James River bituminous coal mines, 12 miles above Richmond, were worked at an earlier period than the Pennsylvania anthracites. The region containing the latter belonged to the tribes of the Six Nations, until their title was extinguished and the proprietary government obtained possession, in 1749, of a territory of 3750 square miles, including the southern and middle of the three anthracite coal-fields. In 1768 possession was acquired of the northern coal-field, and at the same time of the great bituminous region west of the Alleghany mountains. The existence of coal in the anthracite region could not have escaped the notice of the whites who had explored the country, for its great beds were exposed in many of the natural sections of the river banks and precipitous hills, and down the mountain streams pieces of coal, washed out from the beds, were abundantly scattered. The oldest maps now known, dating as far back as 1770, and compiled from still older ones, designate in this region localities of "coal;" but these were probably not regarded as giving any additional value to the territory. The first recorded notice of its use was in the northern basin by some blacksmiths in 1770, only two years after the whites came in possession; and in 1775 a boat load of it was sent down from Wilkesbarre to the Continental armory at Carlisle. This was two years after the laying out of the borough of Wilkesbarre by the Susquehanna Land Company of Connecticut. From this time the coal continued to be used for mechanical operations by smiths, distillers, etc.; and according to numerous certificates from these, published in 1815, in a pamphlet by Mr. Zachariah Cist of Wilkesbarre, they had found it very much better for their purposes, and more economical to use than Virginia bituminous coal, though at the enormous price of 90 cents a bushel. Gunsmiths found it very convenient for their small fires, and one of them, dating his certificate December 9, 1814, stated that he had used it for 20 years, consuming about a peck a day to a fire, which was sufficient for manufacturing 8 musket-barrels, each barrel thus requiring a quart of coal. Oliver Evans, the inventor of the steam engine, certifies in the same pamphlet to his having used it for raising steam, for which it possessed properties superior to those of any other fuel. Judge Fell of Wilkes-barre applied it to warming houses in 1808, and contrived suitable grates for this use of it; but the cheapness of wood and the greater convenience of a fuel which every one understood how to use, long prevented its general adoption. In the first volume of the "Memoirs of the Historical Society of Pennsylvania," T. C. James, M.D., gives "a brief account of the discovery of anthracite coal on the Lehigh," in which he describes a visit he made to the Mauch Chunk mountain in 1804, where he saw the immense body of anthracite, into which several small pits had then been sunk, and which was afterward worked, as it is still, as an open quarry. He states that he commenced to burn the coal that year, and had continued to use it to the time of making this communication in 1826. The discovery of this famous mass of coal was made in 1791, and in 1793 the "Lehigh Coal Mine Company" was formed to work it. But as there were no facilities for transporting the coal down the valley of the Lehigh, nothing was done until 1814, when, at great labor and expense, 20 tons were got down the river and were delivered in Philadelphia. Two years before this a few wagon loads had been received there from the Schuylkill mines; but the regular trade can hardly be said to have commenced until 1820, when the receipts in Philadelphia amounted to 365 tons. Such was the commencement of the great anthracite trade of Pennsylvania, which in the course of 40 years has been steadily increasing, till it now reaches the enormous amount of 8,450,053 tons for the year 1860, and sustains numerous branches of metallurgical and mechanical industry, the possible dependence of which upon this fuel and source of power was hardly dreamed of when its mines were first opened.

The existence of bituminous coal west of the Alleghanies was probably known as early as was that of anthracite in the eastern part of Pennsylvania; and on the western rivers it could not fail to have been noticed by the early missionaries, voyageurs, and hunters. In the old maps of 1770 and 1777 the occurrence of coal is noted at several points on the Ohio. A tract of coal land was taken up in 1785 near the present town of Clearfield, on the head-waters of the west branch of the Susquehanna, by Mr. S. Boyd, and in 1804 he sent an ark load of the coal down the Susquehanna to Columbia, Lancaster county, which, he states, caused much surprise to the inhabitants, that "an article with which they were wholly unacquainted should be thus brought to their own doors." This was the commencement of a trade which has since been prosecuted to some extent by running rafts of timber loaded with coal, and sometimes with pig iron also, from the head-waters to the lower portion of the Susquehanna. The bituminous coal mines on the James River, 12 miles above Richmond, in Virginia, were also worked during the last century, but at how early a period we are ignorant. In an account of them in the first volume of the "American Journal of Science," published in 1818, they are spoken of as already having been worked 30 years.

VARIETIES OF COAL.

The mineral coals are found of various sorts, which are distinguished by peculiarities of appearance, composition, and properties. Derived from vegetable matters, they exhibit in their varieties the successive changes which these have undergone from the condition of peaty beds or deposits of ligneous materials—first into the variety known as brown coal or lignite, in which the bituminous property appears, while the fibre and structure of the original woody masses is fully retained; next in beds of bituminous coal comprised between strata of shales, fire-clay, and sandstones; and thence through several gradations of diminishing proportions of bitumen to the hard stony anthracite, the composition of which is nearly pure carbon; and last of all in this series of steps attending the conversion of wood into rock, the vegetable carbon is locked up in the mineral graphite or plumbago. These steps are clearly traceable in nature, and in all of them the strata which include the carbonaceous beds have undergone corresponding changes. The clayey substratum that supports the peat appears under the beds of mineral coal in the stony material called fire-clay (used when ground to make fire-brick); the muddy sediments such as are found over some of the great modern peat deposits, appear in the form of black shales or slates, which when pulverized return to their muddy consistency; the beds of sand, such as are met with in some of the peat districts of Europe interstratified with different peat beds, are seen in the coal-measures in beds of sandstones; and the limestones which also occur in the same group of strata, represent ancient beds of calcareous marls. The slow progression of these changes is indicated by the different ages of the geological formations in which the several varieties occur. Beds of peat are of recent formation, though some of them are still so old, that they are found at different depths, one below another, separated by intervening layers of sand, clay, and earth. Brown coal, or lignite, is commonly included among the strata of the tertiary period; the bituminous coals are in the secondary formations; and the anthracites, though contained in the same geological group with the great bituminous coal formation, are in localities where the strata have all been subjected to the action of powerful agents which have more or less metamorphosed them and expelled the volatile bitumen from the coal. The graphite or plumbago is in still older groups, or in those which have been still more metamorphosed by heat.

All these varieties of fossil fuel are found in the United States. Peat beds of small extent are common in the northern portion of the country, and in some parts of New England are much used for fuel, and the muck, or decomposed peat, as a fertilizer to the soil. In the great swamps of southern Virginia, the Carolinas, and Georgia, vegetable deposits of similar nature are found upon a scale more commensurate with the extent of the ancient coal-beds. Lignite is not found in workable beds, as in some parts of Germany and England, but in scattered deposits of small extent among the tertiary clays, chiefly near the coast of New Jersey, Delaware, and Maryland, and in the western territories. The distribution of the true coal formations will be pointed out after designating more particularly the characters of the different coals. All of these consist of the elements carbon, hydrogen, oxygen, and nitrogen; the carbon being in part free, and in part combined with the other elements to form the volatile compounds that exist to some extent in all coals. Earthy matters which form the ash of coals are always intermixed in some proportion with the combustible ingredients, and water, also, is present. When coals are analyzed for the purpose of indicating their heating quality by their composition, it is enough to determine the proportions of fixed carbon, of volatile matter, and of ash which they contain. How the combined carbon, hydrogen, oxygen, and the little nitrogen in their composition, may be distributed in the forms of carburetted hydrogen, ammonia, the bituminous oils, etc., cannot be ascertained by analysis, as the means employed to separate most of these compounds cause their elements to form other combinations among themselves: the determination of the ultimate proportions of all the elements would serve no practical purpose. So, if it be required to prove the fitness of any coal for affording illuminating gas, or the coal oils, it must be submitted to experiments having such objects only in view; and even their capacity for generating heat is better determined by comparative experiments in evaporating water, than by any other mode. The bituminous coals are characterized by their large proportion of volatile matter, which, when they are heated, is expelled in various inflammable compounds, that take fire and burn, accompanied by a dense, black smoke and a peculiar odor known as bituminous. If the operation is conducted without access of air, as in a closed platinum crucible, the fixed carbon remains behind in the form of coke; and by removing the cover to admit air, this may next be consumed, and the residuum of ash be obtained. By several weighings the proportions are indicated. Coals containing 18 per cent. or more of volatile matter are classed among the bituminous varieties; but as the proportion of this may amount to 70 per cent. or more, there is necessarily a considerable difference in the characters of these coals, though their most marked peculiarities are not always owing to the different amounts of volatile matter they contain. Thus, some sorts, called the "fat bituminous," and "caking coals," that melt and run together in burning, and are especially suitable for making coke, contain about the same proportion of volatile matter with the "dry coals," as some of the cannel and other varieties, which burn without melting, and do not make good coke. Other varieties are especially distinguished for their large proportion of volatile ingredients; such are the best cannels, and those light coals which have sometimes been mistaken for asphaltum, as the Albert coal of the province of New Brunswick. These varieties are eminently qualified for producing gas or the coal oils; but have little fixed carbon, and consequently can produce little coke. Coals that contain from 11 to 18 per cent. volatile matter, are known as semi-bituminous, and partake both of the qualities of the true bituminous coals, in igniting and burning freely, and of the anthracite in the condensed and long-continued heat they produce. The Maryland coals, and the Lykens valley coal of Pennsylvania, are of this character. The true anthracites contain from 2 to 6 per cent. of gaseous matters, which by heat are evolved in carburetted hydrogen and water, even when the coal has been first freed from the water mechanically held. Their greatest proportion of solid carbon is about 95 per cent. There remains a class which has been designated as semi-anthracite, containing from 6 to 11 per cent. of combustible volatile matter. These coals burn with a yellowish flame, until the gas derived from the combination of its elements is consumed.

The earthy ingredients in coals, forming their ash, are derived from the original wood and from foreign substances introduced among the collections of ligneous matters that make up the coal-beds. The ash is unimportant, excepting as the material which produces it takes the place of so much combustible matter. In some coals, especially those of the Schuylkill region, it is red, from the presence of oxide of iron, and in others it is gray, as in the Lehigh coals. This distinction is used to designate some of the varieties of anthracite; but the quality of these coals is more dependent on the quantity of the ash, than on its color. From numerous analyses of the Schuylkill red ash coals an average of 7.29 per cent. of ash was obtained, and of the white ash anthracite, 4.62 per cent. Coals producing red ash are more likely to clinker in burning than those containing an equal amount of white ash. In some varieties of coal the proportion of earthy matter is so great that the substance approaches the character of the bituminous shales, and may be called indifferently either shale or coal. Though such materials make but poor fuel, some of them have proved very valuable from the large amount of gas and of oily matters they afford. The most remarkable of this class is that known as the Boghead cannel. This is largely mined near Glasgow, in Scotland, and is imported into New York to be used in the manufacture of coal oil. It is a dull black, stony-looking substance, having little resemblance to the ordinary kinds of coal. Its composition is given for comparison with that of other coals, in the following table:—

		Localities.	Authority.	Specific Gravity.	Carbon.	Water and other Vol. Mat.	Ashes.
ANTHRACITE.	RED ASH.	Shenowith Vein, Penn	H. D. Rogers	1.50	94.10	1.40	4.50
		Peach Mountain, Penn.; mean of 40 analyses	W. R. Johnson	1.46	86.09	6.96	6.95
	WHITE ASH.	Lackawanna	W. R. Johnson	1.42	88.98	6.36	4.66
		Beaver Meadow	"	1.56	91.64	6.89	1.47
		Price's Mountain, Montgomery Co., Virginia	A. H. Everett	1.37	89.25	2.44	8.30
		Portsmouth, Rhode Island	Dr. C. T. Jackson	1.85	85.84	10.50	3.66
		Mansfield, Mass	"	1.69	87.40	6.20	6.40
SEMI-BITUMINOUS.		Atkinson's and Templeman's, Maryland; average of 2 specimens	W. R. Johnson	1.313	76.69	15.53	7.83
		George's Creek, Maryland	"	1.35	70.75	16.03	13.22
BITUMINOUS.		Pittsburg, Pennsylvania	B. Silliman, jr.	..	64.72	32 95	2.31
		Cannelton, Indiana	W. R. Johnson	1.272	59.47	36.59	3.94
		Black Heath, James River, Virginia	"	..	58.79	32.57	8.64
		Monroe Co., S. Illinois	J. G. Norwood	1.246	58.70	36.20	4.50
		La Salle Co., N Illinois	"	1.287	55.10	39.90	3.09
		Albert Coal, New Brunswick	B. Silliman, jr.	1.129	36.04	61.74	2.22
		Grayson (Ky.) cannel	"	1.371	14.36	62.03	23.62
		Breckenridge (Ky.) cannel	"	1.150	27.16	64.30	8.48
		Boghead, black cannel	Dr. Penny	1.218	9.25	62.70	26.50
		Boghead, brown	"	1.160	7.10	71.06	26.20

A complete description of the coals, such as may be found in the Report of Prof. Walter R. Johnson (Senate Document, 28th Congress, No. 386), and presented, in a condensed form, in Johnson's Edition of "Knapp's Chemical Technology," presents many other features affecting the qualities of the coals, and their adaptation to special uses. Such are—1, their capacity for raising steam quickly; 2, for raising it abundantly for the quantity used; 3, freedom from dense smoke in their combustion; 4, freedom from tendency to crumble in handling; 5, capacity, by reason of their density, and the shapes assumed by their fragments, of close stowage; and 6, freedom from sulphur. The last is an important consideration, affecting the value of coals proposed for use in the iron manufacture, sulphur, which is often present in coal in the form of sulphuret of iron, having a very injurious effect upon the iron with which it is brought in contact when heated. It is again to be cautiously guarded against in selecting bituminous coals to be employed in steam navigation; for by the heat generated by spontaneous decomposition of the iron pyrites, the easily ignited bituminous coals may be readily set on fire. This phenomenon is of frequent occurrence in the waste heaps about coal mines, and large bodies of coal stored in yards and on board ships have been thus inflamed, involving the most disastrous consequences. In stowage capacity coals differ greatly, and this should be attended to in selecting them for use in long voyages. Tendency to crumble involves waste. Dense smoke in consuming is objectionable in coals required for vessels-of-war in actual service, as it must expose their position when it may be important to conceal it. The following table was prepared by Prof. Johnson to present some of the general results in these particulars of his experiments:—

GENERAL SCALE OF RELATIVE VALUES FORMED FROM THE AVERAGES OF EACH CLASS OF COAL SUBJECTED TO TRIAL.

	1.	2.	3.	4.	5.
Maryland free-burning coals	1000	1000	395	880	682
Pennsylvania anthracite	977	986	1000	893	319
Pennsylvania bituminous	951	938	390	1000	914
Virginia (James River) bituminous	850	757	242	948	730
Foreign bituminous	801	741	331	948	1000

Column 1 gives the relative evaporative powers of equal weights of the coals; 2, the same of equal bulks; 3, their relative freedom from tendency to clinker; 4, rapidity of action in evaporating water; 5, facility of ignition, or readiness with which steam is gotten up. The general results of experience in use, as well as of special trials systematically conducted upon a large scale, agree in these particulars—that while the bituminous coals are valuable for the greater variety of uses to which they are applicable, and especially for all purposes requiring flame and a diffusive heat, as under large boilers; and while they are quickly brought into a state of combustion, rendering the heat they produce more readily available; the anthracites afford a more condensed and lasting heat, and are to be preferred in many metallurgical operations, especially where great intensity of temperature is required. And for many purposes, the free-burning, semi-bituminous coals, which combine the useful properties of both varieties, are found most economical in use.

GEOLOGICAL AND GEOGRAPHICAL DISTRIBUTION.

The United States is supplied with coal from a number of coal-fields belonging to what are called the true coal-measures, or the carboniferous group, a series of strata sometimes amounting, in aggregate thickness, to 2000 and even 3000 feet, and whether found in this country or in Europe, readily recognized by the resemblance in the various members of its formation, its fossil organic remains, its mineral accompaniments, and by its position relative to the other groups of rock which overlie and underlie it. The principal one of these fields or basins is that known as the Appalachian, which, commencing in the north-eastern part of Pennsylvania, stretches over nearly all the state west of the main Alleghany ridge, and takes in the eastern portion of Ohio, parts of Maryland, Virginia, Kentucky, Tennessee, the north-west corner of Georgia, and extends into Alabama as far as Tuscaloosa. Its total area, including a number of neighboring basins, as those of the anthracite region to the east of the Alleghany ridge, which were originally a part of the same great field, is estimated at about 70,000 square miles. A second great basin is that which includes the larger part of Illinois, and the western portion of Indiana and of Kentucky. Its area is estimated at about 50,000 square miles; but its coal-beds are few and thin compared with those of the great Appalachian coal-field. The same may be said of the third coal-field, on the other side of the Mississippi. This extends over a large part of Iowa and of Missouri, and to the Red River in the western part of Arkansas. The Kansas coal-beds are contained in this field, which along its western borders is more or less broken up at the surface by patches of rock of later formation, as the cretaceous and middle secondary. Beneath these groups, the coal-bearing strata disappear toward the great plains. The

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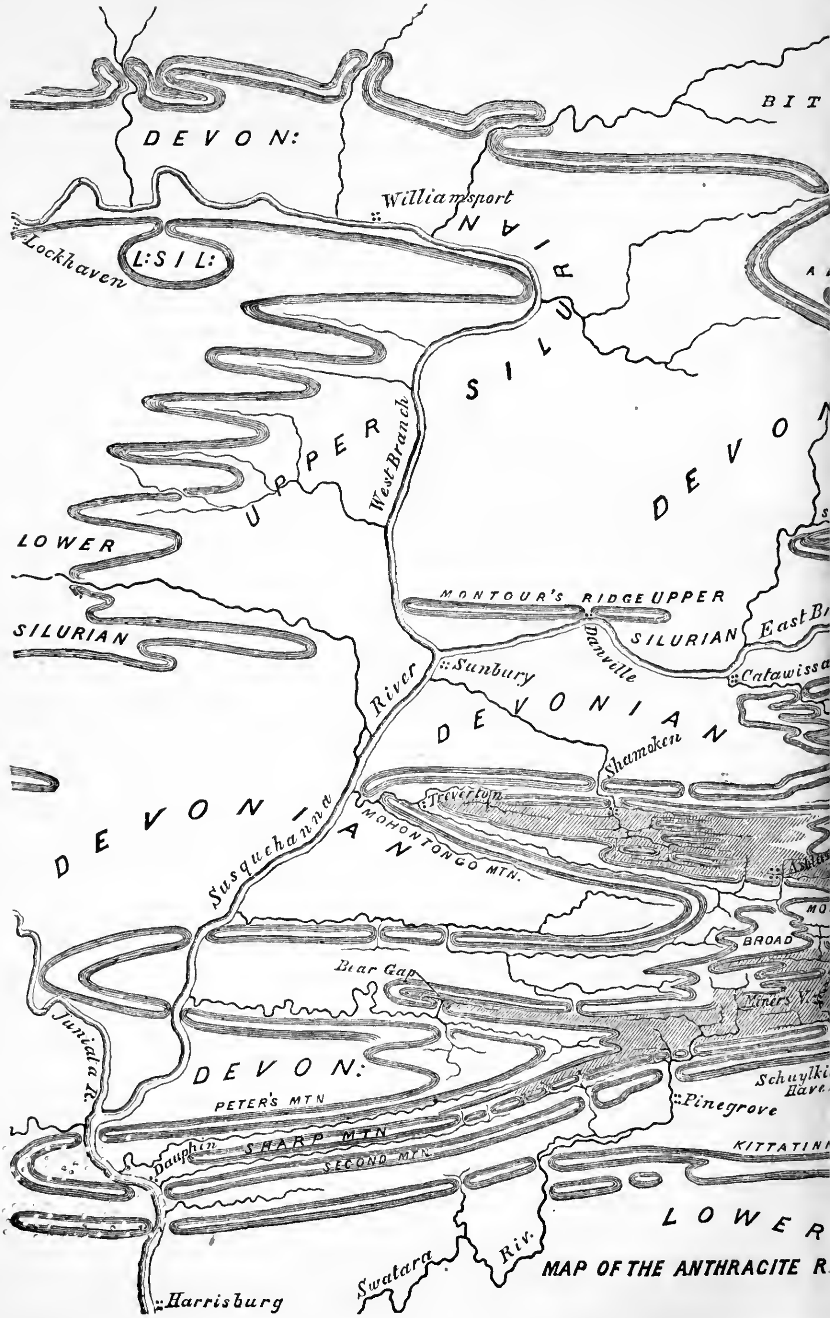

MAP OF THE ANTHRACITE R

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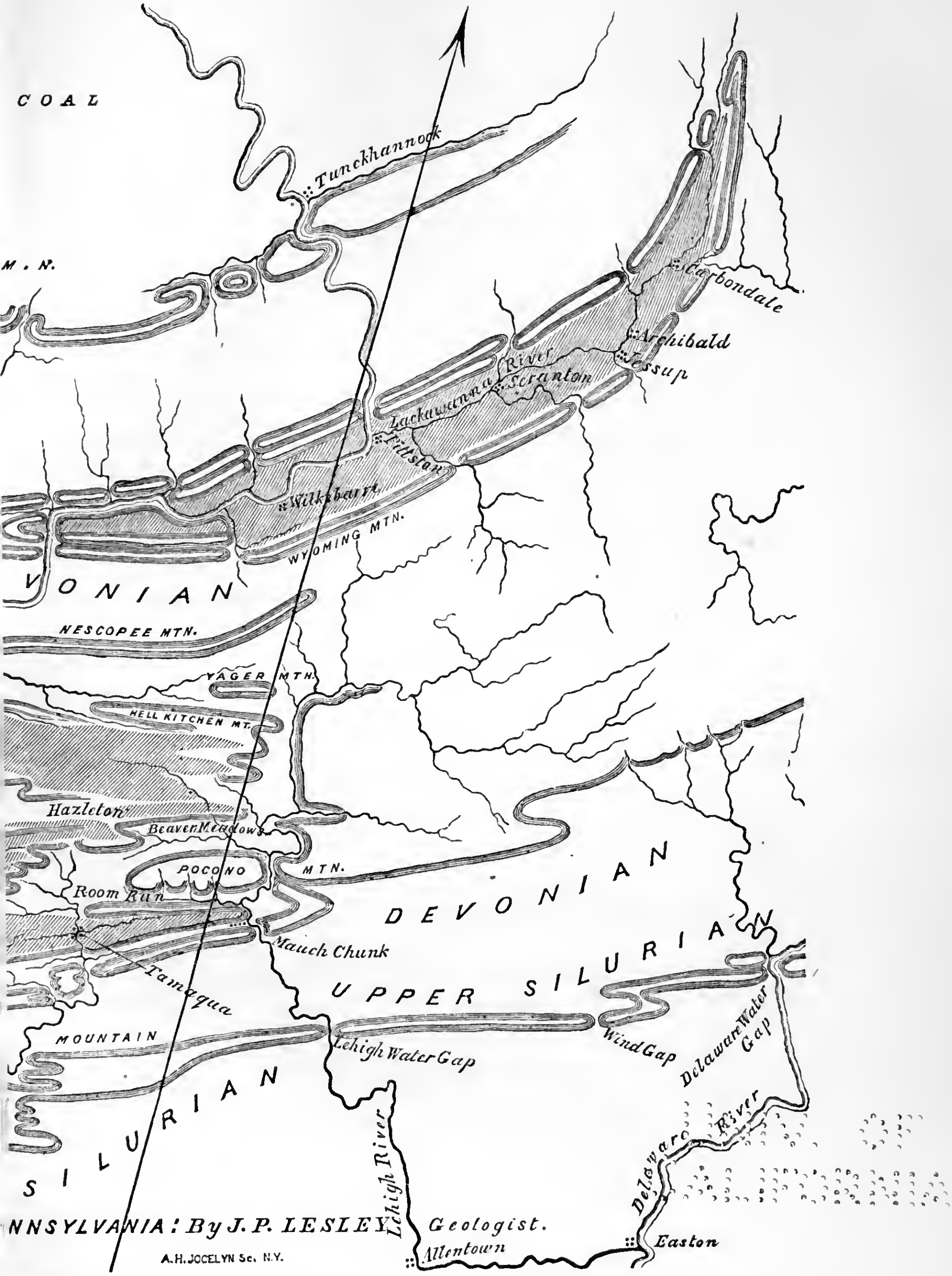
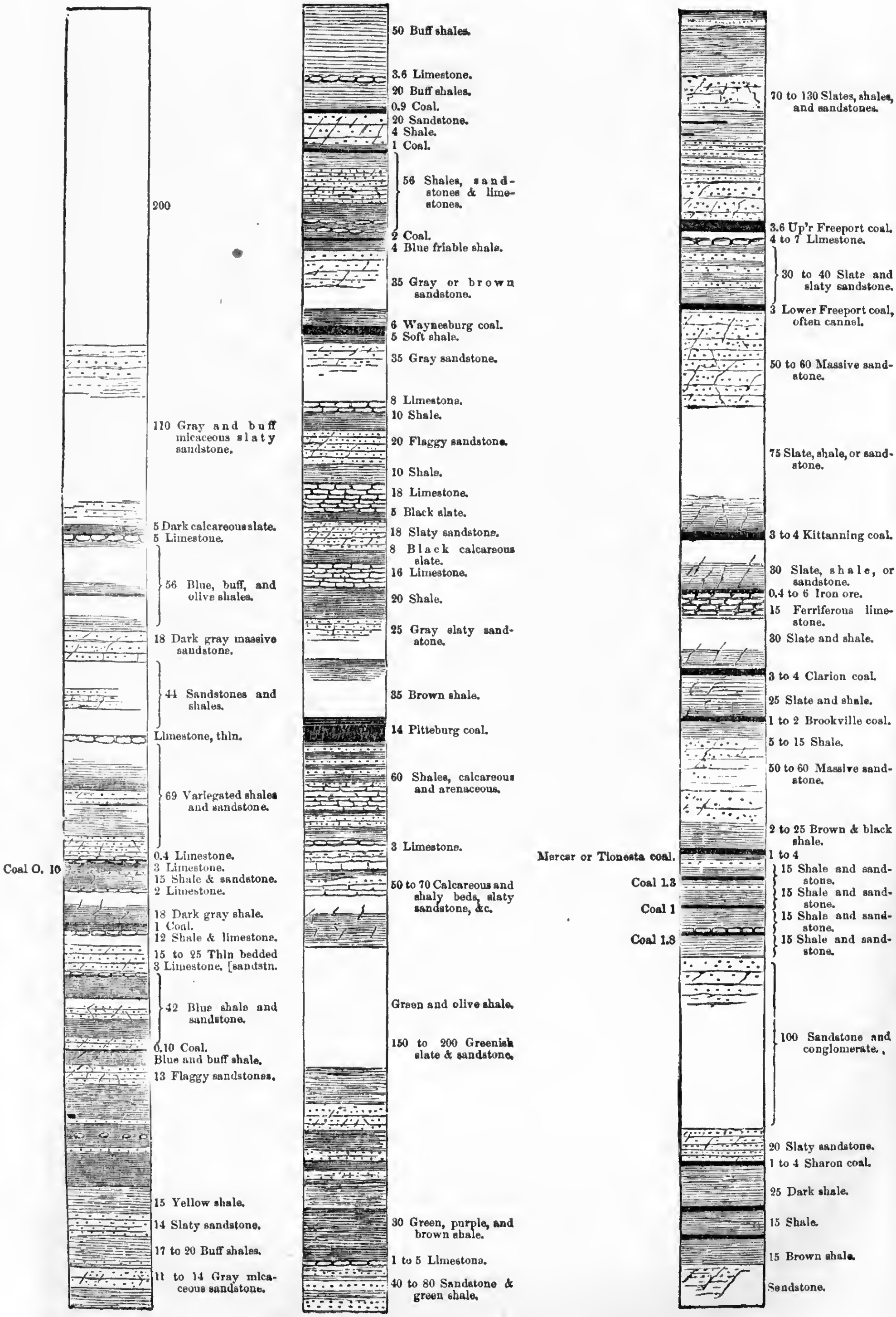


American Cyclopedia.

whole area of this field has been computed at 57,000 square miles; but its limits have never been accurately defined. A fourth coal-field occupies the central portion of the southern peninsula of Michigan, its area being about 13,350 square miles. Several small beds of bituminous coal are worked in this district, but they have only local importance. A fifth coal-field is that of Rhode Island and south-eastern Massachusetts. The strata of this district are considered as belonging to the true coal-measures, although, from the metamorphic action to which they have been subjected, their true character is very obscure. They contain a few beds of anthracite, very irregular in their dimensions, and much crushed. A number of mines have been opened, but the only one now worked is at Portsmouth, 8 miles north of Newport. In south-eastern Virginia is a bituminous coal-field, lying on both sides of the James River, a few miles above Richmond. The strata which contain the coal-beds of this district are recognized as members of later formation than those of the true coal-measures, being classed with the geological group known as the oolite, or lias; and the coal-beds of central North Carolina, on Deep River, probably belong to the same position in the geological column. Notwithstanding the limited area of this coal-field in Virginia, which is only about 25 miles long and 8 to 10 miles wide, it has produced for more than sixty years past large quantities of coal chiefly for the supply of iron manufacturing establishments, and the gas-works along the seaboard to the north. The strata of these coal-measures occupy a deep depression in the granitic rocks of this region, attaining in the centre of the basin a thickness of nearly 2000 feet. They consist in great part of a micaceous sandstone, and the two or three coal-beds are contained in the lower 150 feet. A great bed at the bottom, which in some places exceeds 40 feet in thickness, and in others dwindles away to 4 or 5 feet only, appears to have been deposited upon the uneven granitic floor, from which it is separated by only a few inches of slate. Shafts have been sunk near the east border of the coal-field to the depth of nearly 900 feet. The amount of coal obtained of late years does not probably exceed 130,000 tons per annum. A singular phenomenon is observed at one point in this district, where a coal-bed is penetrated and overlaid by a body of trap-rock. The coal near this rock is converted into a mass of coke, resembling that artificially produced, except that it is more compact and of a duller lustre.

A large amount of bituminous coal has been brought to Boston and New York, for many years past, from a coal-field belonging to the true coal-measures, in Nova Scotia and Cape Breton. The same formation extends into New Brunswick, and ranges along the western part of Newfoundland, and has been estimated as comprising in all an area of 9000 square miles. The productive portions, however, are limited to a few localities upon the coast of Nova Scotia and Cape Breton, and at these, beds of great thickness have been opened, and worked to the depth of from 200 to 450 feet. At the Pictou mines, opposite the southern point of Prince Edward's Island, one bed is 29 feet thick. Another bed, at the Albion mines, 8½ miles from Picton, affords 24 feet of good coal, and 12 more of inferior quality; and in Sydney, Cape Breton, are beds of 11 feet, 9 feet, and 6 feet, besides at least 11 others of less thickness. At the South Joggins cliffs, in Nova Scotia, the total thickness of all the strata of the coal-measures was found by Mr. Logan to amount to 14,571 feet, very much exceeding the thickness of the formation as observed in other places on the American continent.

The strata which make up the coal formation, the principal varieties of which have already been named, are regularly laid one upon another in no particular order, and amount in aggregate thickness to several thousand feet, rarely exceeding in the United States 3000 feet. Their thickness is ascertained by sections measured at different localities, some giving one part of the column, and others other portions. In western Pennsylvania the nearly horizontal beds of rock are often exposed in the sides of the precipitous hills, so that sections of several hundred feet may be fully made up. Any peculiar member of the pile, as a bed of limestone, occurring near the top of the section, may be recognized in other localities, where by the dip of the strata it is brought to the lower levels, and the hills above it then present the succession of the higher members of the column; or if the layer taken as the starting point be in the one case at the base, it will be found in the direction of the rising of the strata, at higher and higher elevations, and the lower mem-


200
110 Gray and buff micaceous slaty sandstone.
5 Dark calcareous slate.
5 Limestone.
56 Blue, buff, and olive shales.
18 Dark gray massive sandstone.
44 Sandstones and shales.
Limestone, thin.
69 Variegated shales and sandstone.
0.4 Limestone.
Coal O. 10
3 Limestone.
15 Shale & sandstone.
2 Limestone.
18 Dark gray shale.
1 Coal.
12 Shale & limestone.
15 to 25 Thin bedded [sandstn.
3 Limestone.
42 Blue shale and sandstone.
0.10 Coal.
Blue and buff shale.
13 Flaggy sandstones.
15 Yellow shale.
14 Slaty sandstone.
17 to 20 Buff shales.
11 to 14 Gray micaceous sandstone.
50 Buff shales.
3.6 Limestone.
20 Buff shales.
0.9 Coal.
20 Sandstone.
4 Shale.
1 Coal.
56 Shales, sandstones & limestones.
2 Coal.
4 Blue friable shale.
35 Gray or brown sandstone.
6 Waynesburg coal.
5 Soft shale.
35 Gray sandstone.
8 Limestone.
10 Shale.
20 Flaggy sandstone.
10 Shale.
18 Limestone.
5 Black slate.
18 Slaty sandstone.
8 Black calcareous slate.
16 Limestone.
20 Shale.
25 Gray slaty sandstone.
35 Brown shale.
14 Pittsburg coal.
60 Shales, calcareous and arenaceous.
3 Limestone.
50 to 70 Calcareous and shaly beds, slaty sandstone, &c.
Green and olive shale.
150 to 200 Greenish slate & sandstone.
30 Green, purple, and brown shale.
1 to 5 Limestone.
40 to 80 Sandstone & green shale.
70 to 130 Slates, shales, and sandstones.
3.6 Up'r Freeport coal.
4 to 7 Limestone.
30 to 40 Slate and slaty sandstone.
3 Lower Freeport coal, often cannel.
50 to 60 Massive sandstone.
75 Slate, shale, or sandstone.
3 to 4 Kittanning coal.
30 Slate, shale, or sandstone.
0.4 to 6 Iron ore.
15 Ferriferous limestone.
30 Slate and shale.
3 to 4 Clarion coal.
25 Slate and shale.
1 to 2 Brookville coal.
5 to 15 Shale.
50 to 60 Massive sandstone.
2 to 25 Brown & black shale.
Mercer or Tionesta coal.
1 to 4
15 Shale and sandstone.
Coal 1.3
15 Shale and sandstone.
Coal 1
15 Shale and sandstone.
Coal 1.8
15 Shale and sandstone.
100 Sandstone and conglomerate.
20 Slaty sandstone.
1 to 4 Sharon coal.
25 Dark shale.
15 Shale.
15 Brown shale.
Sandstone.

bers of the column will then be brought into view at the base of the hills. Thus, at Pittsburg, the hills opposite the city afford a section of 300 or 400 feet, and the marked stratum is here the great coal-bed, which up the Alleghany river toward the north rises to higher and higher levels in the hills, and toward the south, up the Monongahela, sinks to lower levels, till it passes beneath the bed of the stream. By extending these observations over the coal-field, it is found that the whole series of strata maintain their general arrangement, and the principal members of the group, such as an important coal-bed, a peculiar bed of limestone, etc., may be identified over areas of thousands of square miles. It is thus the sections have been prepared at many localities to complete the series, as presented on the opposite page, of the bituminous coal-measures of the extreme western part of Pennsylvania. The coal-beds introduced are those which are persistent over the greatest areas. Others occasionally appear in different parts of the column, and various other local differences may be detected, owing to the irregularities in the stratification; thus sandstones and slates often thin out, and even gradually pass from one into the other. By their thinning out beds of coal separated by them in one locality may come together in another, and form one large bed; and again, large coal-beds may be split by hardly perceptible divisional seams of slate or shale, which may gradually increase, till they become thick strata, separating what was one coal-bed into two or more. The limestones, though generally thin, maintain their peculiar characters much better than the great beds of sandstone or shale, and are consequently the best guides for designating in the columns the position of the strata which accompany them, above and below. The fire clay is almost universally the underlying stratum of the coal-beds. In the sections it is not distinguished from the shale-beds. The total thickness of all the measures, is from 2000 to 2500 feet.

Such is the general system of the coal-bearing formation west of the Alleghanies. Every farm and every hill in the coal-field is likely to contain one or more beds of coal, of limestone, of good sandstone for building purposes, of fire clay, and some iron ore; and below the surface, the series is continued down to the group of conglomerates and sandstones, which come up around the margins of the coal-fields and define their limits. At Pittsburg this group, it is found by boring, as well as by the measurements of the strata in the hills toward the north, is about 600 feet below the level of the river. The coal-measures in this portion of the country are the highest rock formation; but in the western territories beyond the Mississippi they pass under later geological groups, as the cretaceous and the tertiary. All the coals are bituminous, and the strata in which they are found are little moved from the horizontal position in which they were originally deposited. They have been uplifted with the continent itself, and have not been subjected to any local disturbences, such as in other regions have disarranged and metamorphosed the strata.

East of the Alleghanies, in the narrow, elongated coal-fields of the anthracite region, a marked difference is perceived in the position assumed by the strata, and also in the character of the individual beds. They evidently belong to the same geological series as the bituminous coal-measures, and the same succession of conglomerates, sandstones, and red shales, is recognized below them; but the strata have been tilted at various angles from their original horizontal position, and the formation is broken up and distributed in a number of basins, or canal-shaped troughs, separated from each other by the lower rocks, which, rising to the surface, form long narrow ridges outside of and around each coal-field. Those on each side being composed of the same rocks, similarly arranged, and all having been subjected to similar denuding action, a striking resemblance is observed, even on the map, in their outlines; and in the ridges themselves this is so remarkable that their shapes alone correctly suggest at once to those familiar with the geology of the country, the rocks of which they are composed. Upon the accompanying map, from the first vol. of the "New American Cyclopædia," these basins are represented by the shaded portions, and the long, narrow ridges which surround the basins, and meet in a sharp curve at their ends, are indicated by the groups of four parallel lines. Within the marginal hills the strata of the coal-measures, and of the underlying formations, while retaining their arrangement in parallel sheets, are raised upon their edges and thrown into undulating lines and sharp flexures; and the extrac-

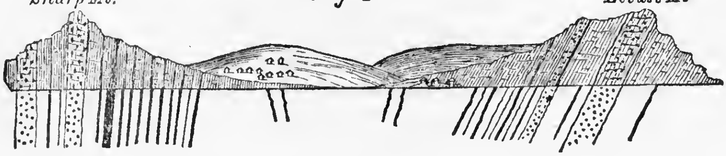


Fig. 1

tion of the coal, instead of being conducted by levels driven into the side of the hills, is effected by means of inclined shafts following down the course of the beds from the surface, or by vertical slopes sunk so as to cut them at considerable depths. The arrangement of the strata in its general features is represented in the accompanying wood cuts. Fig. 1 is a section from Sharp Mountain, on the south side of the Mauch Chunk summit mine, across this great body of coal, and the higher coal-beds of the formation repeatedly brought to the surface by their changes of dip, to Locust Mountain, which bounds the basin on the north. Fig. 2 is a section across the same basin at Tamaqua, six miles west from Mauch Chunk mine. In this section it is seen how the coal-measures are separated into basins by the lower rocks coming up to the surface and forming anticlinal axes. Fig. 3 represents the position of single beds, as they occur among the slates and sandstones, and the manner in which they are sometimes reached by means of a tunnel driven in from the base of the hill. The curved portion of the coal at the top is formed by the coal-beds at their outcrop becoming disintegrated, and their fragments and decomposed smut being spread down the slope of the hill. The Roman numerals, "IX," "X," "XI," "XII," in fig. 2, designate the lower formations of rock, known respectively as the red sandstones (corresponding to the "Old Red Sandstone"); a series of gray sandstones; one of red shales; and lastly, the conglomerate. The dotted lines above and below the section mark the continuity of the conglomerate beneath the base of the section and its original course above the present surface before this portion had been removed by diluvial action. The other formations obviously accompany the conglomerate with similar flexures.

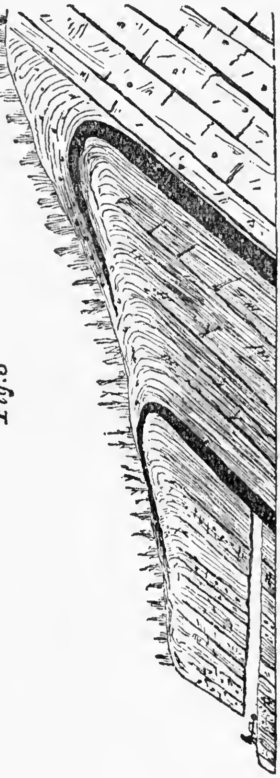


Fig. 3

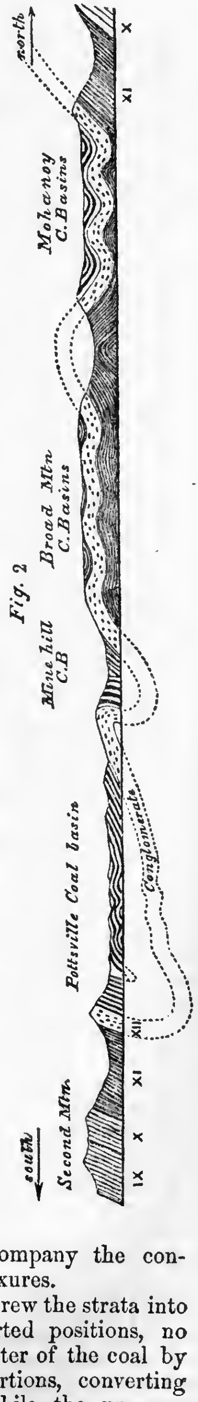


Fig. 2

The same cause, that threw the strata into their inclined and contorted positions, no doubt changed the character of the coal by dispelling its volatile portions, converting it in fact into coke, while the pressure of the superincumbent beds of rock prevented the swelling up of the material, as occurs in the ordinary process of producing coke from bituminous coal, and caused it to assume the dense and compact structure of anthracite. As the anthracite basins are traced westward, it is observed that the coals in those districts which have been less disturbed, retain somewhat of the bituminous character; and if the continuity were uninterrupted between the anthracite and the bituminous coal-fields, there is no doubt that a gradual passage would be observed from the one kind of coal to the other, and that this would be accompanied by an amount of disturbance in the strata corresponding to the degree in which the coal is deficient in bitumen.

AMOUNT OF AVAILABLE COAL.

In estimating the quantities of workable coal in any district, several points are to be taken into consideration besides the amount of surface covered by the coal-measures and the aggregate thickness of all the beds they contain. Where the strata spread out horizontally, as in the western coal-fields, extensive regions may be covered with a very thin portion of the coal-bearing strata, especially near the margins of the coal-fields; while in the deep basins, like those of the anthracite region, a number of large beds may be accumulated together in very limited districts. Then again, out of the total number of coal-beds, there are more or less of them that must be excluded from the estimate, on account of their being too thin to work; and as the thickness of all of them varies in different localities, a fair average thickness of workable beds is as difficult to arrive at as a fair average area into which this thickness is to be multiplied. The problem is rendered still more complex by the slopes and flexures of the strata in the districts east of the Alleghanies, and by the gaps between the hills which cut off the beds whose plane is above the lowest levels. The great depth at which lie the lower beds in the central parts of the Appalachian coal-field must probably prevent their ever being worked; but for this no allowance is ever made in the estimates of quantities of coal.

The most careful and complete computations of this nature which have been made are those of Professor H. D. Rogers, in vol. ii. of the Geology of Pennsylvania, page 1015. From this source we obtain the following estimates:—

EXTENT OF COAL-FIELD IN THE SEVERAL STATES POSSESSING THE COAL FORMATION.

	Sq. miles.
Massachusetts and Rhode Island	100
Pennsylvania	12,656
Ohio	7,100
Maryland	550
Virginia	15,900
Kentucky	13,700
Tennessee	3,700
Alabama	6,130
Georgia	170
Indiana	6,700
Illinois	40,000
Michigan	13,350
Iowa	24,000
Missouri	21,329
Nebraska	3,712
Kansas	11,880
Arkansas	12,597
Indian Territory	10,395
Texas	2,970
Total	196,939

In the anthracite basins of Pennsylvania the number of workable beds varies from 2 or 3 to 25, according to the depth of the basin; the average number is supposed to be 10 or 12. The maximum thickness of coal is in the Pottsville basin, and amounts to 207 feet. Rejecting the thin seams, the average thickness in the south anthracite field is reckoned at 100 feet; in the middle or north field at about 60 feet; and the general average of the whole, 70 feet.

The maximum thickness of the 15 or 16 coal-beds of the central part of the Appalachian coal-field is about 40 feet, but the average of the whole basin is considered to be 25 feet.

The basin extending over Illinois and into Indiana and Kentucky, contains in the last-named state 16 or 17 workable beds, with a maximum thickness of about 50 feet. The average over the whole area is supposed to be 20 or 25 feet.

The basin of Iowa, Missouri, and Arkansas contains only 2 or 3 workable beds, of total thickness not exceeding 10 feet; while the average for the whole area must be considerably less.

The following estimates of the number and thickness of the beds in some of the British coal-fields are introduced for comparison. The great coal-field of South Wales contains 23 workable beds of 92 feet thickness, averaging over the whole area probably 60 feet. The coal-beds in the South Staffordshire basin amount to 57 feet in thickness, and in one quarter to 70 feet. The average for the whole area is assumed to be 40 feet. The Derbyshire coal-field has about 20 workable beds; aggregate thickness 66 feet, average 40 feet. The Lancashire and Cheshire coal-field in one district has 150 feet of coal in 75 beds, and in another 93 feet in 36 beds, some of which are too thin to be worked. Average thickness of workable coal over the whole field is supposed to be 50 or 60 feet. The Durham and Newcastle coal-field has total thickness of coal 60 feet, of workable coal 30 feet, and average about 20 feet. Over a total area of coal-fields in Great Britain, amounting to 5400 square miles, the average thickness of workable coal is supposed to be 35 feet. Extending these computations to Belgium and France also, Prof. Rogers presented the results of his calculations in tons as follows:—

RELATIVE AMOUNT OF COAL IN THE SEVERAL GREAT COAL-FIELDS OF EUROPE AND AMERICA.

	Tons.	Ratio.
Belgium (assuming an average thickness of about 60 feet of coal) contains about	36,000,000,000	1
France (with same thickness) contains about	59,000,000,000	1.64
The British Islands (averaging 35 feet thickness) contain nearly	190,000,000,000	5.28
Pennsylvania (averaging 25 feet thickness) contains	316,400,000,000	8.8
The great Appalachian coal-field (including Pennsylvania, averaging 25 feet)	1,387,500,000,000	38.5
Coal-field of Indiana, Illinois, and western Kentucky (average thickness 25 feet)	1,277,500,000,000	35.5
The Missouri and Arkansas basin (averaging 10 feet)	739,000,000,000	20.5
All the productive coal-fields of North America (with an assumed thickness of 20 feet of coal, and a productive area of 200,000 square miles)	4,000,000,000,000	111.
All the coal-fields of Europe	..	8.75

The following table contains the yearly returns of the coal product of eastern Pennsylvania and Maryland, from the commencement of the trade in 1820:—

STATISTICS OF PRODUCTION.

Year.	SCHUYLKILL.			WYOMING REGION.				
	Canal.	Railroad.	Total.	Del. & Hud. Coal Co.	Penn. Coal Co.	By canal.	D. L. & W. railroad.	Total tons.
1820	..	..	..	..	..	..	..	..
1821	..	..	..	..	..	..	..	..
1822	1,480	..	1,480	..	..	..	..	..
1823	1,128	..	1,128	..	..	..	..	..
1824	1,587	..	1,587	..	..	..	..	..
1825	6,500	..	6,500	..	..	..	..	..
1826	16,763	..	16,763	..	..	..	..	..
1827	31,360	..	31,360	..	..	..	..	..
1828	47,284	..	47,284	..	..	..	..	..
1829	79,973	..	79,973	7,000	..	..	..	7,000
1830	89,984	..	89,984	43,000	..	..	..	43,000
1831	81,854	..	81,854	54,000	..	..	..	54,000
1832	209,271	..	209,271	84,600	..	..	..	84,600
1833	252,971	..	252,971	111,777	..	..	..	111,777
1834	226,692	..	226,692	43,700	..	..	..	43,700
1835	339,508	..	339,508	90,000	..	..	..	90,000
1836	432,045	..	432,054	103,851	..	..	..	103,861
1837	523,152	..	523,152	115,387	..	..	..	115,387
1838	433,875	..	433,875	78,207	..	..	..	78,207
1839	442,608	..	442,608	122,300	..	..	..	122,300
1840	452,291	..	452,291	148,470	..	..	..	148,470
1841	514,692	850	515,542	192,270	..	..	..	192,270
1842	461,602	49,902	502,504	205,253	..	47,346	..	252,599
1843	447,058	230,254	677,312	227,605	..	58,000	..	285,605
1844	393,887	441,491	835,288	251,005	..	114,906	..	365,911
1845	263,587	820,237	1,083,824	273,435	..	178,401	..	451,836
1846	3,440	1,263,144	1,266,584	320,000	..	192,503	..	512,503
1847	222,693	1,360,361	1,583,054	388,203	..	284,398	..	672,601
1848	436,602	1,216,233	1,652,835	437,500	..	237,271	..	674,771
1849	489,208	1,115,918	1,605,126	454,240	..	259,080	..	713,320
1850	288,080	1,423,977	1,712,057	441,403	111,014	243,250	..	795,667
1851	579,156	1,602,727	2,181,883	479,078	316,017	336,000	6,000	1,131,095
1852	800,932	1,663,117	2,464,049	497,105	426,164	319,341	67,487	1,310,097
1853	888,869	1,587,211	2,476,080	494,327	51[illegible],659	442,511	97,358	1,546,855
1854	907,354	1,983,478	2,890,832	440,944	496,648	492,689	133,964	1,564,245
1855	1,105,263	2,213,292	3,319,555	565,460	504.803	464,039	188,865	1,723,167
1856	1,169,286	2,148,903	3,318,189	499,650	612,500	510,631	296,232	1,919,013
1857	1,275,989	1,672,544	2,948,533	480,677	543,873	405,822	490,023	1,920,395
1858	1,323,804	1,542,592	2,866,396	348,789	630,056	350,000	680,500	2,009,345
1859	1,371,753	1,633,150	3,004,903	590,839	688,855	433,548	830,000	2,543,242
1860	1,356,688	1,878,867	3,235,555	499,568	691,465	430,242	1,077,500	2,698,775
Total,	17,970,239	25,848,158	43,818,382	9,089,643	5,534,054	5,799,978	3,867,929	24,291,604

STATISTICS OF PRODUCTION.—CONTINUED.

Year.	LEHIGH.			SEMI-ANTHRACITE.					BITUMINOUS.		Aggregate.
	Canal.	Railroad.	Total.	Shamokin.	Lykens Valley.	Dauphin & S. R.	Treverton.	Broad-top.	Blossburg.	Barclay.	
1820	365	..	365	..	..	..	..	..	..	..	365
1821	1,073	..	1,073	..	..	..	..	..	..	..	1,073
1822	2,240	..	2,240	..	..	..	..	..	..	..	3,720
1823	5,823	..	5,823	..	..	..	..	..	..	..	6,951
1824	9,541	..	9,541	..	..	..	..	..	..	..	11,108
1825	28,393	..	28,393	..	..	..	..	..	..	..	34,893
1826	31,280	..	31,280	..	..	..	..	..	..	..	48,043
1827	32,074	..	32,074	..	..	..	..	..	..	..	63 430
1828	30,232	..	30,232	..	..	..	..	..	..	..	84.613
1829	25,110	..	25,110	..	..	..	..	..	..	..	148.083
1830	41,750	..	41,750	..	..	..	..	..	..	..	185.734
1831	40,966	..	40,966	..	..	..	..	..	..	..	207.420
1832	70,000	..	70,000	..	..	..	..	..	..	..	363.871
1833	123,000	..	123,000	..	..	..	..	..	..	..	487,748
1834	106,244	..	106,244	..	..	..	..	..	..	..	376,636
1835	131,250	..	131,250	..	..	..	..	..	..	..	560,758
1836	148,211	..	148,211	..	..	..	..	..	..	..	684,126
1837	223,902	..	223,902	..	..	..	..	..	..	..	862,441
1838	213,615	..	213,615	..	..	..	..	..	..	..	725,697
1839	221,025	..	221,025	11,930	..	..	..	..	..	..	797,868
1840	225,318	..	225,318	15,505	..	..	..	..	4,235	..	845,819
1841	143,037	..	143,037	21,463	..	..	..	..	25,966	..	898,278
1842	272,546	..	272,546	10,000	..	..	..	..	13,164	..	1,050,818
1843	267.793	..	267,793	10,000	..	..	..	..	6,268	..	1,246,978
1844	377,002	..	377,002	13,087	..	..	..	..	14,234	..	1,605,522
1845	429,453	..	429,453	10,000	..	..	..	..	29,836	..	2,004,949
1846	517,116	..	517,116	12,572	..	..	..	..	16,509	..	2,325,284
1847	633,507	..	633,507	14,904	..	..	..	..	29,087	..	2,923,158
1848	670,321	..	670,321	19,356	..	..	..	..	33,762	..	3,042,045
1849	781,656	..	781,656	19,650	25,325	..	..	..	32,095	..	3,177,172
1850	690,456	..	690,456	19,921	37,763	..	..	..	23,161	..	3,279,025
1851	964,224	..	964,224	24,899	52,060	20,000	..	..	25,000	..	4,400,161
1852	1,072,136	..	1,072,136	25,846	55,000	33,639	..	..	20,000	..	4,980,767
1853	1,054,309	..	1,054,309	15,500	60.000	29,000	..	..	45,571	..	5,227,315
1854	1,207,186	..	1,207,186	63,500	53,000	63,000	..	..	70,554	..	5,912,317
1855	1,275,050	9,063	1,284,113	116,117	112,000	52,494	..	..	73,201	..	6,680,647
1856	1,186,230	165,740	1,354,970	117,406	100,000	77,307	73,142	42,000	70,670	4,115	7,106,782
1857	900,314	418,236	1,318,550	153,525	121,550	82,285	110,711	78,812	94,314	6,239	6,834,914
1858	908,800	471,029	1,379,829	137,000	127,750	..	106,686	105,478	40,001	18,000	6,790,485
1859	1,050,592	577,651	1,628,243	180,000	139,200	..	124,250	130,387	..	30,143	7,780,368
1860	1,091,032	730,642	1,821,674	211,100	176,290	..	89,515	188,250	..	30,000	8,451,159
Total,	17,204,172	2,372,361	19,576,533	1,253,281	1,059,938	357,725	504,274	544,927	667,626	88,597	92,222,526

In presenting the statistics of the product of the principal coal districts of the United States, it will be observed that these are limited to the eastern portion of Pennsylvania and the Cumberland district of Maryland. It is from these sources almost exclusively that the great markets of the New England states, of the states of New York and New Jersey, and of the eastern portion of Pennsylvania and Maryland have been supplied; and it is from the records preserved by the lines of transportation from the mines that any statistics of the coal products are now available. In the Western states, where the bituminous coal-beds are very generally distributed over large territories, there exists no concentration of the business, as at the East, and no means are afforded of obtaining even an approximate estimate of the amount of coal annually mined.

TRANSPORTATION OF COAL TO MARKET.

The first anthracite from the Schuylkill mines was brought to Philadelphia in wagons. The navigation of the river and canal was hardly practicable for boats previous to the year 1822; and though from that year anthracite was conveyed to Philadelphia and the trade continued to increase, it was not until after the improvements were completed in 1825, that a large amount of coal could be transported by this route. The effect of these improvements was experienced in the transportation of 6500 tons in 1825, which was more than four times the business of 1824; and in 1826 it increased to 16,763, and this nearly doubled in the succeeding year. As for successive years the trade steadily and rapidly increased in importance, the capacity of the canal proved at last insufficient for it, and the Reading railroad was laid out especially for its accommodation, and constructed with a uniform descending grade from the mining region at Pottsville to the Delaware river. This went into operation in 1841, and proved a formidable competitor to the Schuylkill canal, but the still increasing trade has well nigh reached the capacity of both these routes. The greatest amount of coal transported in one year by any one line was in 1855 over the Reading road, being 2,213,392 tons. The number of tons carried by canal the same year was 1,105,263 tons. Since that time the business has been more equally divided between them, the railroad still doing the larger portion of it.

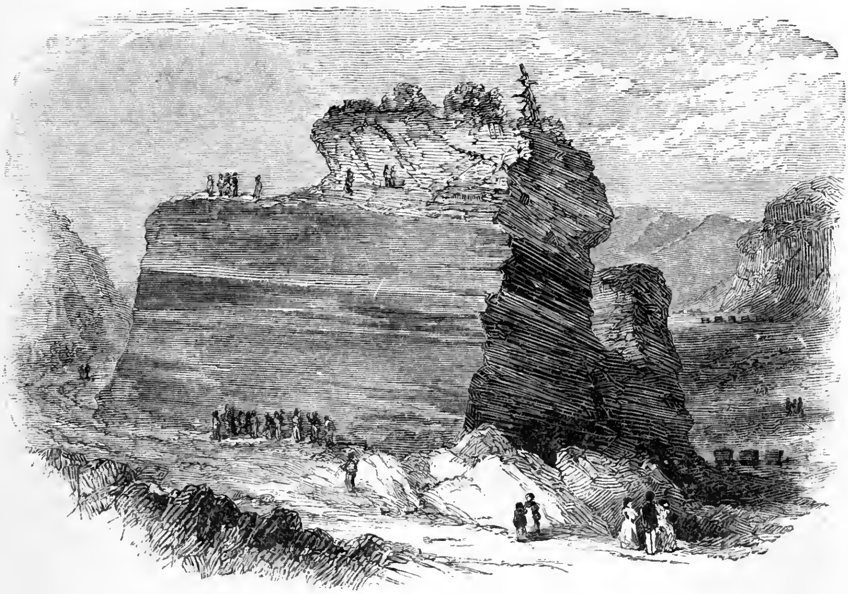
As seen by the table, the first shipments of anthracite were from the Lehigh region, two years before any were sent from the Schuylkill. The transportation was effected by arks or large boxes built of plank, and run down the rapid and shoal river with no little risk. To return with them was impracticable, nor was this desired, for the arks themselves were constructed of the product of the forests, which in this form was most conveniently got to market. They had before been the chief means of conveyance down into the Delaware of the products of the country, which indeed were little else than lumber. As the coal trade increased in importance, the improvement of the river was undertaken by the Lehigh Coal and Navigation Company to insure greater facility in running the arks. They constructed dams across the shoaler places in the river, by which the water was held back, thus increasing the depth above. As the arks coming down the river reached one of these dams, the sluice gates were opened and the boats descended into the next division in which the water was kept up by the next dam below. At first two arks were used together, being connected by hinges at the ends; and as the facilities for running them were improved, more of them were thus joined together, till they reached nearly 200 feet in length. In 1831 the slack-water navigation of the Lehigh was so far perfected, that it was used by canal boats ascending and descending through regular locks.

Up to the year 1827 the transportation of anthracite to Mauch Chunk from the mines, nine miles distant, had been by a wagon road. In January of that year the construction of a railroad was commenced, and in May the road was completed. This was the second railroad built in the United States, the first one being a short road from the granite quarries in Quincy, Massachusetts. The Mauch Chunk road was made with a descending grade all the way, averaging about 100 feet to the mile, so that the loaded cars ran down by gravity. Each train carried down with it in cars appropriated to this use the mules for drawing the empty cars back; and it is stated that after the animals once became accustomed to the routine of their duties they could never be made to travel down the road if accidentally left behind. The trade before many years outgrew these increased facilities of transporting the coal, and it was found essential to provide a new track, upon which the empty cars could be returned by some more economical method. On account of the heavy up-grade, locomotives, it was concluded, could not be advantageously employed, and hence a system of inclined planes and gravity roads was devised, by which the cars hoisted by stationary power to the summit of the planes and thence descending the gravity roads might be returned to the mines, and the use of mules and horses be entirely dispensed with. In the accompanying sketches a part of this arrangement of roads is exhibited.

The high hill called Mount Pisgah, above the village of Mauch Chunk, is the terminating point at the Lehigh river of the long ridge called Sharp Mountain. The great mines of the Lehigh are on its summit about nine miles west of the village. The lower road seen in the sketch is called the loaded track. The cars come by this from the mines, and being let down the inclined plane at its terminus, their loads are discharged into the great bins over the edge of the river. They are then hauled a short distance to the foot of the long plane that reaches to the summit of Mount Pisgah, and by the stationary steam engine are drawn up in about six minutes to an elevation 850 feet above that at the foot. The length of this plane is 2250 feet. From its summit the empty cars run down the inclined road constructed along the south side of the ridge, and at the distance of six miles, having descended about 300 feet, they reach the foot of another inclined plane at Mount Jefferson. This plane is 2070 feet long, rising 462 feet. The ascent is accomplished in three minutes, and from the top another gravity road extends about a mile, descending 44 feet to the Summit Hill village. From this point branch roads lead to the different mines in Panther Creek valley, and all meet again in the loaded track road by which the cars return to Mauch Chunk.

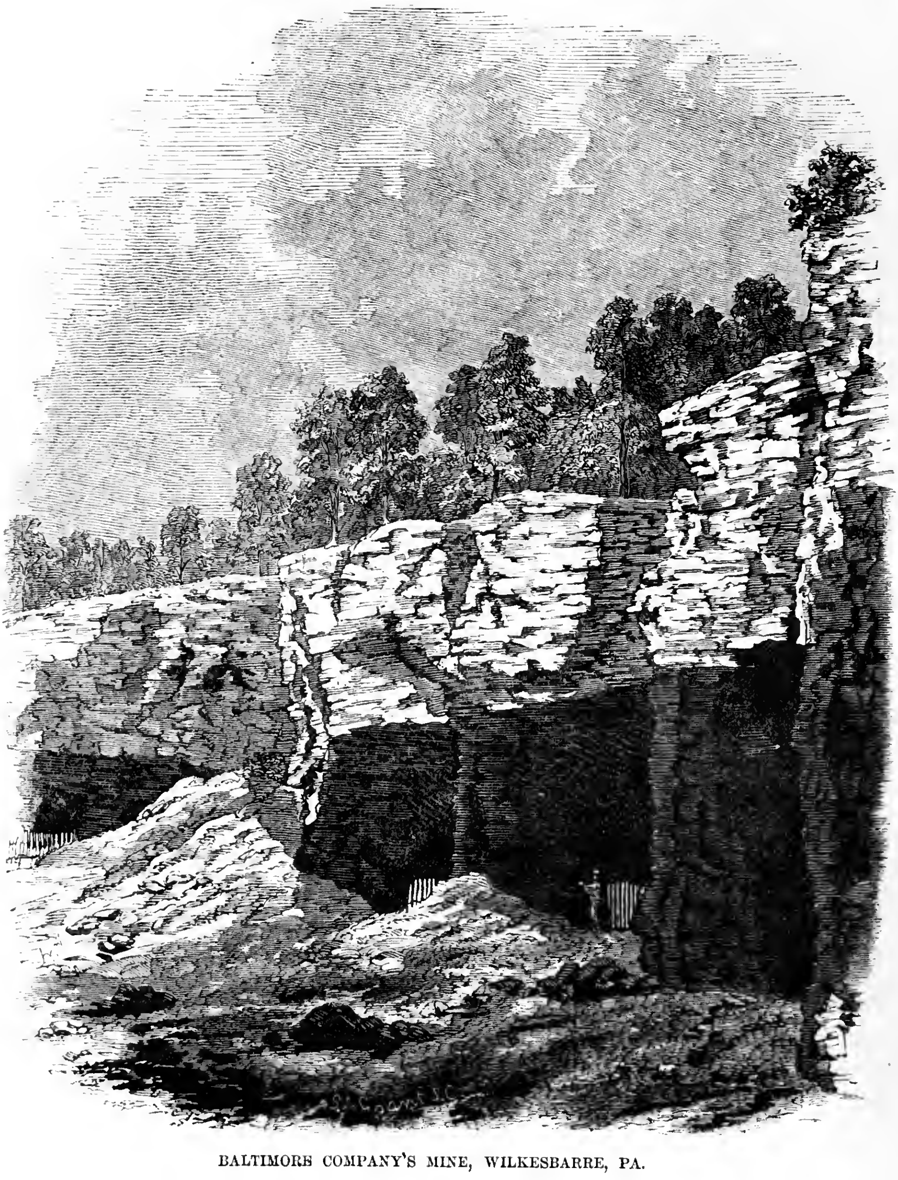
The transportation of coal from Mauch Chunk was conducted by the river and canal

MOUNT PISGAH PLANE, MAUCH CHUNK, PA.

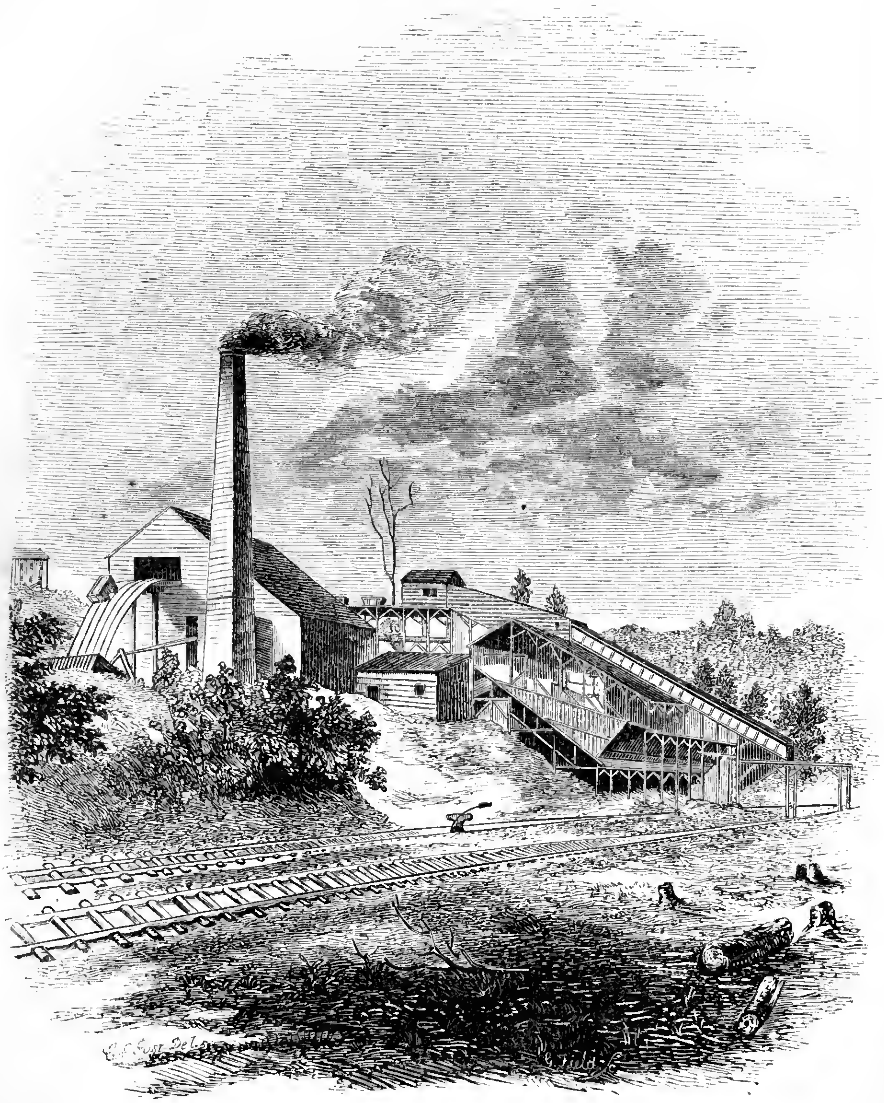


THE GREAT OPEN QUARRY OF THE LEHIGH.

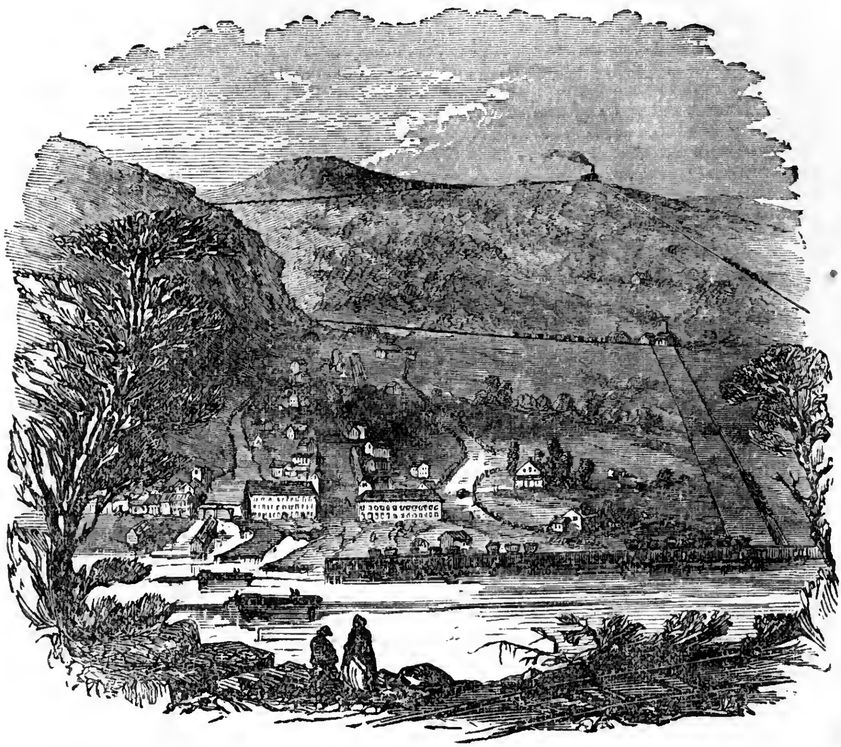
In working this great quarry of anthracite at the Summit mine, above Mauch Chunk, blocks of coal were occasionally left standing for a time, one of which, surmounted by the soil of the original surface and the relics of the vegetation, is represented in the above cut. In this block are discerned the lines of stratification of the coal; and an idea of its extraordinary thickness and extent is conveyed by the appearance of the cliffs upon the further side of the excavated area. Upon the floor of the quarry are seen the mining wagons used for conveying away upon temporary tracks the coal and rubbish of the excavations.



BALTIMORE COMPANY'S MINE, WILKESBARRE, PA.



COLLIERY SLOPE AND BREAKER AT TUSCARORA, PA.



MOUNT PISGAH PLANES AND THE GRAVITY RAILROAD, MAUCH CHUNK.

exclusively until the partial construction of the Lehigh railroad in 1846. But it was not until its completion in 1855, that this began to be an important outlet of the coal region and a powerful competitor for the trade with the canal.

A considerable amount of anthracite finds a market on the borders of Chesapeake Bay, being transported from the mines near the Susquehanna river by the Susquehanna tide-water canal, and by the Baltimore and Susquehanna railroad. Its consumption is extending in this region by its use in the blast furnaces in the place of charcoal, for smelting iron ores, and the receipts of this fuel in the city of Baltimore are steadily gaining upon those of the semi-bituminous coals of the Cumberland region, which are brought to the city by the Baltimore and Ohio railroad. For four years past these receipts have been as follows:—

	1857. Tons.	1858. Tons.	1859. Tons.	1860. Tons.
Bituminous	443,782	331,365	344,223	397,684
Anthracite..........	257,334	277,967	258,189	325,129
	701,116	609,332	602,412	722,813

The principal outlet of the Northern coal-field had been from 1829 to 1850 by the Delaware and Hudson canal. Since 1847 there have been taken every year to the Hudson river by this route from about 440,000 to 499,650 tons, except in 1855, when the quantity was 565,460 tons. A number of railroads now connect this basin with the central railroad across northern New Jersey, and in other directions it is connected both by railroad and canals with the Erie railroad to the North and the Susquehanna river to the South-west. As large an amount of coal is now transported over each one of three of these lines as by the Delaware and Hudson canal.

The various railroads and canals which have been constructed with especial reference to the transportation of anthracite, are more than 40 in number, and have cost about $93,000,000. Most of them are presented in the following table; of some of them only those portions which may fairly be counted as constructed for coal purposes:—

Names of railroads and canals.	Canals. No. miles.	Railroads. No. miles.	Total cost.
Lehigh Navigation	87	..	$4,455,000
Lehigh and Susquehanna railroad	..	20	1,350,000
Mauch Chunk and Summit railroads	..	36	831,684
Delaware division of the Pennsylvania canal	43	..	1,734,958
Beaver Meadow railroad and branch	..	38	360,000
Hazleton railroad	..	10	120,000
Buck Mountain railroad	..	4	40,000
Summit railroad	..	2	20,000
Lehigh Valley railroad	..	45	3,500,000
Delaware and Hudson canal	108	..	3,250,000
Morris canal	102	..	4,000,000
The Schuylkill Navigation	108	..	5,785,000
Reading and Pottsville railroad	..	98	19,004,000
Shamokin and Pottsville Valley railroad	..	30	900,000
Little Schuylkill railroad	..	28	1,416,187
Danville and Pottsville railroad (44½ miles unfinished)	..	29	680,000
Mine Hill and Schuylkill Haven railroad and branches	..	100	2,800,000
Mount Carbon railroad	..	7	155,000
Port Carbon railroad	..	2	120,000
Schuylkill Valley railroad and branches	..	25	300,000
Mill Creek railroad	..	6	120,000
Lykens Valley railroad	..	16	200,000
Wiconisco canal	12	..	370,000
Swatara railroad	..	4	20,000
North Branch canal	163	..	3,790,310
Union canal and Pine Grove branch	90	..	1,000,000
Schuylkill and Susquehanna railroad	..	52	1,500,000
Northern Central railroad	..	60	1,000,000
Pennsylvania canal (from Wilkesbarre to Columbia)	100	..	3,000,000
Susquehanna tidewater canal	45	..	1,000,000
York and Cumberland railroad	..	26	600,000
Cumberland Valley railroad	..	56	1,192,111
Franklin railroad	..	22	450,000
Nesquehoning railroad	..	5	50,000
Room Run railway	..	6	40,000
Delaware, Lackawanna, and Western railroad	..	170	9,995,000
Lackawanna and Bloomsburg railroad	..	68	1,600,000
Quakake railroad	..	14	280,000
Catawissa, Williamsport, and Erie railroad	..	65	4,145,096
Elmira and Williamsport	..	78	2,000,000
Pennsylvania Coal Company's railroad	..	52	3,745,500
New Jersey Central railroad	..	63	5,746,366
Railroads by individuals	..	120	180,000
Underground railroads	..	200	75,000
Total	858	1,557	$92,921,212

COAL MINING.

Coal-beds are discovered and worked by different methods, varying according to the circumstances under which they occur. In regions where they lie among the piles of strata horizontally arranged, and passing with the other members of the group upon a level or nearly so through the hills, their exact position is often detected by their exposure in the precipitous walls of rock along the rivers; or it is indicated by peculiar indentations, known as "benches," around their line of outcrop, caused by their crumbling and wearing away more rapidly than the harder strata above and below them; and again by the recurrence of springs of water and wet places at the foot of the benches, which point to an impervious stratum within the hill that prevents the water percolating any further down; and lastly, in the little gorges worn by the "runs," the beds are often uncovered, and loose pieces of coal washed down lead to their original source above. However discovered, the method of working them is simple. A convenient place is selected upon the side of a hill, and an excavation called a drift, usually about four feet wide, is made into the coal-bed. The height of the drift is governed by the thickness of the coal-bed and the nature of the overlying slate. Miners sometimes work in drifts only 2½ feet high. Coal-beds three or four feet thick are very common, and are worked without the necessity of removing the overhanging slate, unless it is too unsound to serve as a roof. Beds of ten feet thickness or more require much additional care over those of smaller size, both in removing the coal and supporting the roof; and in many cases it is found expedient to leave a portion of the bed, either at the top or bottom, untouched, especially if the upper layers contain, as they often do, sound sheets of slate. At the entrance of the mines, and in general in all places where the cover is not sound, the materials overhead are prevented from falling by timbers across the top of the drifts, rudely framed into posts set up against the walls on each side; and where the strata are very loose, slabs are driven in over the cross timbers and behind the posts. In such ground the coal cannot be excavated over large areas without leaving frequent pillars of coal and introducing great numbers of posts or props. But previous to abandoning the mine the pillars may be removed, commencing with those furthest in, and all the strata above are thus allowed to settle gradually down. When drifts or gangways have been extended into the coal-beds far enough to be under good cover, branches are commenced at right angles, and a system of chambers is laid out for excavation, leaving sufficient blocks or pillars of coal to provide for the support of the overlying strata. Thus the work is carried on, ventilation being secured by connections made within the hill with gangways passing out in different directions, and sometimes also by shafts sunk from the surface above, or, when these means are not practicable, by ventilating fans worked by hand, and thus forcing air through long wooden boxes which lead into the interior of the mine. Drainage is often a serious trouble, and unless the strata slope toward the outlet of the mine, it can be effected only by a channel cut to the required depth for the water to flow out, or else by the use of pumping machinery. When the strata lie nearly upon a horizontal plane, it is very common for a slight descent to be found from the exterior of a hill toward its centre, as if the beds of rock had been compressed and settled by their greater weight in the middle of the hill. In such positions the coal is extracted with much expense for drainage, and it is therefore an important consideration in judging of the value of coal-beds to ascertain whether or no the water will flow freely out from the excavations. In the bituminous coal-fields west of the Alleghanies, owing to the general distribution of the coal-beds above the level of the water-courses, it has not yet been found worth while to work any of the beds that are known to lie below this level. Coal must reach a much higher value before beds of the moderate size of those in that region can be profitably explored below water level.

It is rare that bituminous coal is obtained by open quarrying. Where the beds lie near the surface, so that they might be uncovered, the coal is almost invariably in a rotten condition and worthless. Consequently one of the first points to be assured of in judging of the value of a coal-bed is that it has sufficient rock cover. After this may be considered the quality of the coal, its freedom from sulphur, etc., the soundness of its roof, and the facilities offered for drainage and ventilation. The quality of a coal-bed undergoes little or no change after it is once reached under good cover beyond atmospheric influences; and hence no encouragement can be given to continue to work a poor bed in hopes of its improving.

Coal is excavated chiefly by light, slender picks. With one of these a miner makes a shallow, horizontal cut as far as he can reach under the wall of coal before him, stretching himself out upon the floor to do this work, and then he proceeds to make a vertical cut extending from each end of that along the floor up to the roof. By another horizontal cut along the roof, a cubical block of coal is thus entirely separated from the bed, except on the back side which cannot be reached. The separation is completed by wedges driven into the upper crevice, or sometimes by small charges of powder. By this means blocks of coal are thrown down amounting to 70 or 80 tons in weight, and with the least possible loss by the reduction of portions of it to dust and fine coal.

The cost of mining and delivering coal at the mouth of the mines, varies with the size and character of the beds. Under the most favorable conditions the horizontal beds of bituminous coal, as those in the hills opposite Pittsburg, have been worked and the coal delivered outside for $1\frac{1}{2}$ cents a bushel, or 45 cents a ton; but in general the total expenses are nearly double this rate. In estimating the capacity of production of coal-beds it is usual to allow a ton of coal to every cubic yard, and a bed of coal a yard thick should consequently contain a ton to every square yard, or 4840 tons to the acre: but the actual product that can be depended on, after the loss by fine coal, by pillars left standing, etc., may not safely be reckoned at more than 3000 tons, or for every foot thickness of the bed 1000 tons.

In the anthracite region, and in other coal districts where the beds are of large size and lie at various degrees of inclination with the horizon, the methods of mining differ more or less from those described. The anthracite beds frequently extend in parallel layers longitudinally through the long ridges, dipping, it may be, nearly with the outer slope, and descending to great depths below the surface. In such positions they are conveniently reached at the ends of the ridges and in the gaps across these, by a level driven on the course of the bed, and rising just enough for the water to drain freely. A level or gangway of this sort is the great road of the mine, by which all the coal is to be brought out in case other similar gangways are not driven into the same bed at points further up or down its slope. Unless the dip is very gentle, one at the lowest point should be sufficient. At different points along its extension passageways are cut in the coal, directed at right angles up the slope of the bed, and as soon as one of them can be brought through to the surface, a ventilating current of air is established, which may afterward be diverted through all the workings. The passageways together with other levels above divide the coal-bed into great blocks, and also serve as shutes by which the coal excavated above is sent down to the main gangway. At the bottom of each shute a bin is constructed for arresting the coal and discharging it, as required, into the wagons which are run in beneath on the tracks laid for this purpose. Coal-beds in this position are also worked from the gangway by broad excavations carried up the "breast" or face of the bed, sufficient pillars of coal from 12 to 25 feet long being left in either case to support the roof. These pillars usually occupy the most room just above the gangways, and on passing up between them, the chambers are made to widen out till they attain a breadth of about 40 feet, and thus the breast is extended up to the next level. Props are introduced wherever required to support the roof, and the rubbish, slates, etc., are stacked up for the same purpose, as well as to get them out of the way.

It often occurs that coal beds within the ridges can be reached only by a tunnel driven in from the side of the mountain across their line of bearing. Tunnels of this kind are sometimes extended till they cut two or more parallel coal-beds. Each one may then be worked by gangways leaving the tunnel at right angles and following the coal-beds, and the tunnel continues to be the main outlet of them all.

When it is desirable to obtain the coal from the portion of the bed below the level of the gangway, preparations must first be made for raising the water, which may be done for a time by bucket and windlass, and as the slope is carried down and the flow of water increases, then by mining pumps worked by horse or steam power. The slope may commence from the exterior surface or from the lower gangway of a mine already in operation, and is made large enough to admit wagons, which ascend and descend upon two tracks extending down its floor. At the depth of 200 or 300 feet a gangway is driven at right angles with the slope in each direction on the course of the bed, and from this the workings are carried up the breast as already described. Other gangways are started at lower levels of 100 feet or more each, dividing the mine into so many stories or floors. The coal above each gangway is sent down to its level and is received into wagons. By these it is conveyed to the slope, and here running upon a turn-table, each wagon is set upon the track in the slope and is immediately taken by the steam engine to the surface, another car at the same time coming down on the other track. Reservoirs are constructed upon the different levels to arrest the water, that it may not all have to be raised up from the bottom, and the pumps are constructed so as to lift the water from the lower into the higher reservoirs and thence to the surface. Many mines of this character are opened from the surface, one of which is represented in the cut of the "Colliery Slope and Breaker, at Tuscarora, Pennsylvania." An empty wagon is seen in this cut descending the track from the engine house down into the mouth of the pit, and through the end of the building passes the pump rod which by means of a vibrating "bob" is turned down the pit and works by the side of the track. The men pass down into the mines of this character, sometimes by the wagons, and sometimes by ladders or steps arranged for the purpose between the two tracks. Though the opening, as represented, appears insignificant for an important mine, such a slope may extend several hundred feet in depth, and many gangways may branch off from it to the right and left, extending several miles under ground in nearly straight lines along the course of the bed. These, however, to secure ventilation, must have other slopes coming out to the surface, and at these may be other arrangements for discharging the coal and water. In extensive mines the gangways are made wide and capacious for the continual passing back and forth of the wagons drawn by mules. These animals once lowered into the mine are kept constantly under ground, where they are provided with convenient stables excavated from the coal and rock. The men continue at work from eight to ten hours, and in well-ventilated mines the employment is neither very laborious, hazardous, nor disagreeable. The pursuit has, however, little attraction for Americans, and is mostly monopolized by Welsh, English, Irish, and German miners.

In the anthracite region there have been some remarkable instances of open quarries of coal. That of the Summit mine of the Lehigh is unsurpassed in the history of coal mining, for the enormous body of coal exposed to view. The great coal-bed, which appears to have been formed by a number of beds coming together through the thinning out of the slates that separated them, arches over the ridge, forming the uppermost layers of rock, and dipping down the sides at a steeper angle than their inclination. It thus passes beneath the higher strata. On the summit a thin soil, formed chiefly of the decomposed coal itself, covered the beds and supported a growth of forest trees. For several feet down the coal was loose and broken before the solid anthracite was reached. As the excavations were commenced and carried on from this point, it appeared as if the whole mountain was coal. Shafts were sunk into it and penetrated repeated layers of anthracite, separated by thin seams of slate, to the depth, in some places, of more than 55 feet. The work of stripping off and removing the covering of yellow and greenish sandstones and refuse coal was carried on, till the quarry had extended over about 50 acres, and on the north side the overlying sandstone, which had been steadily increasing in thickness, presented a wall of 30 to 40 feet in height. Over this area rail tracks were laid for removing the waste northward to the slope of the hill toward the Panther Creek valley; and when the piles thus formed had grown into large hills, the rubbish was deposited in the spaces left after the coal had been removed. During the progress of this work the scenes presented were of the most picturesque and novel character. The area laid bare was irregularly excavated into steps, upon which temporary rail tracks were laid in every direction. Upon these the wagons were kept busily running, some carrying off the coal, some loaded with slates and waste, and others returning empty for their loads. Here and there stood huge isolated masses of anthracite, with their covering of sandstone, soil, and the relics of the original forest growth, reaching to the height of 50 or 60 feet, monuments of the vast amount of excavation that had been carried on, and presenting in their naked, vertical walls, fine representations of the extraordinary thickness of the bed and of the alternating layers of slate and coal of which it was composed. In the accompanying cut of the great open quarry of the Lehigh is represented one of these blocks. Gradually these masses disappeared as the miners continued their operations; but in the boundary walls of the quarry there are still to be seen black cliffs of solid coal more than 50 feet high, and overtopped by a wall of yellow sandstone of nearly equal additional height. Under these walls operations have been carried on by the regular system of underground mining. From ten acres of the quarry it has been estimated that 850,000 tons of coal have been sent away, the value of which in the ground at the usual rate of 30 cents per ton, would be $255,000, or $25,500 per acre. Estimating the average working thickness of the coal in this part of the coal-field, from the Little Schuylkill to Nesquehoning, at 40 feet, which according to the report of the state geologist is not exaggerated, every available acre contains not less than 65,000 tons. The expense of extracting and preparing the coal from the great bed for market, is stated by the same authority to be 37½ cents per ton for mining and delivering ready for breaking and cleaning. For this operation 12½ cents; and for raising it to the summit and running it to Mauch Chunk 25 cents.

Another locality where coal has been

worked by open quarrying is at the mines of the Baltimore Company, near Wilkesbarre. Here, too, an immense bed of coal was found so close to the surface that it was easily uncovered over a considerable area. As the overlying slates and sandstone increased in thickness, it was found at last more economical to follow the coal under cover; and it was then worked after the manner of mining the bituminous coal-beds west of the Alleghany Mountains. Horizontal drifts 25 feet high, which was the thickness of the bed, were carried in from the abrupt wall, several of them near together and separated by great pillars of coal left to support the roof. The gangways were so broad and spacious that a locomotive and train of cars might have been run into the mine. Within they were crossed by a succession of other levels, and through the wide spaces thus left open, the light of day penetrated far into the interior of the hill, gradually disappearing among the forest of black pillars by which it was obstructed and absorbed.

In the anthracite region, several coal-beds of workable dimensions are often found in close proximity, so that when dipping at a high angle they are penetrated in succession by a tunnel driven across their line of bearing. Larger quantities of coal are thus concentrated in the same area than are ever met with in the bituminous coal-field. In the northern coal-fields, between Scranton and Carbondale, tracts have brought $800 or more per acre, and single tracts of 650 to 700 acres are reported upon by competent mining engineers as containing five workable beds, estimated to yield as follows—each one over nearly the whole area: one bed working 7 feet, 11,200 tons per acre; a second, working 8 feet, 12,800 tons per acre; a third, 6 feet, 9600 tons per acre; a fourth, the same; and a fifth, 3 feet, 4800 tons—altogether equalling a production of 48,000 tons per acre, from which 20 per cent. should be deducted for mine waste, pillars, etc.

The anthracite as usually brought out from the mines is mostly in large lumps of inconvenient size to handle. In this shape it was originally sent to market, and when sold to consumers a man was sent with the coal to break it up in small pieces with a hammer. At present every mine is supplied with an apparatus called a coal-breaker, which is run by steam power, and which crushes the large pieces of coal in fragments. It consists of two rollers of cast iron, one solid, with its surface armed with powerful teeth, and the other of open basket-work structure. These revolve near together, and the coal, fed from a hopper above, is broken between them, and the pieces discharged below into another hopper are delivered into the upper end of a revolving cylindrical screen, made of stout iron wire, and set on a gentle incline. The meshes of this screen are of four or more degrees of coarseness. At the upper end the finer particles only drop through; passing this portion of the screen, the coarser meshes which succeed let through the stove coal sizes, next the "egg coal," and next the "broken coal," while the coarsest pieces of all, called "lump coal," are discharged through the lower end of the screen. Under the screen are bins or shutes, separated by partitions, so as to keep each size by itself. Their floor slopes down to the railway track, and each bin at its lower end is provided with a trap-door, through which the coal is delivered as required into the wagons. The general plan of this arrangement is seen in the preceding wood-cut of the Colliery Slope and Breaker at Tuscarora. The coal wagons are here run from the mine up into the top of the engine house, and thence through the building to the breaker at the upper end of the slope over the shutes. As the coal falls from the screen into these, boys are employed, one in each bin, to pick out and throw away the pieces of slate and stone that may be mixed with the coal. This they soon learn to do very thoroughly and with great activity; and upon the faithfulness with which their work is done depends in no small measure the reputation of the coal.

USEFUL APPLICATIONS.

While anthracite, by reason of its simple composition, is fitted only for those uses in which the combustion or oxidation of its carbon is required to generate heat, or else to extract oxygen from other substances, the bituminous coals, containing a greater variety of ingredients, serve to produce from their volatile ingredients illuminating gas and coal oils. These two subjects will be treated in distinct chapters, and that upon the oils may properly include an account of the wells of natural oil recently developed in the north-west part of Pennsylvania, and in neighboring districts in New York and Ohio, as also in Virginia and Kentucky.

CHAPTER X.

ILLUMINATING GAS.

The supply of artificial light in abundance and at little cost is one of the most important benefits which science and mechanics can confer. It contributes not merely to physical comfort and luxurious living, but supplies the means to multitudes of obtaining instruction during those hours after the cessation of their daily labors, which are not required for sleep, and which among the poor have in great measure been spent in darkness, on account of the expense of artificial light. At the present day it is not unusual, in the less cultivated portions of the country, to see a farmer's family at night gathered around a blazing fire, and some among them seeking by its fitful light to extract the news from a public journal, or perhaps conning their school tasks, and making some attempts at writing or ciphering; and when the hour to retire has come, the younger members disappear in the dark, and the more honored are favored with a home-made tallow candle, just sufficient for this use, and endurable only to those who are unaccustomed to a more cleanly and efficient method of illumination. With the advance of cultivation and learning, the demand for better light has increased the more rapidly it has been met. The sea has been almost exhausted of whales for furnishing supplies of oil. The pork of the West has been largely converted by new chemical processes into lard oil and the hard stearine for candles; and numerous preparations of spirits of turpentine, under the name of camphene and burning fluid, have been devised and largely introduced with ingenious lamps contrived to secure the excellent light they furnish, with the least possible risk of the awful explosions to which these fluids are liable when their vapor comes in contact with fire. The bituminous coals have been made to give up their volatile portions—by one process to afford an illuminating gas, and by another to produce burning oils; and the earth itself is bored by deep wells to exhaust the newly-found supplies of oil gathered beneath the surface at unknown periods by natural processes of distillation. The resinous products of the pine tree are applied to the production of oil and gas for the same purposes; and peat, wood, and other combustible bodies—even water itself—are all resorted to as sources from which the cry for "more light" shall be satisfied.

The distillation of carbonaceous and bituminous substances to obtain an illuminating gas is a process, the practical application of which hardly dates back of the present century. The escape of inflammable gases from the earth, in different parts of the world, had been observed, and the phenomenon had been applied to superstitious ceremonials, especially at Bakoo on the shores of the Caspian. The Chinese are said to have applied such natural jets of gas to purposes of both illumination and heating; but the first attempts to light buildings by gas distilled from bituminous coal were made about the year 1798 by Mr. Murdock in the manufactory of Messrs. Boulton and Watt, at Soho, England, and about the same time in France by a Frenchman named Le Bow. The London and Westminster Chartered Gas Light and Coke Company was incorporated in 1810, and Westminster bridge was lighted with gas, Dec. 31, 1813. The process was introduced into this country about the year 1821. Some attempts had been made at an earlier date, as in Baltimore according to some statements in 1816, and in New York four years before this. In the New York *News* of August 15, 1859, is an account of the efforts made by Mr. David Melville of that city to establish the use of coal gas in 1812. He lighted his own house with it, and then a factory at Pawtucket. He also succeeded in having it applied to one of the lighthouses on the coast of Rhode Island, and for one year its use was continued with success. But on account of the disturbed state of the times and the prejudices against the use of a new material, the enterprise fell through. In 1822 the manufacture of gas was undertaken in Boston; and the next year the New York Gas Light Company was incorporated with a capital of $1,000,000. The works, however, were not completed and in operation until 1827. Another company, called the Manhattan Gas Light Company, was incorporated in 1830 with a capital of $500,000, which has since been increased to $4,000,000. Such were the beginnings of this branch of manufacture, which has of late rapidly extended itself throughout all the cities and many of the towns of the United States, having works in operation representing a capital of more than $35,000,000, which in 1859 were owned by 237 companies. Some of these works are among the largest and most expensive manufacturing establishments of any kind in the country, including besides the apparatus employed for generating and holding the gas, the pipes extending throughout the cities for the supply of consumers. In New York city the pipes belonging to the Manhattan Gas Light Company, of diameters varying from 3 to 20 inches, amounted in 1858 to 207 miles in length; and those of the New York Gas Light Company, of diameters from 4 to 18 inches, amounted to 138 miles. The former company supplies that portion of the city which lies above Grand street as far as Seventy-ninth street, and the latter that portion below Grand street.

Within the last few years the use of gas has increased with great rapidity throughout the cities and towns of the United States, till the number of companies in operation in the year 1860 amounted to 381, according to the statistics published in July of that year, in the *American Gas Light Journal.* These companies represented a capital of $47,911,215; and it is since ascertained that this sum must be considerably increased by adding to the list over 50 other companies from which no returns had then been received. The interest it appears must already rank among the important branches of industry of the country. For much of the statistical information on this subject we are chiefly indebted to the records collected for the journal above named. The first table below will serve to present some idea of the extent of the larger establishments, and the range in the cost of gas, which varies according to the cost of the coal employed, the scale of the operations, etc. The lowest price paid for gas is at Pittsburg, Pennsylvania, $1.50 per 1000 cubic feet, the bituminous coal employed costing only $1.25 per ton. In many of the smaller towns $7 is the price, which is the maximum on the Atlantic side of the continent.

The second table gives the aggregate number of gas works in the several states, amount of capital invested, etc.

SOME OF THE PRINCIPAL GAS LIGHT COMPANIES IN THE UNITED STATES.

Chartered.	Localities.	Chartered capital.	Approximate annual production. Cubic feet.	Prices to private consumers per 1000 cubic feet.	Average cost of coal used per ton.
1830,	Manhattan, N. Y.	$4,000,000	725,321,000	$2 50	$6 50 to $11 00
1823,	New York, N. Y.	1,000,000	430,000,000	2 50	.. ..
1825,	Brooklyn, N. Y.	2,000,000	163,000,000	2 00	7 28 to 8 15
1859,	Citizens' Co., Brooklyn.	1,000,000	..	2 00	.. ..
1841,	Philadelphia	3,000,000	432,000,000	2 25	6 50 ..
	Northern Liberties	400,000	70,000,000	2 50	6 29 ..
1822,	Boston, Mass.	1,000,000	200,000,000	2 50	5 00 to 12 00
1851,	Cincinnati, Ohio	1,600,000	96,708,900	2 50	3 40 ..
1849,	Chicago, Ill.	1,300,000	86,250,810	3 50	5 78 ..
1846,	Charleston, S. C.	723,800	..	4 00	.. ..
1839,	St. Louis, Mo.	600,000	74,500,000	3 50	7 50 ..
1835,	Pittsburg, Penn.	300,000	54,720,000	1 50	1 25 ..
1848,	Providence, R. I.	1,000,000	41,437,883	3 00	7 20 ..
1845,	Albany, N. Y.	250,000	40,250,000	3 00	6 75 to 8 00
1838,	Louisville, Ky.	600,000	33,750,000	2 70	.. ..
1850,	Williamsburg, N. Y.	500,000	33,493,082	3 50	6 25 to 9 50
1848,	Troy, N. Y.	200,000	28,000,000	3 60	7 20 ..
1851,	Richmond, Va.	341,975	27,000,000	3 00	4 15 ..
1852,	Rochester, N. Y.	200,000	25,000,000	2 50	5 38 ..
1849,	Lowell, Mass.	200,000	21,000,000	3 25	6 50 ..
1848,	Cleveland, Ohio	200,000	20,000,000	3 00	4 25 ..
1849,	Detroit, Mich.	500,000	20,000,000	3 50	5 00 ..
1853,	Jersey City, N. J.	300,000	19,234,000	3 00	7 89 ..
	Milwaukee, Wis.	400,009	19,049,560	3 50	6 00 ..
1849,	Hartford, Conn.	200,000	15,000,000	3 00	8 68 ..
1849,	Portland, Maine	250,000	..	3 50	.. ..
1857,	Columbia, California	50,000	..	10 00	.. ..
1852,	San Francisco, "	1,000,000	..	8 00	.. ..
1858,	Marysville, "	50,000	..	12 50	.. ..
	Stockton, "	50,000	..	10 00	.. ..
1857,	Sacramento, "	500,000	..	10 00	.. ..

TOTAL OF GAS COMPANIES IN THE UNITED STATES FROM RETURNS OF JULY, 1860.

State.	Companies.	Capital.	Coal gas.	Average price.	Rosin gas.	Average price.
Alabama	3	$320,000	3	$5 16	..	..
Arkansas	None.	..	..	..	..	..
California	9	1,790,000	9	10 05	..	..
Connecticut	14	953,000	14	3 83	..	..
Delaware	3	244,300	3	3 50	..	..
District of Columbia	1	500,000	1	3 25	..	..
Florida	1	30,000	1	7 00	..	..
Georgia	6	559,160	4	4 68	2	$6 50
Illinois	13	2,595,000	13	3 91	..	..
Indiana	7	605,000	7	3 97	..	..
Iowa	5	355,000	5	4 40	..	..
Kansas	1	200,000	1	5 00	..	..
Kentucky	5	905,000	5	4 04	..	..
Louisiana	2	1,540,000	2	4 50	..	..
Maine	10	905,300	9	3 90	1	7 00
Maryland	6	780,000	3	3 49	3	6 60
Massachusetts	49	4,759,000	45	3 43	4	6 37
Michigan	8	745,000	8	3 78	..	..
Minnesota	1	200,000	1	6 00	..	..
Mississippi	4	212,000	4	4 75	..	..
Missouri	4	775,000	4	4 50	..	..
New Hampshire	9	425,000	9	3 98	..	..
New Jersey	19	1,849,610	17	3 72	2	6 50
New York	71	12,780,250	61	3 70	10	6 70
North Carolina	8	187,000	..	..	8	5 93
Ohio	30	3,338,600	29	3 85	1	7 00
Oregon	1	50,000	1	8 00	..	..
Pennsylvania	48	5,657,700	48	3 55	..	..
Rhode Island	7	1,344,000	6	3 58	1	7 00
South Carolina	2	767,800	2	5 00	..	..
Tennessee	4	663,000	4	4 00	..	..
Texas	3	225,000	3	6 33	..	..
Vermont	8	216,000	6	4 25	2	6 50
Virginia	11	1,030,000	10	3 68	1	7 00
Wisconsin	8	778,500	8	4 44	..	..
Grand total	381	$47,911,215	346	..	35	..

The preparation of illuminating gas from bituminous coal, wood, rosin, and other bodies of organic nature, is a chemical process, too complicated to be very fully treated in this place. When such bodies are introduced into a retort and subjected to strong heat, the elements of which they consist, as carbon, hydrogen, oxygen, and nitrogen, resolve themselves into a great variety of compounds, and escape (with the exception of a fixed carbonaceous residue of charcoal or of coke) through the neck of the retort in the form of gas or vapors, some of the latter of which condense on cooling into liquids and solids. These compounds are rendered more complicated by appropriating the elements of air and moisture that may be present in the retort or in the crude material, and also of the foreign substances or impurities contained in the latter. In processes of this kind, the products vary greatly in their character and relative proportions according to the degree of heat employed, and the rapidity with which the operation is conducted. The object in this special distillation is to obtain the largest proportion of the gases richest in carbon, particularly that known as olefiant gas, which consists of 86 parts by weight of carbon and 14 of hydrogen, represented by the formula C_4H_4. This and some other gaseous hydrocarbons of similar composition, or even containing a much larger amount of carbon in the same volume, and hence having a correspondingly greater illuminating capacity, it is found, are produced most freely from carbonaceous substances which contain a large proportion of hydrogen compared with that of oxygen. Many of the common bituminous coals contain about 5·5 per cent. each of hydrogen and oxygen, the rest being carbon. Boghead cannel of Scotland contains 11 per cent. of hydrogen and 6·7 of oxygen; rosin 10 per cent. hydrogen and 10·6 oxygen; wood 5·5 hydrogen and 44·5 oxygen. Of such compounds the cannel yields the richest gas and in largest quantity. Still, as will be more fully explained hereafter, the process may be so conducted as to obtain chiefly liquid instead of gaseous products. With the olefiant gas and the others of similar composition, a number of other gases also appear, some of which seem to be essential for producing the effect required in illuminating gas, though they do not themselves afford light by their combustion. Their part is rather like that of nitrogen in the atmosphere, to moderate the intensity of the more active agent of the mixture. Such are the light carburetted hydrogen, carbonic oxide, and hydrogen, all of which are inflammable, but possess little or no illuminating power. The first named contains in an equal volume only half as much carbon as olefiant gas, its composition being represented by the formula $C_2\ H_4$, and if its proportion is too great for the purpose it serves as a diluent, the quality of the gas is impaired, and must be corrected by the use of richer material or increased care in the process.

The light produced by the combustion of gas is variable, not only according to the quality of the gas, but also according to the manner in which it is burned. If its elements undergo the chemical changes which constitute combustion simultaneously, the hydrogen combining with the oxygen of the air to form aqueous vapor, and the carbon with oxygen to produce carbonic acid, no yellow flame appears, but instead of this, a pale blue flame like that of hydrogen alone. Such an effect is produced when air is thoroughly intermixed with the gas as it passes through a tube to the jet where it is ignited. But if the conditions of the combustion are such that the hydrogen burns first and appropriates the oxygen in contact with the gas, the particles of carbon are brought to an incandescent state and produce the yellow light before they reach the oxygen with which they combine. The particles may even be arrested while *in transitu* and be deposited upon a cold surface in the form of soot. The greatest heat is produced with the most thorough mode of combustion and the appearance of the pale blue flame; and lamps designed to give great heat are now in general use among chemists, in which gas is burned in this manner. When the air is impelled by a bellows they even produce an intensity of heat sufficient for many crucible operations.

If too much carbon be present a part of it escapes unconsumed and produces a smoky flame, hence the necessity of the diluents or gases deficient in carbon for neutralizing the too large proportion of those gases richest in carbon. The noxious compounds in illuminating gas, and which should be as far as possible extracted from it before it is delivered for consumption, are the sulphurous ingredients formed by the combination of the sulphur of the iron pyrites commonly present in bituminous coals with the carbon, and with the hydrogen and the ammoniacal products. They are the highly offensive sulphurets of carbon, the sulphuretted hydrogen, etc. Carbonic acid, nitrogen, oxygen, carbonate of ammonia and aqueous vapors are to be regarded as foreign substances, though always present to some extent in the gas.

The liquids generated by the distillation mostly condense in two layers on cooling, the upper an aqueous fluid, rendered strongly alkaline by the ammoniacal compounds in solution; and the lower a black tarry mixture commonly known as coal tar, which is composed of more than a dozen different oily hydrocarbons, as benzole, tuluole, etc., and contain in solution the solid oily compounds of carbon and hydrogen, as naphthaline, para-naphthaline, and several others. Many of these are likely to prove of considerable practical importance. Benzole is a highly volatile fluid, a powerful solvent of the resins, india-rubber, gutta percha, greasy matters, etc. A most beautiful light is produced by the flame of benzole mixed with due proportions of common air, and the mixture is effected by passing a current of air through the fluid, the vapor of which it takes up and carries along with it. The difficulty attending this application is the condensation of the benzole and its separation from the air at temperatures below 50°. Above 70° too much vapor is taken up, and the effect is a smoky flame. In Europe much attention has been directed to the separation of the more hidden products of coal tar; and among these the following are enumerated in a statement exemplifying the rapid increase in the value of these products as they are obtained by more extended researches. Benzole worth about 25 cents a pound; nitro-benzole, a substance having the odor and taste of bitter almonds and used as a flavoring, worth, crude, 70 cents, or refined, $1.50 per pound. The ordinary aniline dye for producing the mauve color, $4.50 to $8 per pound, and the pure aniline violet in powder $240 to $325 per pound, or about its weight in gold.

Gas works established in cities and towns are commonly built in places where the property and buildings around are least likely to be injured by the escape of the products, and rather upon a low than a high level, for the reason that the gas on account of its lightness compared with the atmospheric air ascends more freely than it descends to its points of communication with the external air. The works consist of the apparatus for distilling the coal and receiving the products of the distillation, that for purifying the gas, and that for conveying it to the places where it is consumed, and there measuring the quantities supplied to each customer. The retorts in general use are either of cast iron or of fire clay. The latter are a late improvement highly recommended, and introduced at the present time into a few of the gas works. Various forms have been tried; the most approved are of ⌓ shape, 7 to 9 feet long, 1 or 2 feet wide, and 12 or 15 inches high. They are set in the furnace stacks, commonly two on the same horizontal plane, two more over these, and a fifth at the top. A single furnace fire below is sufficient for heating them, and the capacity of the works is increased by multiplying these fires along the length of the stacks. Sometimes the stacks are made double, so as to take two retorts set end to end, each opening on opposite sides of the stack. In place of two retorts a single long one has been substituted, passing entirely through and having at each end an opening for charging and discharging. In large establishments as many as 600 or more retorts may be set, all of which may be kept employed in the winter season, when the consumption of gas is largest. The outer end of each retort projects a little way in front of the wall of the furnace, and is provided with a movable mouth-piece covering the entire end, which may be readily removed for admitting the charge of coal. Upon the top of this projecting end or neck stands the cast-iron pipe of about 4 inches in diameter, called the stand pipe, through which the volatile products pass from the retort. It rises a few feet, then curves over back, and passes down into a long horizontal pipe of large diameter, which is laid upon the outer edge of the brick-work, and extends the whole length of the furnace stacks. This is called the hydraulic main, and into it all the volatile products from the retorts beneath are discharged. It is kept about half filled with water or the liquid tarry matters, and the dip pipes terminate about three inches below this fluid surface. By this arrangement the retorts are kept entirely independent of each other, while their products all meet in one receptacle.

In manufacturing gas it is found necessary to introduce the charge into the retorts already at a full red heat, and bring it as rapidly as possible to the high temperature required for producing the richest gaseous hydrocarbons. A low and slowly increasing heat causes the ingredients of the charge to form a large proportion of liquid and oily substances, and little gas. It is only while the coal is approaching a vivid red heat that the best gaseous mixtures are obtained; and even these are deteriorated by change in the composition of the olefiant and other rich gases of which they are in part composed, if the mixture is exposed to too high temperature, or remains in contact with red hot surfaces of iron. The duration of the charge used formerly to be from 8 to 10 hours; but from the observations of the qualities of the gases evolved at different stages of the process, it has gradually been reduced to 4 to 6 hours, varying according to the character of the coal employed. The richest gases are obtained in the first hour, and after this the proportional quantity per hour steadily diminishes at the same time that the quality gradually deteriorates. The temptation, however, to obtain the largest amount of a commodity which is sold only by measure, and to consumers who have no means of assuring themselves of its real quality, no doubt often leads to extending the operation to the separation of gaseous mixtures having very little illuminating power. The manufacturers knowing their materials, and checking their operations by regular photometrical tests, can control the quality of the product as they see fit.

In order that the least loss may be incurred in bringing the charge up to the proper temperature, the retorts are kept at a full red heat; and when ready for a new charge the mouth-piece is partially removed, and the gas that escapes is ignited. When the danger of explosion by sudden admission of air has passed the lid is removed, and the red hot coke is raked out and quenched with water.

The new charge is then introduced by means of a long iron scoop bent up at the sides, which is pushed into the retort, and being turned over, discharges its contents. The mouth-piece is then replaced, and tightly secured with a luting of clay or lime. It is obvious that the more perfectly the coal is freed from moisture, the better must be the gas; and if it were also first somewhat heated, the result would be still more satisfactory. The coals employed at the different gas works of the United States are generally mixtures of the caking coals of the interior, or of those of Richmond, Virginia, and of Nova Scotia, with cannel coal, which for the cities near the coast is imported from Great Britain, and for those in the interior is obtained from the mines of this coal in western Virginia and in Kentucky. The larger the proportion of cannel, the better should be the gas, under the same method of manufacture. In the works in New York city, the proportion of cannel is generally from one third to one fourth of the whole. Other establishments generally use a less proportion of it. The amount of gas it may produce varies with the kind of cannel from 9500 cubic feet to the ton to 15,000 cubic feet. The last is the yield of the Boghead cannel. In general, the greater the yield the better also is the quality of the gas, as is indicated by its increased specific gravity, that of the cannel last named being .752, while the gas from other cannels yielding about 10,000 cubic feet may not exceed .500. The best Newcastle coals are not inferior, either in the amount or quality of the gas they afford, to most of the cannels. They produce about 12,000 cubic feet of gas to the ton, and of specific gravity sometimes exceeding .550 or even .600. The specific gravity is not depended upon as a certain test of the quality of the gas, the density of which may be increased by presence of impure heavy gases, or even of atmospheric air; but it is resorted to only as an indication in the absence of more exact tests.

The coke obtained from the retorts, amounting to about 40 bushels to the ton of coals, furnishes all the fuel required for the fires beneath, and three times as much more, which is sold for fuel. As the volatile products pass through the hydraulic main, the principal portions of the oily and ammoniacal compounds are deposited in it; but some of these pass on in vapors, and would, if not separated, cause obstructions in the pipes in which they might condense in liquids and solids. They are consequently passed through a succession of tall iron pipes standing in the open air, and sometimes kept cool by water trickling down their outside. A pipe from the bottom of each pair conveys the condensed tar and ammonia into a cistern in the ground. To still further separate the condensable portions, the gas at some works is next passed into the bottom of a tower filled with bricks, stones, etc., among the interstices of which it finds its way up, at the same time that water constantly sprinkled on the top is working down and keeping the whole cool. The water washes away the remaining ammonia; but it is to be feared that it also removes some of the richest hydrocarbons, and the use of the wet scrubber, as it is called, is already abandoned at some of the gas works for similar methods of condensing, except that the water is dispensed with. The gas makes its exit from the top of the scrubber; and its passage being already somewhat impeded so as to throw considerable pressure back into the retorts, thus effecting chemical changes in the gas, which impair its quality, it is found necessary to introduce a revolving exhauster, which takes off this pressure, and at the same time propels the gas forward into the succeeding apparatus. This is first a purifier, the object of which is to arrest the carbonic acid and sulphurous gases. Dry quicklime, and also the solution of this in water, known as milk of lime, have the property of absorbing these gases as they are made to pass among the particles of the one spread upon shelves, or interspersed among a porous substance such as dry moss; or to bubble up through the aqueous solution. The lime as it becomes saturated with the impure gases is replaced with fresh portions.

The cleansing process is now complete, and the gas is in proper condition to be delivered to the consumer. It must first, however, be measured, that a record may be kept of the quantity produced, and it is next conducted into the great gas-holders in which it is stored. The measurement is effected by means of a large station meter, constructed on the principle of the small service-meters, with one of which each consumer is supplied. A revolving drum with four compartments of equal capacity is made to rotate in a tight box by the gas entering and filling one of these compartments after another.

Their capacity being known, and the number of revolutions being recorded by a train of wheel-work outside the box, the quantity of gas which passes through is exactly indicated. The largest meters pass about 650 cubic feet by one revolution of the drum, or about 70,000 cubic feet in an hour.

The gas-holders are the large cylindrical vessels of plate iron, the most conspicuous objects at the gas works. Each one is set with its open end down, and immersed in a cistern of water of diameter a little exceeding its own. It is buoyed up by the water, and also counterbalanced by weights passing over pulleys. The gas admitted under the inverted cylinder lifts this up, and fills all the portion above the water. The weight of the cylinder when the influx is shut off, and the discharge pipes are opened presses the gas out and through the mains to the points where it is consumed. The gas-holders of the largest works are of immense size. In Philadelphia, there is one 160 feet in diameter and 95 feet high, holding 1,800,000 cubic feet of gas. Even this is exceeded by one at the Imperial Gas Company's works, London, which is 201 feet in diameter, 80 feet high, and of the capacity of 2,500,000 cubic feet. This cost upward of $200,000; and contains 1500 tons of iron, 5000 cubic feet of stone work, and 2,000,000 bricks. No advantage is gained in a single structure of this immense size over several smaller ones. On the contrary, this involves heavy expenditures to protect them against the force of the wind, and render them manageable. Those of great height are made in sections, which shut one within another in descending, like the parts of a telescope. As each section is lifted in turn out of the water, its lower edge, which is turned up in an outward direction, forming an annular cup, includes a portion of water, into which the upper edge of the next lower section catches, being turned over inward for this purpose. A gas-tight joint between the two sections is thus formed.

To insure uniformity of pressure, as the gas enters the mains it is first made to pass through the apparatus called a governor, in which, according to the force or slowness with which it moves, it causes a valve to rise and partially close an aperture within the machine through which the gas flows, or to descend and open this aperture. The increase of pressure as the gas is carried to higher levels, amounting to one fifth of an inch of water in every 30 feet, renders it important in hilly towns to have governors upon different levels. In high buildings a very sensible difference is perceived in the force with which the gas issues from the burners on the different stories. This involves a waste of gas where the pressure is great, for under such conditions a considerable portion of that consumed adds little to the illuminating effect. Various governors or regulators have been devised for the use of consumers with a view of producing an increase of light with reduced consumption of gas; and when judiciously applied, some of them, as Kidder's and Stirling's, have proved very successful. The latter has been introduced into some of the public buildings of New York city, controlled by the Street Department, and according to the report of the Street Commissioner, the saving has been in many instances very remarkable.

Each consumer of gas is supplied with a meter, which is under the control of the gas company; and from its indications the amount furnished is determined by inspection every month.

Though in the use of gas the consumer is in a great measure dependent on the manufacturer as regards the economy of the light, there are several points, by giving personal attention to which, he may more fully realize the saving it affords. In the first place, he must be aware that every one employing this source of light uses it more freely than that derived from lamps and candles. It is enjoyed with so little trouble and apparent cost, that much more light is soon regarded essential, than was perfectly satisfactory under the old methods of producing it. He should next see that the area of the delivery pipe bears such proportion to the quantity usually required, that there is no undue pressure upon the burners, as is evident when the gas "blows" through them as it burns. This should be checked by shutting off a part of the supply by means of the stop-cock at the meter; and this should be looked to after every visit of the gas man to the meter. The regulator also is intended to remedy this over supply, but it may still be necessary to keep part of the gas turned off, and by so doing the regulator may be dispensed with. Attention should next be directed to the burners, that those of largest size, such as consume with the ordinary pressure six feet or more of gas an hour, should be placed only where the greatest quantity of light is required, and that burners of four feet, three feet, two feet, or even one foot an hour, be placed where the light they give will be sufficient. The burners called Scotch tips, giving what is called the fish-tail flame, are in common use, but a great variety of others have been contrived, and some of them are highly recommended for affording more light with the same amount of gas. All, however, are liable to become foul after a time, and should be occasionally cleaned or replaced. The iron of which they are made is corroded by the ingredients of the gas, especially when not in use, and air entering its elements form acid compounds with those of the gas which remain in the open portion of the pipe. The argand burner is recommended for the powerful and steady light it gives, but it is far from being economical, and moreover produces great heat. For a steady light Gleason's "American gas-burner" combines the advantages of brilliant light, steadiness of flame, and moderate consumption.

The quality of gas is determined either by analysis, or more conveniently by testing with the photometer its comparative capacity of producing light. The standard adopted for comparison is spermaceti candles, each one burning 120 grains in an hour. An argand burner consuming five feet of gas an hour (the quantity carefully proved by the meter) is used in making the trial; and the number of candles required to produce an equal amount of light indicates the quality of the gas. At the points of consumption this is sometimes inferior to that of the gas at the works before it enters the gas-holders and passes through the mains; but in very cold weather, by the condensation of the richest hydrocarbon vapor in the pipes, the gas that reaches the burners is poorer than that which left the works. Consequently these facts should be taken into consideration in estimating the quality of gas furnished by any establishment. Again, after a period of excessive cold weather, when the gas has burned dimly by the condensation of its best portions in the pipes—it may be to the extent at times of obstructing the flow through them—and with the return of milder weather the vapors are released and mix with the new gas, they sometimes so overburden this with an undue proportion of the richest compounds, that with the ordinary burners the gas cannot be consumed, and the result is a smoky flame, of which the consumers make great complaint, believing it to be caused by inferior gas. Such are some of the causes, over which the manufacturers have no control, that involve more or less irregularity in the quality of the gas supplied.

The gas produced at different works is of various qualities. That of the Manhattan Gas Light Company is rated at sixteen candles, and is probably as good as any furnished in our cities. It is tested daily with the photometer at their office, at the corner of Irving Place and Fifteenth street, New York. In England, the gas of the London works varies from eleven to eighteen candles. That of Liverpool is much better, sometimes being equal to twenty-two candles.

Other materials than coal have been applied to some extent in the United States for producing gas, chiefly for small supplies for single buildings. The most successful of these processes is that with rosin oil. The apparatus is exceedingly simple, and is placed in an apartment in an out-building. It consists of a stove containing a chamber in the top, into which the rosin oil is allowed to drop slowly. It is decomposed by the heat of the surface upon which it falls, and the gaseous products pass immediately through the pipes into the gas-holder, whence they are distributed as at the large gas works. The supply for a week may be made in less than an hour with very little attention from the person in charge. The gas is superior to that from coal, and the expense, not reckoning the cost of the gas-holder and the apparatus, is less than the price ordinarily paid for gas.

In Philadelphia wood has been successfully used at the Market street bridge works. Six retorts have been kept in operation with it for some time, and the yield and quality of the gas have proved very satisfactory. As in the use of coal, it is found necessary to charge the material into retorts already at a high heat, otherwise the gaseous products have little illuminating power. Gas thus made from pine wood has been found to contain 10.57 per cent. of olefiant gas, and that from oak 6.46 per cent.

Hydrocarbon Gas.—What is known as the hydrocarbon or water gas manufacture was introduced into Philadelphia in 1858, and according to the published reports, its application to lighting a portion of the Girard House in that city, proved for several months perfectly satisfactory. It was introduced into the town of Aurora, Indiana, in January, 1861, and according to the statements published in the Cincinnati *Daily Commercial*, the operation had been very successful. The light is described as very brilliant, and the gas almost free from odor. The process appears to be similar to that of Mr. White, of Manchester, England, which consists in the generation of the non-illuminating gases by the action of steam upon charcoal highly heated in a retort, the aqueous vapor being thereby decomposed, and various gaseous compounds produced by its hydrogen and oxygen combining with the carbon of the charcoal. If the operation is properly conducted these compounds should be almost entirely carbonic oxide and free hydrogen; if carbonic acid is produced, as it may well be, even to the extent of one per cent., it may involve the expense of purification by means of a lime purifier. These gases are immediately passed through another retort, in which the illuminating gases are generated, and mixing with them the whole is immediately swept forward out of the reach of the high decomposing temperature. The material employed for furnishing the illuminating gas is either rosin or rosin oil gadually dropped into the heated retort; and it is stated that various other carbonaceous substances, as the tar from the gas works and cheap greasy compounds, may be economically applied.

Although this method of producing gas has been highly recommended by eminent English authorities, especially by Dr. Frankland, an account of whose experiments and conclusions is given in the recent edition of Ure's Dictionary (London, 1860), vol. i., p. 778, it has not been adopted by gas companies, whose first interest it would be to avail themselves of such improvements, and it is reasonable to suppose there are some insuperable objections to it. Indeed, in the last edition of Clegg's "Treatise upon the Manufacture and Use of Gas," the subject is passed by with scarcely any notice, although it had been in the previous edition treated in detail and with commendation. In the English *Gas Journal*, it is decidedly condemned. No analyses of the gas thus produced in this country have ever been published, nor any reports of photometrical experiments that might establish its light-giving capacity. As the subject has attracted so much interest of late, and has given rise to extravagant expectations of cheap production of gas, it is very desirable that such trials and reports should be made by some competent chemist. In Philadelphia, the subject has given rise to a newspaper controversy, and the publications were embodied, in 1860, in a pamphlet entitled "The Water Gas Correspondence." They contained nothing, however, to determine the real merits of the gas.

Gas for Steamboats and Railroad Cars.—Several methods have recently been put in practice of furnishing gas for the convenience of passengers in steam vessels, or upon railroads. One plan is to place in the boats or under the cars large cases of sheet iron, each one provided with a diaphragm or partition of india-rubber across its upper portion. A connection being made between the receptacle under the diaphragm and the street main, the gas fills this portion of the case and the connection is then shut off. When required for use, the gas is forced out by the pressure of air uniformly applied upon the upper surface of the india-rubber sheet by means of a meter running by clock work. This method has so far been successful; but danger is apprehended by some that atmospheric air may find its way through the flexible sheets, all of which are more or less permeable when used to separate different gaseous compounds, and that an explosive mixture may thus be introduced. By another plan of a New York company, the gas by means of force pumps is compressed into strong cylindrical gas-holders made like the boilers of steam engines. The gas is thus made to occupy a diminished space in proportion to the pressure used, that of 20 atmospheres placing 1000 cubic feet of gas in 50 feet space. In Jersey City, where this method has been applied to furnishing gas for railroad cars, the pressure employed is about 450 lbs. upon the square inch. Under this pressure the gas is conveyed through pipes to the points where the cars receive from them their supplies. The gas by its elasticity presses through the burners, and uniformity of discharge while this force is constantly diminishing is secured by a governor or regulator constructed on the principle already described.

Gas for Fuel.—Besides its use for producing light, gas has lately been applied to other domestic purposes for the sake of the heat it can be made to afford in burning. It was thus first used by chemists, and mechanics, as bookbinders, then applied it in suitable stoves to the heating of such tools as they required of a high temperature. After this stoves were contrived on different plans in which various culinary operations might be conducted, and some also for warming rooms. Though it would appear to be an expensive fuel, it has been found for many purposes, in which only a certain amount of heat is required, and this for a short time, not merely exceedingly convenient, but even economical. No more need be consumed than is required to effect the desired purpose, and it is moreover applied directly to the object to be heated with little dispersion or waste of heat. But for warming rooms, it is objectionable, not only on account of its cost, but also from its vitiating the atmosphere by the large amount of the noxious gases produced by its combustion. If these are conveyed away by ventilating flues, they carry with them a considerable portion of the caloric set free. No doubt when gas is afforded at lower rates, means will be devised of applying it more advantageously to this purpose.

CHAPTER XI.

HYDROCARBON OR COAL OILS.

Notwithstanding the substitution in the cities and most of the towns of considerable size throughout the country of gas for oils, the demand for the latter has increased much faster than the supply, as is shown by the price for sperm oil being now more than three times what it was in 1843, when it brought about fifty-five cents per gallon. Besides its use for illuminating purposes, the consumption of oil is enormous for lubricating machinery. The railroads and steamboats, and the increasing numbers of large factories, demand such quantities of it that all the ordinary sources of supply were overtasked, and the whaling business formerly so prosperous in New England, has fallen off in the face of advancing prices, or been forced to gather itself in fewer centres, where by concentration of its operations the business could be conducted with the greatest economy. From many seaports of New England this business has quite disappeared, and the following changes in others are reported to have taken place between the years 1843 and 1859. In the former period New Bedford had 214 whale ships, and in 1859 the number had increased to 316. In New London, Conn., the number had increased from 45 to 56, and in Mattapoiset from 11 to 19. In other towns the number of ships had fallen off as follows: Nantucket, to 33 from 85; Sag Harbor, to 20 from 43; Warren, R. I., to 15 from 21, etc. At Fairhaven, 46 ships were owned at both periods. The manufacture of lard oil, which of late years has been extensively carried on in the Western states, failed to meet the increasing demands, when at last attention began to be directed to the extraction of oils from the bituminous coals and shales, by processes of recent introduction in France and England. The success attained by Mr. James Young, of Glasgow, in his treatment of the "Torbane Hill mineral," or Boghead cannel of Scotland, served more than any thing else to give encouragement to this enterprise. In 1854, according to the testimony of this practical chemist, in a lawsuit in London, he was producing about 8000 gallons a week of an oil he called paraffine oil, which sold for 5s. a gallon, the sales amounting in all to about $500,000 per annum, of which the greater portion was profit. Operations of a similar character had for some time previously been conducted upon a large scale at Autun, Department of the Saone and Loire, in France; the materials employed being highly bituminous shales, probably not essentially different from the Torbane Hill mineral, except in producing much less oil to the ton.

The first factory for making coal oil in the United States was established on Newtown Creek, Long Island, opposite New York city, and commenced operations in June, 1854. This was known as the Kerosene Oil Works, and was designed to work the Boghead cannel, or coal of similar character from the province of New Brunswick, or from the West, by the patented process of Mr. Young. In Kentucky, Ohio, Virginia, and Pennsylvania cannel coals were found of suitable qualities for this manufacture; and in 1856 the Breckenridge Coal Oil Works were in successful operation at Cloverport, on the Ohio river, in Breckenridge county, Ky. The same year a factory was built in Perry county, Ohio, by Messrs. Dillie and Robinson, and others rapidly sprung up in the vicinity of Newark, which soon became an important centre of this new business. In 1858, several large factories were built in New England, one in Boston, and one in Portland, Maine. The following is an incomplete list of factories which have been put in operation, not including some which have been destroyed by fire:—

TABLE OF THE COAL OIL WORKS OF THE UNITED STATES.

State.	Town or county.	Name of works.	No. of factories.	Daily capacity in 1860. Gallons.
Maine,	Portland	Portland Company	1	4000
Massachusetts,	Boston	Downer Kerosene Co.	1	4000
“	“	Page & Co.	1	600
“	“	Suffolk Company	1	300
“	“	Pinkham	1	..
“	“	Peasley	1	..
“	East Cambridge	E. Cambridge Company	1	800
“	New Bedford	New Bedford Company	1	300
Connecticut,	Hartford	Hartford Company	1	200
“	Stamford	Stamford Company	1	..
New York,	Newtown Creek, L. I.	Kerosene Oil Company	1	4000
“	Hunter's Point, L. I.	Luther Atwood	1	2000
“	“	Carbon Company	1	300
“	South Brooklyn	Empire State Company	1	300
“	“	Franklin Company	1	500
“	Williamsburgh	Long Island Company	1	..
“	“	Knickerbocker Company	1	..
“	“	Fountain Oil Co.	1	400
“	Harlem	Beloni & Co.	1	50
“	“	Excelsior Company	1	..
Pennsylvania,	Darlington, Beaver Co.	Anderson & Co.	1	..
“	“ “		1	..
“	Kiskiminitas	Aladdin Company	1	..
“	“	Lucesco Company	1	
“	Freeport, Armstrong Co.	North American Company	1	2000
“	New Galilee	New Galilee	1	..
“	Enon Valley	Enon Valley Company	1	..
Ohio,	E. Palestine, Columbiana Co.	Palestine Company	1	..
“	Canfield, Mahoning Co.	Cornell & Company	1	..
“	“ “	Sherwood	1	..
“	“ “	Phœnix	1	..
“	“ “	Mystic	1	..
“	“ “	Canfield	1	..
“	Cleveland	Dean	1	..
“	Zanesville	Brooks	1	..
“	“	Cox	1	..
	Newark, Licking Co.	Great Western	1	500
“	“ “	Three others	3	..
“	Steubenville, Jefferson Co.		2	..
“	Coshocton Co.		7	..
“	Columbus, Franklin Co.		1	..
“	Cincinnati	Grasseli	1	..
“	“	Western Company	1	..
“	“	Phœnix Company	1	..
“	Perry Co.	Robinson & Co.	1	..
Virginia,	Kanawha region	Falling Rock Company	1	..
“	“ “	Forest Hill Company	1	..
“	“ “	Greers	1	..
“	“ “	Great Kanawha Company	1	..
“	“ “	Staunton Company	1	..
“	“ “	Atlantic Company	1	..
“	“ “	Union Company	1	..
“	“ “	K. C. C. M. and O. M. Company	1	..
“	Preston Co.	Preston Company	1	..
“	Monongalia Co.	White Bay Company	1	..
“	Ritchie Co.	Ritchie Company	1	..
“	Wheeling	New York and Wheeling Company	1	..
“	Taylor Co.	Marion Company	1	..
Kentucky,	Maysville, Mason Co.	Union Company	1	..
“	“ “	Ashland	1	..
	Carried forward		69	

Note: the figure 2000 is bracketed against the four entries Aladdin Company, Lucesco Company, North American Company and New Galilee.

State.	Town or county.	No. factories.
	Brought forward	69
Kentucky	Cloverport, Breckenridge Co.	1
"	Covington and Newport, opposite Cincinnati	2
"	Owsley Co.	1
Missouri,	St. Louis	1
	Total	74

Supposing these works to average 400 gallons of light oil daily, the total production would be 32,400 gallons, or for 300 days in the year, 9,720,000 gallons. The figures of capacity of production represent the amount of light oils only; besides these about half as much more heavy oils and paraffine are obtained, which are more or less converted to useful purposes. The quantities named are approximate averages of the production, which it is impossible to give with accuracy, as the factories are constantly varying in their capacity by the introduction of more retorts and stills. They are presented rather to show the rapid progress made in this branch of manufacture than to attempt to give its real extent. A correct list of all the works cannot yet be made out.

HISTORY AND METHOD OF THE MANUFACTURE.

The possibility of extracting oil from bituminous minerals appears to have been known since the year 1694, a patent having been granted in January of that year to Martin Eele, Thomas Hancock, and William Portlock, for "a way to extract and make great quantities of pitch, tarr, and oyle out of a sort of stone, of which there is a sufficient found within our dominions of England and Wales." This stone proved to be a bituminous shale; and in 1716 it was again applied to similar use under another patent, granted to M. & T. Belton, of Shrewsbury. In the course of the eighteenth century the oily product obtained was employed to some extent as a medicine, under the name of British or petroleum oil. Though from time to time other patents were granted in England for the same process, the business never became of importance there until the successful trials were made by Mr. James Young, of Glasgow, upon the Boghead cannel already referred to. On the continent the subject was brought before the public by the researches of Baron Von Reichenbach in 1829, '30, and '31, when he discovered and separated numerous new compounds from the products of the slow distillation of bituminous substances. The compound he named eupion is the same thing as the rectified oil now known as coal oil, paraffine oil, kerosene, photogenic, pyrogenic oil, and by other local or commercial names. He appreciated its useful properties, and recommended the prosecution of further trials with the object of establishing the best mode of separating it. In France its character was understood in 1824, when a patent was granted for its manufacture; and in 1833 factories were in operation for producing it. In 1834 the method adopted by Selligue was first published, and in the specification of the patent granted to him, March 19, 1845, is a full account of the process as conducted in the works at Autun. This is still the best treatise published upon the manufacture, and notwithstanding the numerous patents which have since been issued, the improvements are limited to comparatively unimportant modifications of the apparatus. In the United States the first patent granted in this manufacture was in March, 1852, to James Young for his process, which in this country was first introduced at the kerosene oil works on Newtown Creek. The next year two patents were granted, in 1854 and 1855 one each, in 1856 six, in 1858 seven, and in 1859 twenty-two.

As mentioned in the preceding chapter, the products obtained by the distillation of bituminous substances vary according to the amount of heat employed and the manner of its application, whether sudden or gradual. Coals thrown into red hot retorts are resolved into large quantities of gas, with the production of inconsiderable quantities of oily compounds heavier in the aggregate than water, and called coal tar. They consist of a variety of hydrocarbons, as the fluids designated by the name of naphtha, the white crystalline substance called naphthaline, the very volatile fluid benzole, besides carbolic acid and a great number of other curious and interesting compounds of hydrogen and carbon. In general they contain a less proportional amount of hydrogen than the products obtained by slow distillation, the fluids are denser, and their boiling points higher.

When the bituminous substances are gradually and moderately heated in retorts, the production of gas is small, the carbon and hydrogen separating chiefly in the form of oily compounds of a greenish color, the specific gravity of which is less than water. These compounds form what is called crude coal oil, and are similar in appearance and composition to the natural petroleum, or rock oil, obtained in some places from the earth, as will be described in the next chapter. Benzole and naphthaline, products of the other method of distillation, are found, if at all, as a result of the employment of too high heat, and instead of the latter the waxy or spermaceti-like substance called paraffine is generated and is held in solution in the oils, from which it may be separated by repeated distillations, and draining off through filters and pressing out the fluid portions of the concentrated residues, at the lowest available temperatures. The oily products are divisible into a great number of distinct compounds by means of repeated distillations, each one being carefully conducted at a certain degree of temperature, and the product which comes over at this degree being kept by itself. But in the large way they are separated into only three classes, which are distinguished as the light oils for lamps, the heavy oils which are suitable for lubricating purposes, and paraffine. Sometimes a mixture of the heaviest oils and paraffine is made use of and sold for wagon grease and such purposes; and the first products which come over in the distillation are kept by themselves, and sold under the name of naphtha (or incorrectly as benzole) to be used as a solvent for the resins, caoutchouc, etc., and for removing grease spots from fabrics.

The proportions obtained from a ton of coal or shale are very variable. The Boghead cannel yields, in well-conducted operations, about 117 gallons of crude oil, from which the product of refined oil is about 60 gallons. It can be made to produce even 130 gallons of crude oil, containing a larger proportion of refined oil than the 117 gallons ordinarily obtained. The Breckenridge coal yields from 90 to 100 gallons of crude oil, and this 50 to 60 of refined oil. The Cannelton coal of Virginia is of similar quality to the Breckenridge cannel. The coals of Ohio run from 55 to 87 gallons of crude oils to the ton, and those of Darlington, Penn., from 45 to 55 gallons. Besides the oils there also come over from the retorts, as in the gas manufacture, a quantity of water rendered alkaline by the ammonia it holds. This collects at the bottom of the reservoirs into which the products are received, and the oil that floats upon the surface being removed the ammoniacal liquors are allowed to escape.

While the general plan of the operations is the same in all the factories, the apparatus is variously modified. By Mr. Young's process the coal is distilled in cast-iron ∩-shaped retorts, like those employed in making gas, and the volatile products are passed by a worm through a refrigerator kept at a temperature of about 55° F. The oils as they condense drop from the end of the worm into a receiver. Many patents have been granted in Europe and in this country for different kinds of retorts. Some are made of cylindrical form and set upright in the furnace; the charge is introduced at the top and drawn out, when exhausted, at the bottom; the volatile products making their exit either through pipes at the top or at different heights. Some have been constructed of fire clay instead of cast iron. In order that the charge may be uniformly heated, revolving cylindrical retorts have been contrived and patented, first in France many years ago, and recently in the United States. They are sometimes eight feet long and six feet diameter, suspended upon an axle at each end. They are charged through a manhole in the front end like the common horizontal retorts, and the vapors pass out through the axle at the opposite end, which is made hollow for this purpose. Retorts of the size named are charged with about a ton of cannel coal, and four such charges may be worked off in twenty-four hours. They revolve slowly, about twice in a minute, thus turning the charge over and causing it to be uniformly exposed to the fire beneath. At the Lucesco works, thirty miles above Pittsburg, on the Alleghany, ten large revolving retorts are stated to be in operation, each one of the capacity of two and a half tons. They are recommended for the rapidity with which the process is conducted, and the large amount of oil obtained to the ton of coal while they continue in good order; and on the other hand it is objected to them that the coal is apt to be ground to powder, and the dust is carried along with the vapors, obstructing the condensing worm and adding to the cost of purification. They are, moreover, expensive to construct and liable to get out of order.

By all these arrangements the fire which causes the expulsion of the volatile matters is outside of the retorts. But the same object is also attained by the use of ovens and pits similar to those used for producing charcoal and coke, in which the material operated upon is itself partially consumed, to generate the heat required to drive off so much of its volatile constituents as may escape combustion. Kilns thus designed for extracting coal oils have been in use in this country and in Europe; and in Virginia, near Wheeling, the plan has been adopted of distilling the coal or shale in large pits dug in the ground of capacity sufficient to contain 100 tons of the raw material. These are covered with earth, and the fire being started at one end, the heat spreads the volatile products forward, and they are drawn out at the opposite end by the exhausting action caused by a jet of steam, and received into suitable condensing apparatus. Some of the kilns are constructed to be fired at the bottom, and the vapors then pass upward through the charge, and are conveyed in pipes from the top to the condensers. The kilns of the Kerosene Oil Company, patented by Mr. Luther Atwood, are made open at the top, and a downward draught through the charge, which is fired on the upper surface, is produced by a steam jet thrown into the eduction pipe that passes out from the bottom of the kiln. A partial vacuum is thus produced, causing a current of air to flow in from the kiln. At the works of this company there are 18 of these kilns in shape like a circular lime kiln, built of ordinary brick and lined with fire brick. They are 20 feet high and 12 feet diameter inside, each one having a capacity of over 25 tons of coal. When this amount of Boghead cannel is introduced it is covered with about four tons of Cumberland coal and a quantity of pine wood. This is set on fire, and at the same time the steam jet is let on. The heated gases from the combustibles above pass through the bituminous materials below; but little air reaches these that is not already deprived of its power of sustaining further combustion. The volatile products are gradually expelled before the slowly increasing heat, and the operation is not completed till the expiration of four days. It is hastened or checked, as may be necessary, by means of the steam jet by which the draught is controlled. What is left in the kiln is unconsumed coal and ashes —no good coke is produced. The condensers at these works are tall cylinders of boiler-plate iron. Passing through a succession of these the vapors collect and trickle down their sides, and the mixed oily and aqueous products are received into iron vats placed in the ground. The uncondensable gases escape into the open air from the top of the last of the cylinders. From the vats the oil rising to the surface flows over into a conduit that leads to a large cistern in the ground of the capacity of 40,000 gallons. The water at the same time is discharged by a pipe, one end of which is at the bottom of the vat, and the other is bent over its upper edge, the flow being caused by the difference of an inch in the elevation of the surface of the two vats. Some oil is carried over into the second vat, and this is separated by a repetition of the same arrangement, and so on through several vats, till the ammoniacal waters are finally allowed to escape after being first received into a large cistern, where some oil still collects upon the surface, and is removed by occasional skimming.

Still another method of conducting the dry distillation is by the introduction of highly heated steam into the retorts, as patented by Mr. William Brown, in 1853, in England and in this country, though this seems also to have been used in the original operations of Selligue in France. The effect of the steam is to aid in heating the charge, while at the same time the vapors are taken up and carried along by it, and protected from being burned or decomposed by remaining in contact with the hot surfaces of the retort. In the subsequent distillation of the crude oil, high steam is similarly applied in the stills.

Nearly the same process of refining is practised at all the factories. The crude oil is pumped up into large stills of cast or boiler-plate iron, with cast-iron bottoms two inches thick. The capacity of these at the works above referred to is 1500 gallons each, and the time required for distilling off this amount of oil is 24 hours. They are heated by fires of anthracite and coke, the latter being itself a product of the distillation and obtained from the inside of the stills after each heat. It is deposited from the crude oil and forms a solid and extremely hard incrustation which is sometimes nearly a foot thick upon the bottom of the stills. It is a much superior coke to that obtained from the gas retorts, and in its structure is coarsely honey-combed in the upper or last formed portions, gradually growing closer and more compact toward the bottom upon which it adheres. The distillation should be conducted at a temperature not exceeding 800° F., and the process may be rendered continuous by admitting a small stream of oil into the stills. The vapors passing through the goose-neck are condensed in a long worm kept in the water condenser, which should be, in the latter part of the distillation, at a temperature of 80° or more. It is necessary to guard against so low temperature as might cause the paraffine to solidify in the worm, which by stopping the flow of the products might result in blowing up the still. The heat is carefully regulated so that the oil comes over uniformly, flowing from the end of the worm in a steady stream. It is still of a greenish color, with more or less of its peculiar, disagreeable odor. Yet it is evidently purified to a considerable extent by its separation from the free carbon and other impurities, usually amounting to 10 or 12 per cent., which are left behind in the stills. The oils are next pumped into large cylindrical cisterns called agitators, to undergo the chemical treatment, which is in general the same as that practised by Selligue. An addition is made to them of a quantity of sulphuric acid, it may be to the amount of 5 per cent. The mixture is then violently agitated or made to sweep rapidly round by stirrers in the cisterns, moved by machinery. The pure oil and paraffine are unaffected by the chemical agents, but the carbonaceous particles and coloring matters are more or less charred and oxidized, and their condition is so changed that when the mixture is left for some hours to repose, they subside in great part together with the acid, and these can then be drawn off leaving the partially purified oil in the upper portion of the cisterns. This is next washed with about one fifth its quantity of water, which removes the soluble impurities and a portion of the remaining acid. These, after subsiding, being drawn off, a strong lye of potash or soda is introduced into the oil, which neutralizes and fixes what acid remains, and causes the precipitation of further portions of the coloring and tarry matters. The mixture is again agitated and is then left six hours to repose, after which the sediment being drawn off, it is again washed with water, and this too, with the matters it has taken up, are drawn off. In some places chalk or lime has been employed instead of the alkaline lye to neutralize and fix the acid, and the chemical treatment, as it is called, is in other respects variously modified. Though this has been designated the "cold" treatment, the temperature should not be allowed to fall below 90° during these processes.

At last the oils freed from most of their impurities are introduced into stills like those of the first set. The product which first comes over is a very light oil somewhat discolored, which is soon followed by a clear oil having little odor. This gradually increases in density from 0.733 to 0.820, up to which point the mixture of oils is classed as illuminating, and is without further preparation sufficiently pure to be at once barrelled for the market. After this the increasing depth of the color and the greater density of the product indicate that the light oils have been nearly exhausted, and the remaining portions are hence kept by themselves to afford the heavy lubricating oils, and also it may be, by means of fractional distillation, the additional quantities of light oils they still contain, and finally the paraffine which is chiefly concentrated with the last portions. This substance when separated from the oils by filtration and pressure at low temperatures, is of a dark color and somewhat offensive odor; and to bleach and deodorize it have proved to be somewhat troublesome and expensive operations. Exposure to the sunlight has a bleaching effect; but the processes for this purpose have not yet been made public. When obtained perfectly pure and white, difficulties have been encountered in running it into candles, which are not common to other materials used for this purpose. When cooled in ordinary moulds the paraffine would crack in lines radiating from the wick, and the exterior would present a clouded, mottled surface. The method of obviating this difficulty, as described in the French work, "Le Technologiste," of 1859, is to use a mould in two parts, that part for the point of the candle working in the other like a piston. These moulds being brought to the temperature of melted paraffine are filled and then immediately plunged into water at nearly the freezing point. Having remained 3 or 4 minutes, they are taken out and exposed to a current of cool air for 15 or 20 minutes. The candles then come out, as the movable part of the mould is pushed in, free from defects. This method is successfully introduced into the United States. Paraffine candles have been made at some of the coal oil works, as at those of New York, New Bedford, and Portland. They are of beautiful appearance, resembling the best sperm candles, and at the same time are more economical for the amount of light they afford. The oil that is pressed out from the paraffine is useful chiefly as a lubricator, and from the low temperature at which it is obtained, if for no other reason, it is insured against chilling in cold weather. The residue in the stills, is a mixture of the tarry matters with the portion of the chemical ingredients that was introduced with the oils. For this no use is found. The heavy oils find their principal application in lubricating machinery, and large quantities are consumed for this purpose upon the Western railroads. The heavier natural oils of Ohio, when washed clean from the sand that comes up with them, are also very well adapted for this use; but it is found advantageous to mix either the crude or manufactured article with an equal quantity of lard oil. The petroleum corrects the tendency of this to gum and chill, while it receives additional body from the lard oil. Another use for the heavy oils is for cleansing wool in the woollen factories, and where they have been tried for this purpose, they have been preferred to other oils. In currying leather, also, they are said to have proved a good substitute for fish oil. Experiments have been made with them in Ohio, for mixing paints, and the crude heavier kinds, as those of Mecca, treated in the same manner as linseed oil, boiling them with dryers, etc., formed a good body, covered the wood well, dried rapidly and perfectly, and formed a smooth, hard surface, retaining no odor. The great abundance of the supply of petroleum at the West has led to some speculation as to the probability of the hydrocarbon oils being used for fuel for steamboats, locomotives, and wherever a highly concentrated, portable, and manageable fuel is required. For domestic uses, also, such as require a fire only a little while at a time, the petroleum might be conveniently used in suitable stoves in the same manner that gas is applied to the same purpose. But experiments are wanting to establish the rate per gallon at which it might enter into competition with other fuels upon a larger scale. Besides the heavy and light oils, no other valuable products result from the distillation of the coal oils. Benzole is not a product of this process. It belongs, together with a special class of hydrocarbons designated as the benzole series, to the tar of the gas works; and if ever obtained in the coal oil distillation, it must be by bad management and the use of excess of heat. Some of the light oils, which first come over in the distillation, are often sold as benzole, and are used for removing grease spots—a purpose they answer nearly as well as benzole itself.

The light oils are superior in many respects to any other portable materials employed for illumination. The light they give is exceedingly brilliant, and at the same time pleasant to the eye. They have not the disagreeable odor of sperm oil, nor when spilled upon articles of dress or furniture are the spots difficult to remove. At present prices, the cost of the light is less than half that produced by sperm oil. Coal oils are free from the danger of explosion, which all the so-called "burning fluids" are liable to; and on the score of prudence and humanity their use ought to be encouraged in the place of these dangerous preparations, the employment of which, in spite of the numerous and ingenious safety lamps and expedients to guard against explosion, is continually resulting in terrible accidents and loss of life. The only objection to the coal oils, and the only cause that checks their more general use in the place of all other portable means of producing light, is that the lamps in which they are burned are somewhat more expensive than other lamps, and are incumbered with a glass chimney, which is found necessary for producing a flame free from smoke. Possibly some lamps may yet be contrived in which thorough combustion and a clear flame may be obtained without this inconvenient appendage. In the use of the coal oils a very mistaken preference is given by consumers to the most highly rectified—such as are clear like water; and these are now selling freely at 75 cents a gallon, while the oils of a slightly yellow color hardly find a sale at 60 cents. As regards illuminating power, the latter are actually to be preferred to the former at the same cost, so that the preference given to the clear oils is merely for their appearance.

CHAPTER XII.

PETROLEUM, OR ROCK OIL.

The occurrence of an oily fluid oozing in some regions from the surface of the earth, coming out with the springs of water, and forming a layer upon its surface, has been noticed from ancient times, and the oil has been collected by excavating pits and canals, and also by sinking deep wells. Bakoo, a town on the west side of the Caspian Sea in Georgia, has long been celebrated for its springs of a very pure variety of petroleum or naphtha, and the annual value of this product, according to M. Abich, is about 3,000,000 francs, and might easily be made as large again. Over a tract about 25 miles long and half a mile wide, the strata, which are chiefly argillaceous sandstones of loose texture, belonging to the medial tertiary formation, are saturated with the oil, and hold it like a sponge. To collect it large open wells are sunk to the depth of 16 to 20 feet, and in these the oil gathers and is occasionally taken out. That obtained near the centre of the tract is clear, slightly yellow, like Sauterne wine, and as pure as distilled oil. Toward the margins of the tract the oil is more colored, first a yellowish green, then reddish brown. In the environs of Bakoo are hills of volcanic rocks through which bituminous springs flow out. Jets of carburetted hydrogen are common in the district, and salt, which is almost always found with petroleum springs, abounds in the neighborhood.

Another famous locality of natural oils is in Burmah, on the banks of the Irrawaddy, near Prome. Fifty years ago it was reported there were about 520 wells in this region, and the oil from them was used for the supply of the whole empire and many parts of India. The town of Rainanghong is the centre of the oil district, and its inhabitants are chiefly employed in manufacturing earthen jars for the oil, immense numbers of which are stacked in pyramids outside the town, like shot in an arsenal. The formation containing the oil consists of sandy clays resting on sandstones and slates. The lowest bed reached by the open wells, which are sometimes 60 feet deep, is a pale blue argillaceous slate. Under this is said to be coal (tertiary ?) The oil drips from the slates into the wells, and is collected as at Bakoo. The annual product is variously stated at 412,000 hogsheads, and at 8,000,000 pounds.

The Burmese petroleum has recently been imported into Great Britain, and is employed at the great candle manufactory of Messrs. Price & Co., at Belmont and Sherwood. It is described as a semi-fluid naphtha, about the consistence of goose grease, of a greenish brown color, and a peculiar, but not disagreeable odor. It is used by the natives, in the condition in which they obtain it, as a lamp-fuel, as a preservative of timber against insects, and as a medicine. It is imported in hermetically closed metallic tanks, to prevent the loss of any of its constituents by evaporation. At the works it is distilled first with steam under ordinary pressure, and then by steam at successively increasing temperatures, with the following results:—

Temperature. Fahr.	Proportional product.	Character of product.
Below 212°	11	Mixture of fluid hydrocarbons free from paraffine.
230° to 293°	10	" " " containing a little paraffine.
293° to 320°	..	Distillate very small in quantity.
320° to 612°	20	Containing paraffine, but still fluid at 32°.
About 612°	31	Product which solidifies on cooling, and may be submitted to pressure.
Above 612°	21	Fluids with much paraffine.
	3	Pitchy matters.
	4	Residue of coke, and a little earthy matter in the still.

Nearly all the paraffine may be separated from the distillates by exposing these to freezing mixtures; and the total product of this solid hydrocarbon is estimated at 10 or 11 per cent.

Many other localities might be named which furnish the natural oils upon a less extensive scale, as in Italy, France, and Switzerland. In Cuba impure varieties of bitumen are met with flowing up through fissures in the rocks and spreading over the surface in a tarry incrustation, which sometimes solidifies on cooling. In the island of Trinidad, three fourths of a mile back from the coast, is a lake called the Tar Lake, a mile and a half in circumference, apparently filled with impure petroleum and asphaltum. The latter, more or less charged in its numerous cavities with liquid bitumen, forms a solid crust around the margin of the lake, and in the centre the materials appear to be in a liquid boiling condition. The varieties contain more or less oil, and methods have been devised of extracting this; but the chief useful application of the material seems to be for coating the timbers of ships to protect them from decay. By the patented process of Messrs. Atwood of New York, the crude tar of this locality having been twice subjected to distillation, and treated with sulphuric acid and afterward with an alkali, as in the method of purifying the coal oils, is then further purified by the use of permanganite of soda or of potash. Being again distilled it yields an oil of specific gravity 0.900, which is fluid at 32° F., and boils at 600° F.

In the United States the existence of petroleum has long been known, and the article has been collected and sold for medicinal purposes; chiefly for an external application, though sometimes administered internally. It was formerly procured by the Seneca Indians in western New York and Pennsylvania, and was hence known as Seneca or Genesee oil. At various places it was recognized along a belt of country passing from this portion of New York across the north-west part of Pennsylvania into Ohio. In the last-named state it was obtained in such quantity in the year 1819, by means of wells sunk for salt water, that it is a little remarkable the value of the material was not then appreciated, and the means perceived of obtaining it to any amount. The following description of the operations connected with the salt borings then in progress on the Little Muskingum, in the south-western part of the state, written in 1819, was first published in the *American Journal of Science* in 1826: "They have sunk two wells which are now more than 400 feet in depth; one of them affords a very strong and pure water, but not in great quantity. The other discharges such vast quantities of petroleum, or as it is vulgarly called, 'Seneka oil,' and besides is subject to such tremendous explosions of gas, as to force out all the water and afford nothing but gas for several days, that they make but little or no salt. Nevertheless, the petroleum affords considerable profit, and is beginning to be in demand for lamps in workshops and manufactories. It affords a clear bright light, when burnt in this way, and will be a valuable article for lighting the street lamps in the future cities of Ohio." Several coal-beds were penetrated in sinking these wells.

In north-western Pennsylvania the existence of oil in the soil along the valleys of some of the streams was known to the early settlers. One stream, in consequence of its appearance in the banks, was called Oil Creek. In other localities also it was noticed, and similar occurrences of oil were observed at some places in western Virginia and eastern Kentucky. At Tarentum above Pittsburg, oil was obtained by boring about the year 1845. Two springs were opened in boring for salt, and they have continued to yield small quantities of oil, sometimes a barrel a day. This has been used only for medicinal purposes. On Oil Creek two localities were especially noted, one close to the northern line of Venango county, half a mile below the village of Titusville, and one 14 miles further down the stream, a mile above its entrance into the Alleghany river. All the way below the upper locality through the narrow valley of the creek are ancient pits covering acres of ground, once dug and used for collecting oil after the method now practised in Asia. Cleared from the mud and rubbish with which they are mostly filled, some of them are found to be supported at the sides with logs notched at the ends as if done by whites, and it has been supposed by some that this is the work of the French who occupied that region the first half of the last century. Others think the Indians dug the pits, and in proof of this they cite the account given by Day, in his "History of Pennsylvania," of the use of the oil by the Seneca Indians as an unguent and in their religious worship. They mixed with it their paint with which they anointed themselves for war; and on occasions of their most important assemblages, as was graphically described by the commandant of Fort Duquesne in a letter to General Montcalm, they set fire to the scum of oil which had collected on the surface of the water, and at sight of the flames gave forth triumphant shouts which made the hills re-echo again. In this ceremony the commandant thought he saw revived the ancient fire worship, such as was once practised in Bakoo, the sacred city of the Guebres or Fire Worshippers.

The old maps of this portion of Pennsylvania indicate several places in Venango and Crawford counties where oil springs had been noted by the early settlers. They made some use of the oil, collecting it by spreading a woollen cloth upon the pools of water below the springs, and when the cloth was saturated with the oil wringing it out into vessels. The two springs referred to on Oil Creek furnished small quantities of oil as it was required, and from a third, twelve miles below Titusville in the middle of the creek, the owner has procured 20 barrels or more of oil in a year.* In 1854 Messrs Eveleth and Bissell of New York purchased the upper spring, and leased mineral rights over a portion of the valley. They then obtained from Prof. B. Silliman, jr., of New Haven a report upon the qualities of the oil, and in 1855 organized a company in New York called the "Pennsylvania Rock Oil Company," to engage in its exploration. The same year a new company under the same name, formed in New Haven and organized under the laws of Connecticut, succeeded to the rights of the old company; but for two years they made no progress in developing the resources of the property they had acquired. In December, 1857, they concluded an agreement with Messrs. Bowditch and Drake of New Haven to undertake the search for oil. To the enterprise of Col. E. L. Drake, who removed to Titusville and prosecuted the business in the face of serious obstacles, the region is indebted for the important results which followed. After a well had been sunk and curbed near the spring, ten feet square and sixteen feet deep, boring was commenced in the spring of 1859, and on the 26th of August, at the depth of seventy-one feet, the drill suddenly sank four inches, and when taken out the oil rose within five inches of the surface. At first a small pump threw up about 400 gallons daily. By introducing a larger one the flow was increased to 1000 gallons in the same time. Though the pumping was continued by steam power for months no diminution was experienced in the flow. The success of this enterprise produced great excitement, and the lands upon the creek were soon leased to parties, who undertook to bore for oil for a certain share of the product, sometimes advancing besides a moderate sum to the owner.

The country was overrun by explorers for favorable sites for new wells, and borings were undertaken along the valley of the Allegheny river, and up the French Creek above Franklin. The summer of 1860 witnessed unwonted activity and enterprise in this hitherto quiet portion of the state, where the population had before known no other pursuits than farming and lumbering. Every farm along the deep, narrow valleys, suddenly acquired an extraordinary value, and in the vicinity of the most successful wells villages sprung up as in California during the gold excitement, and new branches of manufacture were all at once introduced for supplying to the oil men the barrels required for the oil and the tools employed in boring the wells. From Titusville to the mouth of Oil Creek, about 15 miles, the derricks of the well borers were everywhere seen. On the Alleghany river the number below Tidioute in Warren county, south into Venango county, showed that this portion of the district was especially productive, and the same might be said of the vicinity of the town of Franklin, both up the Alleghany river and French Creek. The wells had amounted to several hundred, or according to one published statement, to full 2000 in number before the close of the year, and from an estimate published in the *Venango Spectator*, (Franklin) 74 of these on the 21st of November were producing the following daily yield :—

	No. of wells.	Prod. bbls.
On Oil Creek,	33	485
" Upper Alleghany river,	20	442
Franklin,	15	139
Two Mile Run,	3	64
French Creek,	3	35
Total,	74	1165

The capacity of the barrel is 40 gallons, and at the low estimate of only 20 cents the gallon the total value of the daily product is not far from $10,000. The depth of the wells is in a few instances less than 100 feet. The shallowest one reported, belonging to the Tidioute Island Oil Company, was 67 feet deep, and its product was 30 barrels a day. In general the depth is from 180 to 280 feet; one well in Franklin is 502 feet in depth, and one on Oil Creek 425 feet. The deepest wells are not the most productive, and the fact of their being extended beyond the ordinary depths may generally be considered an evidence of their failure to produce much oil. There are exceptions, however, to this, one of the deepest wells, that of Hoover and Stewart, three miles below Franklin, producing largely of excellent oil.

* See a pamphlet by Thomas A. Gale, published in Erie, Penn, 1860, entitled "Rock Oil in Pennsylvania and elsewhere."

The selection of localities for boring is very much a matter of chance. Proximity to productive wells is the first desideratum; but this, when attainable, is not always attended with success. The oil does not appear to be spread out, as the rocks lie in horizontal sheets, or if so there are many places where it does not find its way between the strata, and wells near together from which oil is pumped do not always draw upon each other. No doubt the system of crevices and pervious strata through which the oil flows in its subterranean currents, is very irregular and interrupted. The valleys to which the operations are limited are narrow, and are bounded on each side by hills, the summits of which, from 250 to 400 feet above the bottoms, are on the general level of the country. The increased expense that would be incurred in sinking from the upper surface and in afterward raising the oil to this height, as also the uncertainty of finding oil elsewhere than in the valleys, have so far prevented the explorations being extended beyond the creek and river bottoms; but it cannot be long before the capacity of the broad districts between the streams to produce oil is thoroughly tested. At present the most favorable sites are supposed to be near a break in the hills that form the margin of the valley, as where a branch comes into the main stream. An experiment is already undertaken to test the high grounds west of Tidioute branch.

As the bituminous coals are known as a source of hydrocarbon oils, it is natural to suppose that the springs of oil found near the coal region are fed from the coal-beds or bituminous shales of the coal formation. But it happens that only a few oil springs of western Pennsylvania have been struck in the coal-measures themselves, and that some of these are sunk into the underlying groups of rock to reach the supplies of oil. The oil districts are in general outside of the coal-field and upon the outcrop of lower formations which pass beneath the coal-measures, the whole having a general conformity of dip. Hence the slope of the strata is toward the coal, and an obstacle is thus presented to the flow of the oil from the coal-field toward its margin; and though under some circumstances the elastic pressure of the carburetted hydrogen gas might force the oil considerable distances from its source, it is hardly to be supposed that this should first find its way down into lower formations and then be carried many miles (30 to 50) and find its outlet in another district, rather than to the surface at some nearer point. The strata of north-western Pennsylvania lie nearly horizontally, their general inclination being toward the south. The highest rock upon the summits of the hills of the oil region is the conglomerate or pebbly rock (the floor of the coal-measures). Beneath this are series of thin bedded sandstones, slates, and shales, alternating with each other with frequent repetitions. The shales, often of an olive green color, are readily recognized as belonging to the Chemung and Portage groups of the New York geologists—a formation which overspreads this portion of the country, extending in New York two thirds of the way toward Lake Ontario and as far east as Binghamton. It is also continued through Ohio, crossing the Ohio river at Portsmouth, and in this state is known as the Waverley series. Under this is a heavy bed of bituminous shale, 200 or 300 feet thick, called in Ohio the black slate and in New York the Hamilton shales. This group contains an immense amount of carbonaceous matter, and oil is often disseminated through it. Sometimes it runs out in springs and finds an outlet by the occasional fissures in the beds. Dr. J. S. Newberry, who has given much attention to this subject, is of opinion that this formation contains sufficient carbonaceous material to be the source of the oil, and that the more porous and open shales and sandstones of higher formations are its reservoirs. Such is the geological formation of the Seneca oil region and of the oil springs of Canada West, which are the districts affording this product most remote from the coal-field. But from whatever source the oil may be derived, its origin is at the best very obscure, and little light can be thrown upon the probability of the supply long enduring the heavy drain made upon it by hundreds of wells worked by powerful steam pumps. But though actual experience alone must determine the extent of the quantities of oil stored up and the period they will last, there is certainly encouragement to be drawn from the never-failing yield of the oil districts of Asia, which for centuries have poured forth without stint their rivers of oil.

The sinking of wells is conducted after the usual method of boring artesian wells. After much uncertain consideration of the chances, a particular spot is selected, more, perhaps, from the hope of its being the right one than from any very practical grounds for the choice; but as the oil flows only in crevices among the strata, the location is frequently determined—other things being equal—by the prospect of reaching the rock at a few feet from the surface, and thereby avoiding the necessity of sinking an open well or driving pipes through unknown obstacles down to the rock. If the bed rock is found within ten or fifteen feet, the boring is begun at once. The derrick being raised, an elm, hickory, hemlock, or other elastic timber is cut down, some 25 or 30 feet in length. The larger end is fixed in a notch of a tree, or heavy post planted in the ground, and another post is set under it at a distance from the but determined by the elasticity of the timber. The spring of the pole should be sufficient to raise the drill quickly, with its iron connecting rods, weighing often 300 pounds. The rods are suspended from the free end of the pole by a swivel or simple bolt-head, turning freely around. At the commencement of the boring, the rods being very short do not weigh more, including the drill, than 70 or 80 pounds. Two men, therefore, jerk them forcibly down, to increase the momentum of the drill; the spring of the pole immediately raises the drill for the next stroke, while at each blow a man gives it a slight turn so that it may cut a round hole. Several other methods are employed for making the pole spring; by one, which is conveniently worked without employing steam or horse power, a sort of double stirrup is suspended from the pole into which two men place each a foot, and pressing the stirrup suddenly down it immediately springs up again with the drill. This is much used, though some wells are sunk by horse-power machinery, and some by steam engines of four or five horse power.

As the well is constantly deepening, while the stroke of the spring-pole (about 30 inches) remains constant, a vertical adjusting screw about 18 inches in length is attached to the end of the spring-pole; the rope is clamped to the lower end or nut of this screw, and then extended to the pulley above. As the well deepens, a slight turn of the screw lowers the rope with the rods attached to it, and thus keeps the drill always free to fall to the bottom with an equal stroke. The work is continued, by a constant succession of strokes, to a depth of about fifty feet, successive lengths of iron rods being screwed on as the hole deepens—increasing the weight of the tools to about 300 pounds. The use of any additional rods is then dispensed with, and the upper rod is suspended by a rope attached to the spring-pole, and continued above the pole around a pulley and windlass, used to raise the boring tools when it is necessary to draw them out. They are drawn up in this manner at intervals of an hour or two, in order to sharpen and temper the drill, and to make room for the sand pump. This is a thin iron tube, a little more than half the diameter of the hole, with a simple valve at the bottom opening upward. It is lowered by a cord to the bottom of the well, then raised up with a jerk, and suffered to drop again by its own weight. This is repeated quickly eight or ten times; a whirl is thus produced in the water below which stirs up the mud and small pieces of broken stone; as the tube drops, the mud and small stones enter the open valve and are retained when the tube is drawn out.

The jarrers are employed to increase the force of the spring-pole when the drill happens to be wedged in the hole by broken pieces of stone or by other obstructions. They are two rectangular links about 18 inches in length, formed of stout bars of iron, and connecting the upper rods with the lower. When the drill descends to the bottom, the upper link, as it descends, slips down eight or ten inches in the lower link, and when the pole springs up the upper link has the advantage of moving through this space, and thereby giving a sudden upward jerk to the drill rod. The force of this upward jerk is greatly increased by a heavy rod introduced above the upper link, and which, as it moves up, lends its momentum to the stroke.

The hole is carried down by three men at different rates according to the nature of the strata encountered, varying from a foot or less to six feet in a day. In the hard sandstones of quartz pebbles firmly united together, two or three inches sinking in 12 hours may be all the progress practicable. The material brought up is carefully scanned for any oily appearance indicating the proximity of oil, and the well is watched to observe if any carburetted hydrogen gas escapes from it, which is considered a favorable sign.

The process of drilling in the rock is considered by all concerned in boring for petroleum, a very simple and even welcome operation, especially when contrasted with the uncertainties and apprehensions that surround the driving of pipes. At the outset, the cost of four iron pipes and bands long enough to reach a depth of forty feet, is equal to that of a complete set of boring tools with the rods and ropes sufficient to bore half a dozen wells of 300 feet each in depth. There is often great uncertainty of knowing how deep the pipes will have to be driven, and it is impossible to foresee the various obstacles through which they have to go. When the work has gone down successfully 70 or even 100 feet, the lowest pipe is often suddenly broken or takes an oblique direction. The pipes in the ground are then abandoned, and a new set driven in another place, although in several instances pipes reaching 60 feet in depth have been pulled up by a lever and axle, with chains or rods attached to a lewis wedge driven into the bottom pipe.

The pipes are of cast iron, generally ten or twelve feet long, about five inches bore, and the shell full an inch thick. The lower end of the first pipe is not sharpened, but is driven down blunt as it comes from the mould. The pipes are fastened together in the simplest manner possible, by wrought-iron bands, the ends being turned off, leaving a neck somewhat larger than the interior diameter of the bands, to receive them when expanded by heat.

Through common earth or gravel the pipes are forced down by the ordinary process of pile-driving; but when large stones are encountered, or round boulders as large as a man's head, there is great risk of breaking or turning the pipes. As soon, therefore, as the pipes meet with any great resistance the driving is suspended and the drill is applied to break up the stone or to bore a circular hole in it, which is afterward reamed out as large as the interior diameter of the pipes. The driving is then resumed, and in soft shales the pipes are often forced on, crushing down the sides of the hole, and making their way through to the depth of 12 or 15 inches in the rocky stratum.

The cost of boring a well 200 feet deep is generally estimated at from $1000 to $1500. The latter sum includes the cost of all the tools and materials, and also of a small steam engine, a large tank of pine plank, in which the product is collected for the oil and water to separate, and it also allows for such accidents and delays as are common to these operations.

When the oil is struck it often rises up in the well, sometimes flowing over the top, and in several instances it has burst forth in a jet and played like a fountain, throwing the oil mixed with water high up into the air. Such jets have rarely lasted long, and are usually interrupted by discharges of gas, the elasticity of which drives out with violence the fluids mixed with it, as champagne wine is projected from a bottle on removing the cork. Hundreds of barrels of oil have, however, been wasted at some of the wells for want of means to collect it or stop its flow in its sudden first appearance. At Williams' well, half a mile below Titusville, about 100 barrels of oil were collected the first night the oil was reached, and a large quantity besides was lost. A similar event occurred near Tidioute, the oil rushing up so violently as to knock over the laborer who held the drill and to pass through the derrick and over the trees around. After a time the spouting wells become quiet and the oil settles down, so that it has to be raised by pumping. The pumps are contrived to work at any depth, and by men, or by horse power, or the steam engine. For a time at some of the wells the product has been water alone or water mixed with a little oil; and after pumping several days this has given place to oil with a moderate proportion of water. If the pumping be suspended for a day water accumulates, and it may be several days before this is drawn out and the former yield of oil recovered. The water is generally salt. The flow of oil has rarely if ever been known to fail entirely except by reason of some obstruction in the wells, and in such cases it has usually returned after the hole has been bored out larger or made deeper. The supply is not, however, altogether regular in any of the wells, even after the flow has settled down to a moderate production of 10 or 15 barrels a day. The maximum yield of a well for a considerable time is about 50 barrels a day, and from this the production ranges down to 4 barrels, below which it is considered insufficient to pay expenses.

The oil and water are conducted from the pumps into the large receiving vats, and after the water has subsided the oil is barrelled for the market. From the upper Oil Creek it is mostly wagoned to the Union Mills station in Erie county, on the Erie and Sunbury railroad; and from Tidioute to Irvine, at the mouth of the Broken Straw, on the same road. But most of the oil along the Alleghany river and French Creek is taken by steamboats down the river to Pittsburg. New York city is at present the principal market, but the country refineries are already taking a considerable share of the oil.

The product of the different wells varies somewhat in quality and value. At Franklin the oil for the most part is heavy, marking as low as 33° Baumé, which corresponds to specific gravity 0.864. Some of the wells furnish oils of 35° or 36°—on Oil Creek the range is from 38° to 46°, at Tidioute 43°. The French Creek oils are heavy. It is not unlikely that the depth of the wells may have some effect upon the quality of the oil, as from very shallow wells those of the lighter varieties must be likely to escape by evaporation, leaving the heavier portions behind. The oils obtained at Mecca, Trumbull county, Ohio, are heavy oils, being thick like goose grease and marking 26° or 27°, which is equivalent to specific gravity 0.900. At Grafton, Lorain county, Ohio, the oil is even darker and thicker than this, marking about 25° B.

With the exception of some light, clear oils of reddish color, the petroleum is usually of a greenish hue, more or less deep and opaque. It has an offensive smell which is not entirely removed by the ordinary methods of deodorizing practised in the refineries. The process of purification is similar to that of the coal oil manufacture, as already described. The proportion of light oils separated by distillation varies with the crude petroleum employed. The largest product is about 90 per cent., and from this less amounts are obtained down to about 50 per cent. The properties and uses of these products have already been considered in treating of coal oil.

To complete this account of the petroleum of the United States more particular mention should be made of the extension of the district from north-western Pennsylvania into New York on one side, and Ohio on the other. In Chantauqua, Cattaraugus, and Allegany counties, N. Y., are many places where the appearace of small quantities of oil upon the surface, and the escape of jets of carburetted hydrogen, indicate the existence of petroleum below; and the names of Olean and another Oil creek, a branch of the Genesee river, suggest the probability of this proving another oil district. About a mile north-west from Cuba in Allegany county, is a pool about 20 feet across and 10 feet deep that has always been called an oil spring, its surface being covered with a coating of oil from which supplies have been obtained for medicinal purposes. A pipe was sunk into this, and on the 3d of January, 1861, when it had been driven down 20 or 30 feet, oil mixed with water suddenly gushed up with great force. Oil also appeared on the water drawn up from an artesian well sunk to the depth of 130 feet in the same vicinity. Arrangements are now in progress for thoroughly testing the capacity of this district.

In Ohio the oil-producing counties are Noble, Adams, Franklin, Medina, Lorain, Cuyahoga, Trumbull, Mahoning, and some others. Near Cleveland and in the valley of the Cuyahoga oil appears in many places, but it has not yet proved of much importance. The vicinity of Mecca, Trumbull county, is the most productive locality. Operations were commenced there in February, 1860, and in November it was stated that between 600 and 700 wells had been sunk, and 75 steam engines were in operation pumping oil. Two of the wells were yielding from 50 to 100 barrels a day each. This statement is probably much exaggerated, and while others report that several hundred wells have been sunk, a dozen or more are said to be working profitably. These wells pass through the same formation as those near Titusville, but for the most part they are shallow, ranging in depth from 30 to 100 feet, and the most of them not much exceeding 50 feet. About 30 miles south-east from Mecca, at Lowellville, Mahoning county, a well was sunk 157 feet which proved very successful, yielding 20 barrels of oil a day. This well was commenced in the conglomerate and ended in the Chemung strata. Duck Creek, Noble county, was formerly noted for the oil which appeared with the brine of the salt wells.

In Ritchie and Wirt counties, Virginia, near the Ohio river, some wells are producing oil, and this promises to be an important oil district. Canada West also contains an oil region, extending from London toward the St. Clair river, from which petroleum has been obtained the last two years. The value of the product, however, is considerably deteriorated by its insufferable odor. On the southern coast of California petroleum is said to be found in considerable quantities; and springs of it are described by Captain Stansbury in the report of his expedition to the Great Salt Lake, in 1849, as occurring about 83 miles east from Salt Lake City, in the vicinity of sulphur springs and beds of bituminous coal.

The works for refining petroleum (excepting some originally designed for manufacturing coal oil) were all constructed in 1860–61. Their localities and approximate capacity, as far as known, are given below:—

Localities.	No. factories.	Daily capacity. Bbls.	Remarks.
Pittsburg, Penn.	2	..	Built for coal oil.
Tidioute, Warren Co., Penn.	1	35	
Union, Erie Co., "	1	35	Destroyed by fire.
Meadville, Crawford Co., "	1	50	
Franklin, Venango Co., "	1	10	
Titusville, Crawford Co., "	2	30 & 40	Not completed.
Oil City, mouth of Oil Creek	1	..	" "
Buffalo, N. Y.	1	..	
Cleveland, Ohio	1	..	Built for coal oil, recently burnt.
Columbus, "	1	..	
Canfield, "	1	..	Built for coal oil.

LAND SETTLEMENT—INTERNAL TRADE.

CHAPTER I.

WESTERN SETTLEMENT AND TRADE.

PURCHASE OF LOUISIANA—POPULATION AND LAND SALES—AVENUES TO THE VALLEY—CANAL AND RAILROAD EXPENDITURES—LAKE CITIES AND TRADE—RECIPROCITY.

THE original colonies, settled as they were under different grants, circumstances, and powers, had many and conflicting claims to the then comparatively unknown land running back to the Mississippi river, bounded on the north by the chain of lakes, and on the south by the Spanish territories of Florida and Louisiana, when there was a question of union into a confederacy. These various claims were a matter of dispute, which, from being serious, was settled by a mutual cession of the lands to the federal government, in trust, for the common benefit of all the states then existing, or thereafter to become members of the Union. The federal government having thus become owner of the lands, the constitution conferred upon Congress the power "to dispose of and make all needful rules and regulations respecting the territory and other property belonging to the United States." The obvious policy of the government, like that of every other thrifty owner, was at once to attract settlers to these lands, thereby making them serviceable to the whole people as fast as possible. To do so, the lands were to be sold cheap, and as few formalities as possible placed in the way of the settlers. The domain was organized under the control of the Secretary of the Treasury, being administered under him by a commissioner of the land office. The whole domain is divided into districts, for each of which there is a surveyor general, under whom the territory is subdivided for survey into districts. For each district there is a land office, occupied by a register and a receiver. A plan is prepared of each district by the surveyors, with the utmost care, showing ranges, sections, and townships, with topographic characteristics. Of this plan there are three copies; one is retained at the land office, one by the surveyor, and the third is sent to the general office at Washington, where it serves to regulate all transactions. The land being all surveyed into sections of 640 acres each, is offered for sale by the government at auction, at a *minimum* price of $1.25 per acre. After the land has been on sale two weeks, it may be sold in 40 acre lots, at a less price. The actual occupant of any land offered has the pre-emption to it. The buyer of the land pays the money to the receiver, and gets for it a receipt, of which the register sends a duplicate, with a certificate of the sale, to Washington. On the verification of the sale there, the deed of the land, called a "patent," is made out, and sent to the local land office register, who gives it to the purchaser in exchange for the receipt he holds, and his title is then complete. In addition to the attractions of low prices and pre-emption rights, long credits were originally given, to enable the settler to pay for the land out of its proceeds. But these speedily led to abuses, and the cash plan was finally adopted. There have been, however, large grants of land for military purposes, to schools and universities, to states for internal improvements, for seats of government, public buildings, benefit of Indians, salines, swamp lands, and lastly, in aid of canals and railroads—the construction of which aided the settlement of those lands at a distance from large water courses, and therefore from markets. Some time elapsed before the organization of the department was effected, and the first land office was opened in 1800, at Chillicothe, Ohio. The first sales of land, however, took place in New York three years before, and in that year a triangle on the lake was sold to Pennsylvania, in order to give her a port on the lake. That port is Erie, and is famous for the building of Perry's fleet there in 1812, in seventy days from the time the wood stood in the forest until the stars and stripes floated to the breeze of the lake from the mast-head. That fleet was fatal to British supremacy on the lakes. Almost all the land sales took place in Ohio, until 1807, when offices were opened in Indiana and Mississippi. In 1809 an office was opened in Alabama, and in 1814 one in Illinois; in 1818 in Missouri, Louisiana, and Michigan. The sales of the lands proceeded with great activity in most of these states up to 1821, particularly after the embargo and war had turned attention from commerce and navigation to agriculture and manufacture. Nearly all the lands of the government were then in the great valley of the Mississippi. This is a vast basin, the sides of which are the eastern slopes of the Rocky Mountains on the west, and the western slopes of the Alleghany Mountains on the east. The chain of great lakes stretches across the northern end of the basin, and the Mississippi river flows through its centre to the Gulf of Mexico, receiving on its eastern side the Illinois, the Ohio with its affluents, and other large rivers which flow generally west from the water-shed of the Alleghanies; and on its western side the Missouri and other large rivers whose waters descend from the eastern slopes of the Rocky Mountains. The only outlets to this vast basin were by the St. Lawrence River (not then navigable, however) north to the ocean, and the Mississippi river south to the gulf. Hardy pioneers did penetrate across the mountains, by a perilous seven weeks' journey, to the Ohio; but once there, intercourse was but limited with the east. The fertile soil was, however, attractive, and the Indian trade profitable. In 1790 the whole population west of the mountains was 108,868 souls, or about 3 per cent of the whole population of the Union. In 1800 that population had increased to nearly 400,000, but the only outlet for their produce was down the Mississippi through the French territory of Louisiana. That circumstance led to great dissatisfaction, and being adroitly handled by the political adventurers of that day, threatened disunion, by dissolving the states east and west—the latter to form a new confederacy with the south-west and Mexico. The remedy was to purchase Louisiana. Fortunately, at the moment Napoleon had relinquished his projects of forming French colonies; also being determined on war with England, he feared the seizure of Louisiana by that power, and determined to sell it to the United States for $14,984,872. This money, in 1803, gave him the sinews of war, and also the hope that the transaction would embroil the United States with his enemy. England did at a later period attempt to take the territories. But the troops who had driven the French out of Spain, embarked from France for the enterprise only to encounter the bloodiest defeat before cotton bags and western rifles. Louisiana was then possessed of a certain amount of population and wealth, which, from being French, by annexation became American. A considerable commerce had grown up. The amount of trade then existing between the eastern and western states may be gathered from the official returns of exports to New Orleans, in the four years before it was annexed, as follows:—

States.	1799.	1800.	1801.	1802.
Atlantic,	3,504,092	2,035,789	1,907,998	1,224,710
Western,	———	———	1,124,842	1,596,640
Total,	$3,504,092	2,035,789	3,032,840	2,821,350

The exports from the Atlantic States were mostly foreign merchandise destined for export up the western rivers. The exports of the western states were the produce sent down for sale. Those exports were the productions of hardy adventurers, whom circumstances had induced to seek their fortunes in the west. As long as the commerce of the country was active, and the sales of the farm products of the Atlantic states profitable, there was less inducement to migrate west than there was after the embargo had wrought a change in that respect, and the means of communication *via* New Orleans had improved. When that port became an American city, and the mighty river to its mouth an American stream, a new attraction was added to the fair lands of the valley, and in 1810 its population had risen to 878,315. The impulse thus given to western settlement was strengthened by the effects of war upon the Atlantic states. The interruption of commerce and stagnation of exports threw out of employment large numbers, who now turned an inquiring gaze beyond the mountains. The capital of the east thrown out of commercial employment by the same circumstances, flowed eagerly into banking, in the hope of deriving large profits from the growing resources of the west; although inevitable disaster followed the erroneous principles on which that banking was conducted, the capital, so lost to stockholders, really promoted agriculture. Instead of confining themselves to advances on produce shipped, the institutions loaned money to make improvements and build houses that the farm profits could not pay for. The result was ruin to those accepting such advances, and insolvency to the banks making them. From 1810 to 1820 six states grew into the Union, while in the fifteen years that followed 1821 none were admitted.

This is an instructive fact, and it indicates that western land speculation, so much overdone at those periods, was a long time in recovering itself. The process of forming new states is mostly a speculative one. The shrewdest operators get possession of the leading "sites" of future cities, and by stimulating and guiding the tide of migration, become wealthy in the rise of prices that the tide creates around them. As the wealthiest names of the eastern cities were men eminent in commercial enterprise, so were those of the western cities the earliest and most extensive land-holders. The political influence which brings the government patronage upon the theatre of such locations, is a part of the machinery to guide the popular movement. When in seasons of speculation, these operators become possessed of considerable tracts, a period of steady and healthy migration is required to distribute possession among settlers and clear the way for a new excitement. Yearly the trade grows by reason of the increasing surplus that the settlers throw off for market, and which being sold increases their ability to buy merchandise in return.

There are no data by which to measure the growth of trade in those western states after the admission of Louisiana, up to within twenty years, since the accounts were kept only for the foreign trade, and when Louisiana became a state, reports were no longer made. The sales of lands, and population of the new states, progressed as follows, however :—

	1790 to 1800	1800 to 1810
Population, increase,	276,769	492,678
Sales of land, acres,	1,536,152	3,008,982

	1810 to 1820	Total, 1820
Population, increase,	1,201,248	2,079,563
Sales of land, acres,	8,499,673	13,044,807

So rapid had been the settlement from 1810 to 1820. The agricultural productions of that region, as a matter of course, followed this rapid settlement of lands, and the exchange of those productions created a large trade of which there is little record. The mines and manufactures sprung up in the several towns, following the wants of the people.

The cession of Louisiana to the United States had produced a dispute in relation to its boundaries between this country and Spain, which then owned Florida. This dispute became very warm in 1819, when it was settled through the mediation of the French minister, by a cession of east and west Florida by Spain to the United States, in consideration of being released from claims for spoliation of American property to the extent of $4,985,599, which the United States government undertook to pay its own citizens. The coast line of the United States thus became complete. There were now large interests west of the mountains, a population of over 2,000,000 souls, occupying fertile land, capable of any development, and great numbers were interested in the rapid appreciation of those lands by settlement. The want of communication was a great obstacle. It required seven weeks to reach the newly settled cities of the west; and when during the war it was necessary to send a gun from New York city to Buffalo for defense, it cost six weeks of time and $1,000 in money to do it. There could be little trade under such circumstances, and the question was to open communication. A canal from the lakes to tide water on the Hudson was commenced in 1817, and completed in 1825. This Erie canal cost $7,143,789, and soon paid for itself, being the most profitable, as it was the greatest of modern improvements. It opened the door for the great western valley to tide water, and by doing so wrought an immense change in the condition and prospects of all that region. In October, 1823, New York had also completed the Champlain canal, running 63 miles, from Albany to Lake Champlain, at a cost of $1,179,871. Pennsylvania, in 1825, passed an act for the connection of Pittsburg, on the Ohio, with Philadelphia, a distance of 394 miles. This line was not completed until 1834. In 1828, a company was chartered to connect the Ohio with Georgetown, on the Potomac, by the Chesapeake and Ohio canal. These works gave three outlets from the great basin to tide water. While yet they were in process of construction, however, a new power was being developed to supersede them for trade and light freights. In 1828, Massachusetts had three miles of railroad; from that nest-egg, capital has since hatched 28,270 miles, which cover the country like a network. The opening of the Erie canal was attended with great results, since it placed the produce of western lands cheaply in competition with that of the valley of the Hudson, and of the less productive states of the Atlantic coast. Commerce and manufactures increased, for the reason that agriculture paid less. The supply of labor changed direction, and the increasing numbers in manufacturing employments drew their subsistence from the west. The natural water courses that discharged themselves into the lakes were lined with settlers, and soon Ohio connected the lakes with the Ohio river, by a canal from Cleveland to Cincinnati, and also to Portsmouth. Indiana projected a canal from Toledo, on the lakes, to the Ohio river, cutting the state nearly longitudinally; and Illinois projected one from Chicago to the navigable waters of the Illinois river, thus connecting the lakes with the Mississippi river, nearly opposite the old French town of St. Louis—across the state. These works were not completed, some of them, until ten or fifteen years after they were undertaken. That of Ohio, however, gave a new impulse to trade, not only by Cleveland, on the lakes, but by way of Cincinnati, down the river to New Orleans. These circumstances gave a new impulse to the sales of land and the settlement of the west. The expenditure of money for the construction of canals, and by the federal government for the construction of the great national road running west from the seat of government to the Mississippi, inaugurated the speculative movement in that direction. The bank fever then raged once more in support of the land movement, as it had done in the six years ending with 1820, and with the same results. $200,000,000 of money went from east to west, feeding the flame, until all real capital was nearly consumed, and the speculation ran wild until it burst in 1837. At that time a large quantity of land had passed, under the credit sales of the federal government, into the hands of private speculators, and the western fever lay dormant up to the revival that it experienced in 1846–7, by reason of the famine abroad, and the growing strength of the migration. Attention was then again turned to the lands, and the railroad expenditure began to exert the same influence that canal and bank expenditure had exercised in 1836, and the movement was progressive until the revulsion of 1857.

The natural water courses of the country had been followed by early migrations, and the settlement of the land bordering them had been stimulated by the bank paper speculation of 1810 to 1820. Following the excitement came the construction of the artificial means of navigation, involving an expenditure of some $50,000,000 for canals through new lands opened up by their operation; and these enterprises were again attended with a great bank expansion, that, although ending disastrously, nevertheless had the effect of drawing capital from England and the wealthier Atlantic states to spread it upon the fertile lands of the west. The subsidence of that speculation left the west in comparative quiet, although of general progress, for some years, during which a new and more powerful element of internal development was coming into action. This was the railroad system.

The first railroad of the country was three miles, built in Quincy, Massachusetts, and in operation in 1828, about the time the success of the Manchester railroad in England astonished the world with the new phenomena of locomotion. The example was not slow of imitation in this country; and the Boston and Providence railroad, uniting those cities by forty miles of rail, to connect with the steamboats to New York, was soon in operation. Its success caused other works to be undertaken in New England, and when the Western road was projected, to connect Albany with Boston, it gave the city a direct connection with the Hudson river and the Erie canal. New York projected the Harlem railroad; and from Albany several roads extended west, connecting city after city, until the united lengths of 380 miles made a continuous route to Buffalo—afterward, in 1850, consolidated in the New York Central railroad. Another road—the Erie—to connect New York with Lake Erie at Dunkirk (459 miles), through the lower tier of counties, was commenced in 1842 and completed in 1853. Baltimore projected the connection with Wheeling, on the Ohio, 380 miles, by rail, and Philadelphia connected Pittsburg, on the Ohio, 329 miles, by a line of works which became subsequently a continuous railway.

The New York railroads were not allowed by law to carry freight until 1850, except on payment of the canal tolls. These four routes opened the western valley by rail to tide water. The Canada roads, connecting Detroit and Buffalo, and Detroit and Portland, make five routes, with distances as follows:—

N. York to Chicago, *via* Erie, Lake Shore, and Mich. Southern, - - - - - -	957
N. York to Chicago, *via* Central, Canada, and Mich. Central, - - - - - -	957
Philadelphia to Chicago, *via* Pittsburg and Fort Wayne, - - - - - - -	823
Baltimore to Chicago, *via* Ohio Central, -	942
Portland to " " Canada and Michigan Central, - - - - - - - -	1,133

There had been, meanwhile, many western roads built in important localities, which had much favored the export of food in answer to the foreign demand growing out of the famine of 1846–7. In the year 1850, the federal government made a grant of land of about 2,500,000 acres to the state of Illinois, in aid of the construction of the Central railroad, which was to connect Galena, on the Mississippi, and Chicago, on the lake, with Cairo, at the junction of the Ohio and Mississippi rivers. The two roads leaving respectively Galena and Chicago, run south, converging until they meet at a point 50 miles from Cairo, and thence proceed together. The state not being able to do this herself, made over the lands to a company, on condition that they should construct the road. This was commenced in 1852, and finished in 1857, at a cost of $35,000,000. The tract given by the government was in size equal to the whole state of Connecticut, and was a part of 11,000,000 acres that had been over fifteen years in the market without finding buyers. The fact that the railroad was to run through them, and spend $25,000,000, and employ 10,000 men in the building of the road, made the lands attractive, and excited speculation. At about the same time the state of Michigan sold the Michigan Central road and the Southern Michigan road to two companies, on the condition of their finishing them, which was done in 1852, establishing a connection between Detroit and Chicago. About the same time the Galena and Chicago railroad was commenced and finished in 1850, making a direct communication from the river at Galena to Chicago, prolonged by the Michigan roads to Detroit, and thence by the Lake Shore to New York, by the Erie or the Central railroads, or *via* the Canada route to Portland or to Boston. Subsequent connections have been made with the Pennsylvania and the Baltimore roads; and the western connections of Chicago and Milwaukee have been pushed under a vast expenditure of money. The inauguration of land grants by government, in the case of the Illinois Central, has been followed by grants to other states for the same object, until all the grants amount to 25,403,993 acres. These grants have rapidly developed southern connections, until the route is now complete between Chicago and New Orleans, shortening the river route by over 400 miles. While these "trunk lines" were in process of construction, cross roads were multiplied to an immense extent, and the connections of them form a continuous route from Bangor, Maine, to New Orleans, 1,996 miles. This vast chain of railways is composed of eighteen independent roads, costing in the aggregate, for 2,394 miles of road, $92,784,084, or nearly one-tenth of the whole railway system of the United States.

The progress of the construction by miles in each locality has been as follows, in periods of ten years:—

	East'rn.	Middle.	South'rn.	West'rn.	Total Miles.	Cost.
1828....	3				3	221,101
1830....	3	33	6	6	43	3,501,100
1840....	444	1,436	461	28	2,369	98,170,001
1850....	2,896	2,925	1,415	1,041	7,777	291,482,101
1860....	3,824	8,176	5,552	10,718	28,270	$1,009,172,000

A vast sum of money, amounting in all to $717,689,899, has been expended in the last ten years in the construction of 20,493 miles of road, of which rather more than one half has been built at the west. There are, in addition to these roads, some 16,000 miles of road incomplete. A considerable amount of this money was drawn from abroad. The iron was got in exchange for bonds, which have not in all cases been paid; but if the bonds were poor, the iron has not been of good quality. The quantity of railroad iron imported in ten years, to 1850, was 242,449 tons, at a cost of $9,603,587. In the nine years ending with 1857, the quantity imported was 1,765,693 tons, at a cost of $59,196,300. This number of tons suffices for about 15,000 miles of road, at 70lbs. to the yard. The money expended upon the roads in the employment of men and in the manufacture of superstructure, rolling stock, etc., of itself caused an immense activity and demand for produce, which, as a matter of course, became scarce and high upon the theatre of such expenditure. The manufacture of superstructure, cars, locomotives, stations, etc., were the means of employing great numbers of men. The railroad iron, of which the manufacture requires the investment of much capital, was alone imported to any great extent. The remaining portions of the railroads were manufactured at home. The first locomotives in the United States were imported from England in the fall of 1829 or spring of 1830. The first Stephenson locomotive ever imported was the "Robert Fulton," in 1831, for the Mohawk and Hudson railroad. The first locomotive built in this country was constructed at the West Point foundry in 1830, for the South Carolina railroad. Since then the improvement and manufacture of railroads has been so successful as to admit of the export of many American machines. As the roads were completed, and the hands, numbering at least 200,000 men so employed, were discharged, they naturally turned their attention to the agriculture of the neighborhood where they had been employed, and production thus succeeded to consumption. The effect of the railroad expenditure upon the grain crops is to some extent indicated in the following table of miles of roads in operation in the western states at the periods named, and the population and corn product of those states:—

1850.	Miles of Road.	Population.	Bushels of Corn.
Ohio	299	1,980.329	59,078,695
Indiana	86	982,405	52,964,363
Illinois	22	851,470	57,646,984
Iowa		192,214	8,656,799
Michigan	344	397,654	5,641,420
Wisconsin		305,391	1,988,379
Missouri		682,044	36,214,537
	751	5,391,507	222,191,177
1857.			
Ohio	2,988	2,580,011	82,555,186
Indiana	1,291	1,146,717	80,111,416
Illinois	2,714	1,358,960	119,186,921
Iowa	344	596,251	32,111,502
Michigan	1,032	637,514	8,322,756
Wisconsin	822	822,606	14,186,822
Missouri	547	1,023,888	98,712,561
Total	9,738	8,165,947	435,187,164
Increase	8,987	2,774,440	212,995,987

The corn crops had nearly doubled, and the wheat crop in the same states had risen from 43,840,637 to 107,275,641 bushels in 1857—an increase of 63,400,000 per annum, worth as many dollars; and estimating the corn at the same aggregate, there had been a sum of $126,000,000 per annum, or half the cost of the railroads built, extracted each year from the soil through their influence. We may now observe what had been the actual sales of the public lands by the government in the forty years ending with 1860, to June 30th, when the fiscal year ends, divided into periods of ten years each; the first, being that of recovery from the speculation that attended the close of the war; the second, embracing the period of bank and canal building excitement; the third, that of recovery from that excitement; and the fourth, that of the last great railroad building excitement. The quantity sold during the forty years was, it appears, 140,883,740 acres.

ANNUAL SALES OF LAND BY THE FEDERAL GOVERNMENT.

	Acres.		Acres.
1821,	822,185	1831,	2,804,745
1822,	763,811	1832,	2,411,952
1823,	638,749	1833,	3,856,227
1824,	723,038	1834,	4,658,218
1825,	871,619	1835,	12,564,478
1826,	839,263	1836,	20,074,870
1827,	905,937	1837,	5,601,103
1828,	946,650	1838,	3,414,907
1829,	1,236,445	1839,	4,976,382
1830,	1,880,019	1840,	2,236,889
Total	9,627,716		62,599,771
Population	2,233,880		3,707,299
1841,	1,164,796	1851,	1,846,847
1842,	1,129,217	1852,	1,553,071
1843,	1,605,264	1853,	1,083,495
1844,	1,754,763	1854,	7,035,735
1845,	1,843,527	1855,	15,729,524
1846,	2,263,730	1856,	9,227,878
1847,	2,521,305	1857,	4,142,744
1848,	1,887,553	1858,	3,804,908
1849,	1,329,902	1859,	3,961,580
1850,	769,364	1860,	4,000,000
Total	16,269,421		52,385,782
Population	10,454,245		15,081,894

The total sales of lands, from the opening of the land offices to 1860, were 153,928,547 acres. There had been issued land warrants to the soldiers of the Mexican war, and former wars, which have taken up large portions of the land. These warrants are for 160 acres, 120 acres, 80 acres, and 40 acres, and have been sold in the markets at $1 per acre for the smaller lots, and about 80 cts. the larger warrants, by which means the lands come less to the buyer. In addition to the lands sold, the government has donated 67,736,572 acres to schools; 10,897,313 to internal improvements; 279,972 to individuals; 50,060 to seats of government;

THE HORSE SHOE FALL, NIAGARA, WITH THE TOWER.

44,109,979 to military services; 432,325 salines to states; 3,400,725 Indian reserves; 8,923,908 private claims; 21,948,916 swamp lands, granted to states; 25,463,993 to railroads; and there remain unsold lands on hand, 1,088,732,498 acres, as a small supply for new comers.

The population of the land states had increased, it appears, from 2,233,880 in 1830, to about 15,000,000 in 1860, during which period of thirty years, 131,255,074 acres of land were sold by the Government. These land sales and population are the ground work of the national trade, which grows with the surplus produced by the land settlers. Those people at first make few purchases of goods, but increase them as their surplus produce sells and enables them to do so.

The people who seek new lands on which to rear their future homes and fortunes, are, for the most part, not possessed of much capital, and under ordinary circumstances much is required for a family to perform a distant journey, locate and prepare land and wait until the crops are grown. Nevertheless, pioneers have ceaselessly pushed forward into the wilderness and battled with nature in the shape of forests, animals and savages, until twenty new states and millions of wealth have been added to the Union. The great instrument of this progress, has, under Providence, and in the hands of skilful and determined men, been Indian corn. That grain has been the poor man's capital, enabling him to conquer the wilderness. It needed on his locating his future home but to drop the seed in the fertile soil, and while he busied himself with his new dwelling, a sure crop grew up, which in a few months became food for his family and his animals. The husks furnish his bed and the cobs his fuel. He is thus by the gift of nature furnished with capital for the coming year, until his other crops and young animals have grown. Indian corn has thus given the pioneer a hold upon the land and made his footing firm where otherwise he might have been compelled to succumb to hardships. With every such remove on to new land the circle of trade has increased. A few months only suffice for the settler to furnish a surplus of production in return for comforts that he desires. For this reason chiefly corn figures so largely in the agriculture of the west. The prolific soil throws out quantities far beyond the wants of the planter, and in a region where all are planters, the supply becomes superabundant and must find distant markets only at rates so low as to leave little to the grower. Two local demands are created for it. The most important of them is to feed hogs, and pork becomes a leading staple export; the other is for distillation, and whiskey is largely exported. The quantity of corn required to make a certain quantity of pork becomes accurately known, and the price of meat rises and falls with that of the grain, as does whiskey also. Thus out of the great staple grain Indian-corn come directly the three great articles of export, corn, pork and its manufacture, and whiskey. Lumber in most new countries is also an important export, As the settlements progress, beef, wool, wheat and other grains follow, and trade increases. While Indian corn has been the indispensable instrument of settlement at the west, the nature of the country and the fertility of machine inventions have been no less necessary in securing a surplus for sale. If the corn grows readily it could not under the old system be so readily harvested in a region where land belonged to every man, and every man's labor could be applied only to his own service. At the same time no man's labor more than suffices for the wants of his own family. Here machinery steps in, and favored by the level nature of the soil operates to a charm. A man who could with the scythe cut from one to one and a half acres of grass per day, may ride round a field and cut ten acres in a day without fatigue. Instead of a gang to rake and turn and cock, his horse and himself may with a patent rake perform all that labor and more effectually when driven by a shower of rain, than any gang. His grain is cut by the same means and light labor as his grass. It is threshed out by a similar process; his corn is husked and shelled by machines; and when drawn to the railroad depots it is elevated into vast receptacles to be transported rapidly and at small cost to the best market. All these machine aids enable the man whose own labor would scarcely supply the demands of his family to turn out a vast surplus. This surplus seeks the river and lake cities by rail, canal, and steam, to be transported to the Atlantic markets for consumption or export, or may now leave Chicago and Milwaukee on the lakes, or St. Louis and Cincinnati on the rivers for Liverpool direct without breaking bulk. The table of land sales above gives a very good indication of the accumulating force behind the forwarding cities to push forward the trade. As every bushel of grain they receive requires an equivalent from them in goods, each grows under the double demand. Their combined growth is the basis of lake and river trade, distributing the produce for consumption, and bearing back goods in return, while the foreign commerce of the country grows with the aggregate surplus to be exported and the consequent increase of the merchandise received in exchange. Having glanced at the settlement of the western lands, it becomes no matter of surprise that the cities which were the focus at which such large quantities of surplus products concentrated grew rapidly, and grew in proportion to the rapidity of settlement and the perfection of the means of internal communication. It may be worth while to sketch the leading ones, first those of the lakes.

Buffalo, on Lake Erie, was laid out originally in 1801, but was of small importance until in 1825 by the opening of the Erie canal, it became the gateway from the great valley to the Atlantic states. Its population was then 3,000. As the "great valley" at that time had, however, but little to spare, the importance of Buffalo was to swell with the growth of the west which was rapid indeed. In 1832, thirty-one years from its settlement, Buffalo became a city with 8,653 inhabitants. In the twenty-eight years that have since elapsed the population has risen to 81,131. In 1825, the tonnage belonging to the port was 200 tons. It has grown to 91,974, valued at $3,640,950, besides 600 canal boats. The steam tonnage running to Buffalo is 60,740 tons. The exports of Buffalo by canal are $20,000,000 and by railroad as much more. The opening of Dunkirk to New York over the Erie road created a rival to Buffalo, and the Welland canal round the falls permitted vessels to go to Oswego, where they take either canal or railroad on a shorter route to New York, also rivaling Buffalo. It is obvious that a few miles longer trip adds little to the cost of a loaded ship, and by reducing the canal and railroad transportation the cost is diminished. Hence Oswego has an advantage over Buffalo.

The imports into Buffalo by lake and railroad, showing the relative and aggregate values, indicate the gain of "rails" over "sails." They were, for a number of years, as follows:

	Lake.	Railroad.	Total.
1850,	$22,525,781		$22,525,781
1851,	31,889,951		31,889,951
1852,	34,943,855		34,943,855
1853,	36,881,230	2,234,273	39,115,503
1854,	42,030,931	6,397,923	48,428,854
1855,	50,346,819	10,968,384	61,313,203
1856,	42,684,079	16,422,505	59,106,584
1857,	36,913,166	15,020,580	51,933,746

Oswego, settled in 1820 on Lake Ontario has been mostly the creation of the Oswego canal and of the railroad communication since established, which makes its position on the lake with reference to the Canada and lake trade very desirable. The canal was completed in 1828, and the Oswego and Syracuse railroad in 1848, when Oswego, having 10,305 inhabitants, was incorporated as a city. The modification of the English colonial trade system, and the admission by the United States of goods in bond under the warehouse system, laid the foundation for a great development of the business of Oswego on the occasion of the famine of 1847, when the trade of the place took a sudden start, which it has since sustained. The Welland canal, connecting Lakes Erie and Ontario, gave Oswego a line of communication with the west, by which freight coming thence to the east, would have, *via* Oswego, less canal navigation than by other routes. In May, 1857, the Welland railway, running along the banks of the canal, was projected, and is now completed, thus giving a communication all the year round. By these means Oswego draws its supplies from every western state; Oswego also is a great salt depot, and has a large lumber trade with Canada. The imports from Canada in 1859 were $3,831,041, and the exports $1,918,798; the tonnage of the port amounts to 26,395. Pop. in 1860 16,817

Cleveland.—The place was settled by one family in 1799, but its population did not increase beyond 500 in 1825, when the Erie canal was opened. Its greatest impulse was derived from the construction of the Ohio canal, connecting it with Cincinnati, the Pennsylvania and Ohio canal, connecting it with Pittsburg, and the Welland canal in Canada, connecting Lake Erie with Lake Ontario. Since that event a considerable Canadian trade has sprung up in Cleveland. The canals of Ohio brought down the increasing quantities of produce that were then exported in exchange for the merchandise that was delivered by lake for the consumption of the interior. In 1832 there were 26 sail vessels and one steamer belonging to

Cleveland; there are now 14 steamers and 142 sail vessels, with an aggregate tonnage of 39,984 tons owned there. The multiplication of railroads has, however, added of late more to the city business than either canals or tonnage. There are six roads running into Cleveland, of an aggregate length of 754 miles, and their annual receipts are $4,520,452. These crossing Ohio in every direction, connect the city with Toledo, Columbus, Pittsburg, and New York. With these advantages, under the action of the reciprocity treaty with Canada, a large foreign trade sprung up. In 1858 the imports and exports were as follows:—

	Vessels.	Tons.	Coastwise.	Foreign.	Total.
Exports....	2,084	705,577	$13,166,256	$224,986	$13,391,242
Imports....	2,137	721,519	26,087,849	168,409	26,256,258

The trade between Cleveland and Lake Superior has also become important within four or five years, in which time it has risen to $3,000,000 in value, mostly in copper ore. The most remarkable development of trade is, however, the direct trade between Cleveland and Europe. In 1856 a vessel built in Cleveland, loaded wheat at Chicago for Liverpool, where she was sold to advantage, and now runs to Brazil. In the following year others were sent, and a vessel arrived from Liverpool at Chicago with hardware, etc. In the following year a fleet of ten vessels, 3,600 tons, owned by Cleveland merchants, sailed for Liverpool, and since run to the Mediterranean, South America, and elsewhere. The coal trade of Cleveland has become large for the supply of the steamers and factories on and around the lakes; the supply is about 250,000 tons per annum. Population in 1860, 36,054.

Detroit.—This is the oldest of the western cities, having been early occupied by the French, but its progress, like the others, was slow until the opening of the Erie canal. In 137 years, up to 1820, the population had risen only to 1,442 souls. The greatest impulse has been given to Detroit by the formation, in the last ten years, of the railroad system, which connects it with the interior country. The Great Western railway of Canada, coming 229 miles, has its terminus virtually in Detroit. From Detroit west run the Michigan Central road, 228 miles, to Chicago, and connecting with the whole western net-work of rails; the Detroit and Milwaukee railroad, crossing the Peninsula, 185 miles, to Grand Haven; the Michigan Southern road running also to Chicago. The earnings of the three roads last year were $5,700,000. Pop. in 1860, 45,619.

Chicago is probably the most remarkable of the western cities for its growth. The place in 1812 was but a garrison that was abandoned. Subsequently, and as an Indian trading post, it collected some sixty or seventy persons in 1823. Although situated at the bottom of the lake, with a fine harbor sufficient for any lake trade, it could not thrive until the back country supplied it with produce to sell, and required of it merchandise in exchange. To procure this the Illinois and Michigan canal, connecting the lake with the navigable waters of the Illinois, was commenced in 1836, 100 miles in length. In aid of this work the federal government donated alternate six mile sections of the public lands. The state had also projected a large system of railroad improvements on a scale far beyond its means, and it failed in 1840. Subsequently the means was raised to complete the canal, which was effected in 1850. Since that date numerous railroads have been constructed, leading to the Mississippi river in a fan-like form, having Chicago for the centre. The expenditure of some $150,000,000 for the construction of those roads, over a circle of country of which Chicago is the natural market, has had a prodigious effect upon its welfare. The effect of that expenditure attracted immigrants and speculators, whose outlay reflected prosperity upon the city. The means of communication thus formed by 2,900 miles of railroad diverging from the city, over a vast circle of fertile country, has made Chicago the first primary grain port in the world, shipping as it does more than 20,000,000 bushels of grain per annum. It has millions of tonnage yearly entered and cleared, importing and exporting to the amount of $50,000,000. Chicago is only six or eight feet above the level of the lake, but the harbor has a depth of thirteen feet of water, and will always be ample for the commerce of the lakes. The number of vessels arriving here in 1857 was 7,557. The new Canadian rules in relation to navigation enable Chicago vessels to clear direct for Europe, and there are a number in the trade by which produce and goods are shipped direct to Europe. The total value of produce exported in 1859 was $24,280,890. Inasmuch as breadstuffs are the principal product of the country between Chicago and the Mississippi, and furnish so important an item in the commerce of the place, the following table will best illustrate as well the development of agriculture as the chief element of trade:

SHIPMENTS OF FLOUR (REDUCED TO WHEAT) AND GRAIN FROM CHICAGO FOR TWENTY-THREE YEARS.

	Bushels.		Bushels.		Bushels.
1838,	78	1845,	1,024,620	1853,	6,412,181
1839,	8,678	1846,	1,599,819	1854,	12,932,320
1840,	10,000	1847,	2,248,201	1855,	16,683,700
1841,	40,000	1848,	3,001,740	1856,	21,583,221
1842,	586,907	1849,	2,769,111	1857,	18,032,678
1843,	688,907	1850,	1,830,930	1858,	20,035,166
1844,	923,494	1851,	4,646,291	1859,	16,753,795
		1852,	5,878,141	1860,	30,000,000

The famine abroad in 1845–6–7, consequent upon the failure of the potato crops, caused a demand for grain that was felt in Chicago. The development was not large, however, until 1852, when the Galena road pushed out on to the prairie, and since then the receipts have not ceased to increase by every line of road; the quantity that came in the first six months of 1860 is larger than ever before. These grain receipts are said to make Chicago the largest primary grain port in the world. Pop. in 1860, 109,263.

MILWAUKEE is one of the chief cities of the western shore of Lake Michigan. It was settled in 1834, and up to 1840 could boast of but 1,700 inhabitants. The population had grown to nearly 20,000 in 1850, to 30,000 in 1853, and to 45,254 in 1860. The growth has been most rapid under the settlement of the country west of it, by means of the large expenditures there made in the last four years for railroads. These in the state of Wisconsin, have an aggregate length of 2,403 miles, and have been constructed mostly in the last ten years at an expense of $36,742,063. The expenditure of this large sum of money, in addition to that laid out by speculators and emigrants, imparted an impulse to the prosperity of the city which is reflected in its population and valuation. The circle of fertile country poured into the city products which were exported from it to the value of $27,974,748 in 1856, and in return $20,274,000 worth of goods was imported. The manufactures of the city were also valued at $8,057,000. The quantity of grain shipped from Milwaukee in 1858 was 6,155,507 bushels, and from other lake ports of Wisconsin 1,561,881 bushels. The grain movement, which is the basis of the city's commerce, indicates the ratio of its growth, and this has been as follows:—

	Bushels.		Bushels.		Bushels.
1851,	576,580	1854,	2,534,617	1857,	8,727,468
1852,	1,029,379	1855,	8,758,965	1858,	6,155,507
1853,	1,476,998	1856,	8,720,103	1859,	6,488,038

We may recapitulate these lake cities in the following table, showing the date of settlement, of incorporation, and population at that date, with the population and valuation in 1850 and 1860:—

	Settled.	Incorporated.	Population.
Buffalo	1801	1832	8,653
Oswego	1820	1848	10,305
Cleveland	1799	1836	4,000
Detroit	1683	1802	700
Chicago	1823	1835	800
Milwaukee	1830	1840	9,655
Total			34,118

	Population in 1850.	Total Valuation.	Population in 1860.	Total Valuation.
Buffalo	49,764	$18,427,000	81,131	$37,487,061
Oswego	12,205	9,107,202	16,817	21,500,000
Cleveland	17,034	12,102,101	36,054	21,951,428
Detroit	21,057	10,741,657	45'619	28,141,591
Chicago	29,963	81,205,000	109.263	78,291,000
Milwaukee	31,077	18,421,000	45,254	35,458,130
Total	161,100	$100,003,960	384,138	$222,829,210

Thus these prominent cities have grown up, so to speak, in 25 years, as points where farm produce is received from the country for sale and where goods are furnished in exchange. The whole value of the lake trade has been estimated at $600,000,000 per annum, and the transaction of this business has, it appears, created six cities, with a population of 347,000 and a taxable valuation of $222,829,210. The manufactures have gradually increased in those cities in order to produce a local supply instead of importing, and new inventions in sewing and other machines have promoted that change, as machinery aided the development of surplus produce. The aggregate trade poured upon the lakes from all these sources has been increasingly large. The aggregate quantities of grain shipped from the grain regions are seen in the following table, which shows the routes taken to market:—

	1857.	1858.	1859.
Via Lake Ontario	18,044,354	11,872,995	14,874,961
Via Suspension Bridge	1,049,108	1,900,000	337,778
Via Lake Erie	22,031,164	29,432,121	24,730,582
From Ohio River eastward	4,352,036	6,242,441	4,446,281
Grand total	45,476,662	49,447,557	44,389,602

The totals were composed of these following grains:—

	Flour. barrels.	Wheat. bushels.	Corn. bushels.	Oth. Grain. bushels.	Total in bushels.
1856,	8,879,189	19,956,025	14,282,632	4,634,969	58.269,571
1857,	8,412,904	17,362,161	8,779,832	2,270,149	45,476,662
1858,	4,602,780	20,794,515	10,558,527	5,080,615	49,447,557
1859,	8,760,285	16,864,812	4,423,096	4,310,269	44,889,602

These fluctuations follow the course of western business. In 1857 there was a heavy decline under the influence of the panic of that year. In 1858 the speculative consumption of the interior having ceased, the quantities that sought market were less

UNIV. OF
CALIFORNIA

TORIA BRID

than in 1856. The railroads also delivered considerable quantities.

The rapid settlement of the west attracted the attention of the Canadians, and they began early with some energy to take measures that should give them their share of it. The St. Lawrence river was for them the only outlet, and to make that serviceable, extensive works were necessary to pass around the rapids, and make navigation practicable from the lakes to the sea. The Welland canal, passing around the Falls and connecting Lakes Erie and Ontario, was constructed, with other necessary works, completing, in 1846, a system, at a cost of $20,000,000. The tolls on these works were considerable, and duties on goods imported into Canada from the United States were so high as to check trade—the more so that similar duties were imposed in the United States on Canadian goods. In 1850 the navigation laws were repealed, opening the canals and rivers to foreign vessels. The difficulties in the way of navigating the St. Lawrence have since that date been, to a great extent, removed. Many light-houses have been constructed, the system of pilotage has been revised, a service of tug-boats, of great power, and working at moderate rates, has been organized, and the depth of water between Quebec and Montreal has been increased by dredging, so as to permit the passage of vessels drawing eighteen feet six inches. With these changes and improvements a new element has been introduced. The construction of railways had begun to occupy the attention of the public mind in Canada. In 1849 an act of the Colonial Legislature was passed guaranteeing 6 per cent. on half the cost of all the railways seventy-five miles in extent. Three years later the Grand Trunk line, from Montreal to Toronto, and from Quebec to Riviere-du-Loup, was incorporated as a part of the Main Trunk line, and the line from Quebec to Richmond had been commenced. In 1853 the amalgamation of all the companies forming the Main Trunk line was completed, under a Parliamentary sanction with powers to construct the Victoria Bridge across the St. Lawrence, and thereby connect the lines west of Montreal with those leading to Quebec and Portland.

By the aid of all these enterprises combined, there is now in operation in Canada 2,093 miles of railway, including 1,112 miles of the Grand Trunk, the whole connected with the great winter harbor of Portland, in the state of Maine.

To give effect to this great system of communication, the whole system of tolls upon inland navigation has been abandoned. The whole line of navigation from Chicago to the Atlantic is now free from tolls and lake dues, the ports of Sault Ste. Marie and Gaspe have been made free ports, and it is probable many more will be thrown open. While these measures have been in progress to facilitate trade, a most important measure was adopted in 1854. This was the reciprocity treaty of that year, which designated a number of articles that were to be free on both sides. The treaty went into operation in the latter part of 1854, and the trade has been affected by it as follows:—

	Domestic exports.	Total exports to Canada.	Total imports from Canada.
1852,	$ 6,655,097	$10,509,016	$ 6,110,299
1853,	7,404,087	13,140,642	7,550,718
1854,	15,204,144	24,566,860	8,927,560
1855,	15,806,642	27,806,020	15,136,734
1856,	22,714,697	29,029,349	21,310,421
1857,	19,936,113	24,262,482	22,124,296
1858,	19,638,959	23,651,727	15,806,519
1859,	21,769,627	28,154,174	19,727,551
	$129,129,366	$181,120,270	$116,694,098

The exports of United States produce to Canada have been in this period of eight years over $12,000,000 in excess of all the imports from Canada. In addition there have been exported to Canada fifty millions of foreign goods that have been imported on the seaboard. The domestic exports are composed of the produce shipped from the American lake ports, and entered at the Canadian ports. The freedom of navigation on the canals and rivers enjoyed by the American vessels has also opened a large trade from Cleveland, Chicago, and other ports, direct to Europe. Last year the number of vessels passing through the canals of Canada was 26,466, with a tonnage of 2,455,021. Of these 22,800 were Canadian, with a tonnage of 1,828,383. Deduct 300,000 tons for the traffic on the local canals, from which the tolls are not removed, and there is still a balance of Canadian over American tonnage of 926,638. The lake ports also enjoy more or less import trade on which duties are collected. Those duties at all lake ports for the last four years have amounted to $288,508.

The efforts of Canada to obtain the trade, and cause it to pass down the St. Lawrence, had to overcome, however, the climate, to be successful; for four months in the year that outlet is ice-bound, while the ports of Lake Ontario are never closed by the ice, and offer railroad connection with New York, Boston, and Philadelphia, the former for export and the latter for supplies of manufacture.

CHAPTER II.

RIVER CITIES—ATLANTIC CITIES.

The development given to the lake cities by the canal and railroad construction, was participated in to as great an extent by the river cities, the course of whose trade flowed downward toward New Orleans as an outlet.

Pittsburg is situated at the point where the junction of the Monongahela and Alleghany forms the Ohio river, which thence flows to the Gulf of Mexico. The origin of the place dates from its occupation by the French as a post, and its growth is due to its commanding position. It is 301 miles east by north from Philadelphia, and is 130 miles from Lake Erie. The traveller descends the river 450 miles to Cincinnati; 583 to Louisville, Kentucky; 977 to Cairo, where the Ohio pours into the Mississippi; 1,157 to St. Louis, and 2,004 miles to New Orleans. That vast valley collects in its course the produce coming right and left by streams, canals, and railroads, to deliver it at New Orleans, whence ascend the merchandise, tropical products, and materials of manufacture, to be distributed at the commercial and manufacturing ports. The position of Pittsburg was the most important, commercially, until the opening of the Erie canal. Its resources were highly favorable to ship-building, and it supplied the first boats that descended the Ohio. The commerce and ship-building prospered largely during the war of 1812, but after the peace it declined. Since that period manufacture has taken the place of commerce, and it ranks next to Philadelphia as a manufacturing town. The facilities and resources for manufacture are immense. The population in 1800 was 1,565, and in 1816 it was incorporated as a city with about 6,150 inhabitants. The population of Pittsburg in the present year is given at 130,000, but this includes Alleghany City and other suburbs; the city proper is stated at 49,220. The progress of the city has been as follows:—

	Population.	Value of manufactures.
1816,	6,182	$1,896,366
1836,	15,481	15,575,440
1850,	46,601	55,287,000
1860,	49,220	

Cincinnati was located at the mouth of the Licking river in 1788, in the centre of an area which commanded the commerce of the Miami, the Wabash, the Scioto, the Muskingum, and the Kanawha rivers. These streams delivered large quantities of produce to foster the trade of Cincinnati, which grew with great rapidity, corresponding mostly with New Orleans, to which its merchants sent the produce, and made purchases of goods in the eastern states, which came up the river from New Orleans by a long voyage, charged with heavy expenses for freight, insurance, etc. The exchanges ran on New Orleans against the produce sent down, and these credits were the means of payments for goods. The opening of the Ohio canal to the lakes, to correspond with the Erie canal to tide-water, gave a new outlet for produce of the northern part of Ohio by way of Cleveland, and also a better channel for the receipt of goods. The net-work of railroads has still further multiplied the means of communication. Portland, Boston, New York, Philadelphia, and Baltimore, are almost equidistant from Cincinnati, which by the same means has its markets extended in a broader circle west. The progress of the city has been as follows:—

	Population.	Imports.	Manufactures.	Exports.
1800,	750			
1810,	2,540			
1820,	9,644	$1,619,030	$1,059,459	$1,834,080
1830,	24,831	2,528,590	1,850,000	1,063,560
1836,	31,207	8,270,000	12,388,2 0	8,101,000
1840,	46,338	16,972,000	17,780,033	15,480,000
1850,	115,436	41,256,199	54,550,134	33,234,896
1860,	161,044	96,213,274	112,254,000	66,007,707

These figures give the rapid growth of the city since the railroads have opened a broader field from which to draw the materials of trade in exchange for merchandise demanded by the growers.

Louisville, Kentucky, was a port early in 1781, and it made little progress as a city. Its population grew but to 600 in 1800, and was only 4,012 in 1820. The difficulties of navigation were a drawback upon its commerce, until the Portland canal, two miles long, which had been authorized in 1804, around the falls of the Ohio, was opened in 1830. The cost of the work, $600,000, was paid, one-third by the United

States, and the balance mostly in eastern cities interested in getting goods up the river. A bridge over the Ohio was built in 1836, at a cost of $250,000. The city was incorporated in 1828, and its population was then 10,336. In 1836 the population was 19,967, and the annual amount of business transacted was $29,004,202. In 1840 the population was 21,210, and in 1850 it had again doubled, reaching 43,194.

St. Louis was occupied as a French trading post in 1763, and the town was laid out in the following year, with the name of St. Louis, in honor of that Louis XV. who had so little claim to saintship. The first impulse to its growth was, however, the annexation of Louisiana to the United States, when emigrants poured into the new country, bringing with them a spirit of enterprise which soon made visible effects upon St. Louis, the commerce of which struggled against the difficulties inherent in barge and keel boat navigation. In 1817 the General Pike, the first steamboat, arrived at St. Louis. That event marked a new era, and in 1822, the population being 4,598, the city was incorporated. It was not until the settlement of the north-western states, under the influence of the canals and railroads, that the prosperity of St. Louis became marked. In 1836 the sales of merchandise in St. Louis were given at $6,335,000; in 1858 the local insurance was $31,800,232. The population of the city, which had been 63,491 in 1848, rose to 151,780 in 1860, and the city valuation was $78,463,375. The settlements of the upper Mississippi, east and west, pour naturally an increasing trade into the city, and its railroad connections are now pushing out toward the Pacific. We may recapitulate the leading river cities as follows:—

	Settled.	Incorporated.		1840.	1850.		1860.	
	Date.	Date.	Populat'n.	Populat'n.	Population.	Valuation.	Population.	Valuation.
Pittsburg........	1784,	1816,	6,150	21,115	46,601	$27,960,600	49,220	$46,866,600
Cincinnati.........	1788,	1802,	890	46,338	115,436	55,670,631	161,044	91,861,978
Louisville.........	1773,	1828,	10,336	21,210	43,194	17,277,600	69,740	30,042,800
St. Louis..........	1764,	1822,	4,598	16,469	77,860	38,921,201	151,780	78,463,375
Total			21,974	105,221	283,091	$139,830,032	431,784	$247,234,753

The numbers and wealth of the river cities have increased in a ratio, perhaps, larger than the lake cities. They divide with the latter the trade of country lying between the lakes and the Ohio river, drawing produce and shipping merchandise, while they have also a strong hold upon southern trade. The business of all those cities, as well lake as river, is but a reflection of the growth of the great seaports. The canals, streams, and railroads that pour forth their products in a southerly direction, and feed the river cities, combine with the other business points of the region to swell the trade of New Orleans, the common correspondent of all; the roads, rivers, and streams that deliver their trade in a northerly and easterly direction, glut the great trunk lines with the merchandise which they pour into Boston, New York, Philadelphia, and Baltimore.

The city of New Orleans, at the Delta of the Mississippi, is commercially the second city of the Union, and in respect to the exports of domestic produce, it ranks first. Its position is very advantageous, and its growth has been proportional to the development of the country, the resources of which supply it with produce and depend upon it for merchandise in return. The city itself was founded by the French in 1717, and passed into the hands of the Spanish in 1762. By them it was reconveyed to the French in 1800, and was sold by Napoleon to the United States in 1804. At that time its population, mostly French, was 8,056, and it was rapidly increased by the fact of annexation, which not only carried enterprising men thither, but settled the upper country, which was the source of trade. The city was chartered in 1805. In 1820 the population had increased to 27,176 persons, but the exports of the city still consisted mostly of the produce of the upper country, which a population, increased rapidly by the influence of war and speculation, had greatly developed, although the valley of the Mississippi had not yet attracted cotton planters. In 1830 the trade of the city marked a larger production of farm produce. In the succeeding ten years the migration from the Atlantic cotton states to the new lands of the valley produced a great change in the trade of New Orleans. The cotton receipts rose from 300,000 bales in 1830, to 954,000 in 1840, and tobacco from twenty-four to forty-three thousand hogsheads, and the sugar crop also had risen to 85,000 hhds. The exports were now swollen by the sales of cotton and tobacco, but, with the operation of the canals and railroads in the upper country, the supplies of home produce had again become important. The progress of New Orleans has been as follows. The figures for 1860 are not published, but the cotton is 30 per cent. higher, and the amount will be about $200,000,000 received from the interior.

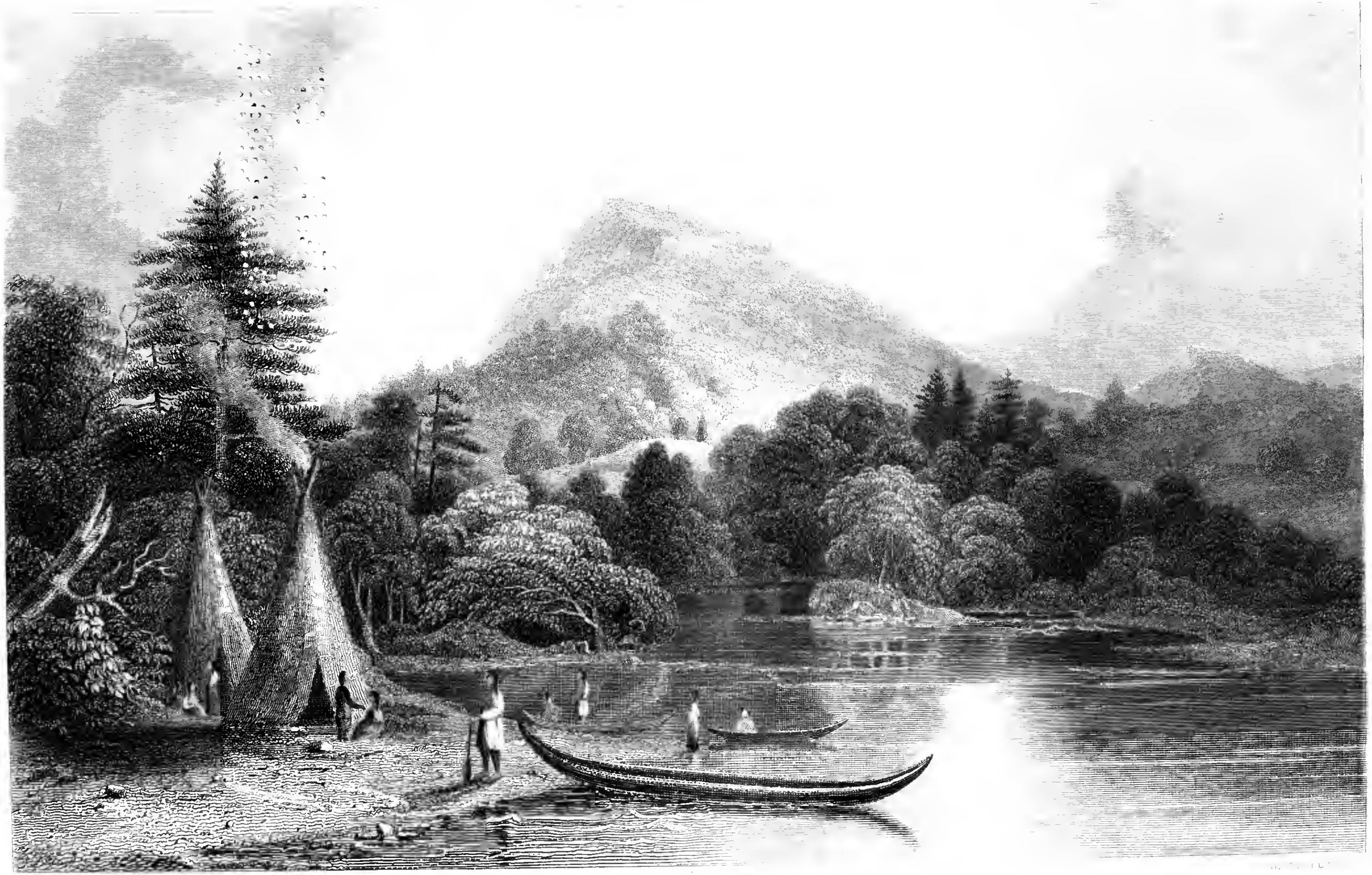
	Population.	Imports.	Exports.	Receipts from Interior.	Receipts of Specie.	Valuation of Real Estate.
1804,	8,056	..	$1,392.093	..	..	..
1810,	17,242	..	1,753,974	..	..	..
1820,	27,176	$3,379,717	7,242,415	..	..	..
1830,	46,310	7,599,083	13,042,740	..	..	..
1840,	102,193	10,673,190	34,236,936	$45,761,045	..	..
1850,	116,375	10,760,499	38,105,350	96,897,873	$3,792,662	..
1851,	..	12,528,460	54,413,963	106,924,083	7,938,119	..
1852,	..	12,057,724	49,058,885	108,051,708	6,278,523	$66,350,260
1853,	..	13,654,113	67,768,724	134,233,731	7,865,226	..
1854,	..	14,402,150	60,172,628	115,336,798	6,967,056	..
1855,	..	12,923,608	55,688,552	117,106,823	3,746,037	..
1856,	..	17,183,327	80,547,963	144,256,081	4,913,540	..
1857,	..	24,981,150	91,514,286	158,061,369	6,500,015	..
1858,	..	19,586,013	88,382,438	167,155,546	13,268,013	108,651,135
1859,	168,472	18,349,516	101,734,952	172,952,664	15,627,016	111,193,802

This table embraces the official figures for population, trade, and valuation. The most marked feature is the small amount of imports as compared with exports. This we shall find to be the reverse with the trade of New York; the trade of the two cities for the past year having been as follows:—

	New York.	New Orleans.
Imports........	$220,247,307	$18,349,516
Exports.......	106,604,097	101,734,952

The domestic exports from New York, exclusive of specie, were but 54,000,000, showing an excess of about $166,000,000 imported; while at New Orleans the excess is $83,385,436 exported. These figures represent the course of trade. The receipts from the interior at New Orleans rose from $96,897,873 in 1850, to $172,952,664 in 1859. This embraces sugar and molasses, of which the value was nearly $32,000,000, but which being sent up the western rivers and to the Atlantic ports, is not exported. Cotton was $92,037,794 of the amount, and tobacco $9,324,326. These sums together make $133,362,120, leaving $39,590,544 as the value of farm produce, which comes down the western rivers as the readiest conveyance. On the other hand, the lighter merchandise which forms the sum of imports into New York, instead of going round by way of New Orleans, goes across the country on railroads. It follows, that when the west sends forty millions of produce to New Orleans for sale, and has purchased an equal amount of goods in the east, that its money is in New Orleans and its debts in New York. It draws upon New Orleans then to pay New York. New Orleans being so large an exporter, has large sums due it, for which it draws to meet what it owes to the west for produce. This state of affairs is the basis of bill operations. Firms being connected, one at Liverpool, one at New Orleans, and one at New York, the New Orleans house buys cotton for shipment to England, and draws for it at sixty days on the New York firm; the bill being discounted, places him in funds to pay for the cotton, which will arrive in Liverpool in thirty days. The New York firm draws a sterling bill against it at sixty days, and, with the proceeds, meets the bill drawn on it from New Orleans. The sterling bill is then met by the sales of cotton four months after it was bought. In the mean time, the bill on New York passes into the hands of the western debtors of New York, who send it thither in payment of goods purchased. The sterling bill is sold to the New York importer, who remits it abroad in payment of goods imported. The receipts of cotton and sugar have been very large of late years, but the quantities of western produce resulting from the more rapid settlement of the land under the influence of the railroads, have also greatly increased. In 1840, the value of cotton, sugar, and tobacco received was $36,124,275, leaving but $9,591,770 for western produce. In the year of famine the aggregate receipts at New Orleans rose to $90,033,251, of which $42,599,361 was western produce. In 1857, those articles were valued at $49,009,976; flour and grain counting in that year for nearly $15,000,000. By means of time bills, New Orleans thus furnishes a large capital to dealers; and in years of economy and re-

UNIV. OF
CALIFORNIA



VIEW ON UPPE[illegible]

trenchment, when the purchases of goods are diminished, it shows a large inward current of specie. In 1851, California supplied a good deal of gold at that point, but changed direction after the establishment of a mint at San Francisco, and the receipts of specie were small at New Orleans in 1855—a speculative year. They became large with the panic year, and have since so continued. The large sales of produce bring a balance in favor of that point, giving great stability to its banking institutions.

While New Orleans thus expanded its trade, and grew in wealth under the influence of western production, the proportion that it enjoyed was by no means the largest. Each Atlantic city had made efforts to obtain a share, and, with more or less success, Canada sought to attract it down the St. Lawrence. New York built two railroads to aid the canals in connecting the lakes with tide water. Boston formed a connection with the Hudson river, and another with the lakes at Ogdensburgh. Philadelphia improved its hold on Pittsburg. Baltimore thrust out its iron arm to Wheeling, and all these offered inducements to trade. The tonnage of these works shows the progress of trade:—

	Tons.	Tons.
Erie canal, 1840		1,416,046
New York canals, 1858, ...	3,344,061	
New York Central railroad, 1858, ..	838,791	
New York and Erie, 1858, ...	978,066	
Northern, Ogdensburgh to Boston,..	177,728	
Pennsylvania, to Philadelphia,......	530,420	
Baltimore and Ohio, to Baltimore, ..	876,239	6,745,105
Increase in tonnage,..........		5,329,059

The valuation of this tonnage is nearly $350,000,000 per annum, and this affords an indication only of the wealth which has passed eastward. Thus, in 1840, the value of western produce, that found market by New Orleans and the Erie canal, was $51,000,000; in 1858, it was nearly $400,000,000, or an increase ten-fold, and on this mainly has the prosperity of the eastern cities depended. The exports of the southern ports have grown mostly with the direct export of cotton, and those at the north have added gradually food and manufactures thereto. The general course of trade has been to centralize imports in New York.

Charleston owes its origin to a stock similar to that of New England, since a colony of French Huguenots, flying from persecution, settled there in 1690. It was not chartered as a city, however, until nearly a century later, viz.: in 1783, when its population was nearly 16,000. The commerce of Charleston is not extensive, but its facilities for internal communications are large, and enjoys the trade of the whole state, together with much of that of North Carolina and Georgia. A canal, twenty-two miles long, connects the Cooper with the Santee river. It has a fleet of steamboats that are running to the neighboring cities, and several lines of packets running to New York regularly. Its most important connection is, however, the South Carolina railroad, running 136 miles to Hamburg, on the Savannah river, opposite Augusta, Georgia. The population and business have been as follows:—

	Population.	Imports.	Exports.
1790,	16,359	$4,516,205	$2,693,268
1820,	24,480	3,007,113	8,882,940
1830,	30,289	1,054,619	7,627,031
1840,	29,261	2,318,791	11,042,070
1850,	42,985	1,933,785	11,447,800
1860,	51,210	2,070 249	16,888,262

The importations have not apparently increased, while the exports have grown in proportion to the improvement of means of intercourse with the interior, affording better freights outward from Charleston.

Baltimore was laid out as a town, by Roman Catholics, in 1729, and up to 1765 it contained but fifty houses. The persuasion of the founders still predominates. It is situated on the Patapsco river, fourteen miles from Chesapeake bay, and two hundred miles from the ocean. The harbor is a very fine one. The city enjoys great facilities for commerce, and possesses the trade of Maryland and part of Pennsylvania, while it has of late obtained a good share of that of the western states. It was the great tobacco market of the country, but Richmond now rivals it in that respect. As a flour market, it has few equals. The building of railroads to connect with the interior has greatly promoted the city trade, which has progressed as follows:—

	Population.	Imports.	Exports.
1790,	13,503	$6,018,500	$2,239,691
1800,	26,514		12,264,331
1810,	46,555		6,489,018
1820,	62,738	4,070,842	6,609,364
1830,	80,625	4,523,866	3,791,482
1840,	102,313	5,701,869	4,524,575
1850,	169,054	6,124,201	6,967,353
1860,	212,419	8,930,157	10,442,616

The importations have been mostly followed with increase in exports, that have been promoted since 1850 by the opening of the Baltimore and Ohio railroad.

PHILADELPHIA, at the close of the last century, was the first city of America, and since that period, although it has not ceased to expand in wealth and population in a ratio far beyond the examples of the old world, yet New York, by force of natural advantages, has come to exceed it as a commercial city. Its resources for manufacturing are such, however, as to have given it a high rank in the interior trade of the country. The water-power of the neighborhood is very important, and rails and canals give it command of limitless supplies of raw materials, coal and iron in particular. The position of the city was early improved by the construction of canals to the extent of 336 miles, at a cost of $24,000,000; and seven lines, composed of twelve railroads, of 567 miles in length, radiate to every point of the compass, having cost $53,716,201. The canals and roads have swollen the coal receipts of Philadelphia from 365 tons in 1820, to 7,781,100 tons in 1859, valued at nearly $35,000,000 per annum. The population and external trade of Philadelphia have been as follows:—

	Population.	Imports.	Exports.	Total valuation.
1684,	2,500			
1790,	42,520		$3,436,893	
1820,	108,116	$8,158,922	5,743,549	$40,487,239
1840,	258,037	11,680,111	3,841,599	99,321,881
1850,	408,762	12,066,154	4,501,606	
1858,	550,000	12,892,215	6,036,411	155,697,669

The city of Philadelphia was first settled in 1627 by the Swedes, but was regulated and laid out in 1682 according to the views of William Penn, and its population in 1684 was 2,500. The city is one hundred miles from the ocean, eighty-seven miles from New York, and 130 miles from Washington. It is five miles from the junction of the Schuylkill and Delaware rivers, extending from one to the other, and its harbor is on the Delaware, or eastern side. Vessels drawing more than twenty feet water cannot reach Philadelphia, and the navigation for large ships below is a little difficult. Pilots take inward bound ships at sea. These circumstances have aided to give Philadelphia less of a commercial character as compared with the commanding harbor of New York.

If the foreign commerce of Philadelphia does not show large, owing to physical difficulties, the internal commerce, from sales of manufactures and goods imported at New York, is very large—and the real growth of the city is indicated by her external trade less than that of, perhaps, any other city of the Union. The census of 1860 has been estimated at 650,000. The manufacturing industry of Philadelphia has increased in a remarkable ratio. In 1845 the capital employed in the city proper was $18,000,000, the production $21,000,000, and of the neighborhood $33,000,000.

In 1858 the capital invested in the various industries was given at $72,000,000, employing 132,000 hands, and producing $145,348,738 of annual value. In the vicinity the amount is $26,500,000 additional. These figures denote that Philadelphia is probably the greatest manufacturing city of the Union, and will continue to grow in that direction by the force of the same influences which tend to give New York the commercial preponderance. The trade of the city is on a grand scale, and second to none in the world for magnitude of operations, or successful method in conducting them. A leading store of that city is a model of mercantile method. Each department in the store is alphabetically designated. The shelves and rows of goods in each department are numbered, and upon the tag attached to the goods is marked the letter of the department, the number of the shelf, and row on that shelf to which such piece of goods belongs. The cashier receives a certain sum extra per week, and he is responsible for all worthless money received. Books are kept, in which the sales of each clerk are entered for the day, and the salary of the clerk cast, as a per-centage on each day, week, and year, and, at the foot of the page, the aggregate of the sales appears, and the per-centage that it has cost to effect these sales is easily calculated for each day, month, or year. The counters are designated by an imaginary color, as the blue, green, brown, etc., counter. The yard-sticks and counter-brush belonging to it are painted to correspond with the imaginary color of the counter; so by a very simple arrangement, each of these necessaries is kept where it belongs; and should any be missing, the faulty clerks are easily known.

All wrapping paper coming into the store is immediately taken to a counter in the basement, where a lad attends with a pair of shears, whose duty it is to cut the paper into pieces to correspond with the size of the parcels sold at the different departments, to which he sees that it is transferred. All pieces too small for this, even to the smallest scraps, are by him put into a sack, and what is usually thrown away by our merchants, yields to the systematic man some $20 per year. In one part of the establishment is a tool closet, with a work-bench attached; the closet occupies but little space, yet in it is seen almost every useful tool, and this is arranged with the hand-saw to form the centre, and the smaller tools radiating from it in sun form; behind each article is painted, with black paint, the shape of the tool belonging in that place.

It is, consequently, impossible that anything should be out of place except through design, and if any tool is missing, the wall will show the shadow without the substance. The proprietor's desk stands at the further end of the store, raised on a platform facing the front, from which he can see all the operations in each section of the retail department. From this desk run tubes, connecting with each department of the store, from the garret to the cellar, so that if a person in any department, either porter, retail, or wholesale clerk, wishes to communicate with the employer, he can do so without leaving his station. Pages are kept in each department to take the bill of parcels, together with the money paid, and return the bill receipted, and change, if any, to the customer. So that the salesman is never obliged to leave the counter; he is at all times ready either to introduce a new article or watch that no goods are taken from his counter, excepting those accounted for.

By a peculiar method of casting the percentage of a clerk's salary on his sales, coupling it with the clerk's general conduct, and the style of goods he is selling, a just estimate may be formed of the relative value of the services of each, in proportion to his salary. By the alphabetic arrangement of departments, numbering of shelves, and form of the tools, any clerk, no matter if he has not been in the store more than an hour, can arrange every article in its proper place; and at any time, if inquired of respecting, or referred to by any clerk, the proprietor is able to speak understandingly of the capabilities and business qualities of any of his employees. Population in 1860, 565,531.

Boston was settled early in the seventeenth century, and in 1684 was the most populous of the Atlantic cities, having 6,300 inhabitants. It is 216 miles from New York, and although possessed of one of the finest harbors on the coast, it had no facilities for reaching the back country, which was for the most part rocky and mountainous, until railroads were constructed. Its early trade was in navigation and the fisheries. Its first adventure was in 1627, when a sloop, loaded with corn, was sent to Narraganset to trade, and made an encouraging voyage. Its inhabitants soon became rich by doing the trade of others in their celebrated ships, until manufacturing became possible. The energy and intelligence of the race, when turned in that direction, soon drew large profits from their industry, and more freight for their coasting tonnage, which increased as the numbers engaged in manufacture required more food and raw materials. The greatest start was given to the trade of the city when railroads had laid open even the remotest regions of the interior to its enterprise. The general course of its population, trade, and valuation has been as follows:—

	Population.	Imports.	Exports.	Valuation.
1684,	6,300			
1790,	18,038	$5,519,500	$2,517,651	$6,990,390
1820,	43,298	14,826,732	11,008,922	38,288,200
1830,	61,392	10,453,544	7,213,194	61,780,210
1840,	93,883	13,300,925	9,104,862	102,101,201
1850,	136,881	30,374,684	10,681,763	180,000,500
1855,	162,629	45,113,774	28,190,925	249,262,500
1858,	170,000	40,432,710	20,979,853	262,014,500

The exports of Boston have taken a great start since 1830, and since then there have been constructed nine lines of railroad, which radiate from Boston in every direction; placing every town in New England in connection with it, and by continuous lines, every city of the Union, from Bangor to New Orleans, St. Louis, Chicago, and St. Paul. The running of the line of Cunard steamers gives it a European connection more prompt and regular than any other. Its extensive trade shows the effect of these connections, and its taxable valuation the wealth that accumulates from its manufacturing industry. That valuation is this year (1860) $276,339,900, and the population 177,481.

CHAPTER III.

NEW YORK—TELEGRAPH—EXPRESS—GOLD.

The city of New York, at the close of the revolution, was the second city of the new world, taking rank after Philadelphia. Its internal trade was limited to the capacity of the Hudson river, but its traders pushed across to Lake Champlain, and even to Lake Ontario, whence they drew skins and furs from the Indians, and brought down some of the produce of Vermont and New Hampshire. At this date there was little trade west of Albany. The trade was mostly with the towns on the east side of the river, and with Rutland, Burlington, and other Vermont towns, as well as the western towns of Massachusetts. Remittances were made from these towns in ashes, wheat, etc., and during the embargo and war, smuggling was very extensively carried on, taking pay in specie. The goods went up the river in sloops. The New England cities had equal commercial advantages, and Philadelphia enjoyed many others in addition. The valley of the Hudson furnished, however, large supplies of farm produce during the wars of Europe, which gave a preponderance to the New York trade, and it began to gain strength. In 1807 the passage of Fulton's steamer to Albany gave a great impulse to the river trade. Her statesmen, however, soon saw the necessity of a more extended inland communication, and the canal, which had been projected before the peace, became a legal reality in 1817, and a physical fact in 1825. The capital of the New York merchants began to be invested in enterprises which resulted in centring trade in the city. The canal connection opened the vast circle of the lake trade to New York city, and poured into its basin the western farm produce at rates far below what the same articles could be raised for at the east. As a necessity, therefore, New York became the point of supply, not only for the foreign trade, but for the neighboring states. The growing manufactures of Philadelphia and Boston found cheaper food in New York than in their own neighborhood, and North river sloops and schooners continued the Erie canal to the Delaware and the Charles river. As new routes to the west, and more extended settlements in that region opened new sources for the supply of produce, and new markets for goods, the tendency was to New York. The capital engaged in commerce at that point being the largest, produce found readier advances and more prompt realization, while the large imports and consignments of foreign goods made the assortment larger and the average cost less there than elsewhere. The same circumstance that drew produce into New York bay, also drew eastern manufactures to the same point, and this increased the assortment which was to be found at the common centre. The fact that produce tended generally to New York, as a matter of course made it the centre of finance. The United States government, and bank, and mint had been established at Philadelphia. Those circumstances could not, however, control the currents of trade. The pork, and corn, and wheat of the west, the manufactures of the east, the tobacco, cotton, and rice of the south, being sent to New York to obtain advances, it followed that from all quarters bills drawn against produce ran on New York. Those bills found buyers among the country dealers, who, in all directions, wanted to remit to New York to pay for goods there purchased. Capital could not keep aloof from the focus of transactions, and all loans to be made or financial operations to be conducted, sought New York. For the same reason all funds seeking investments went there to find them. Produce, goods, raw material, capital, all operated in reference to New York, and the foreign trade was the motor which kept up the circulation. This tendency to a centre once commenced, cannot be turned, but it strengthens with the general increase of the country. The other cities strive to turn a portion of the current each in its own direction, but the result of those efforts is only to increase the aggregate trade of the whole.

If the amount of specie exported, and for the most part that is but a transit trade from California, is deducted from the New York account, New Orleans will be found to exceed it in exports by $32,000,000. The lines of communication with the interior, and the facilities for advancing on produce, drew to New York a considerable portion of the western produce, and operations are now there carried on which partake of a speculative character. Pork, flour, etc., are often sold largely for future delivery on the New York exchange; and much of the cotton shipped from southern ports direct to Europe, is resold in New York many times before it arrives out. When the cotton is put on board ship for Liverpool, samples and bills of lading are sent to New York, and the cotton sold "*in transitu*"—that is, during its passage to Europe. Should the ocean telegraph come into operation, this system could be carried to a much greater extent, since news from the Liverpool market could be received at least thirty days after a cargo is shipped before its arrival out; and in speculative times, other articles will be subject to the same operations. The export of corn first became a large business in the famine years of 1847–8, and the subdivisions of qualities, round and flat, yellow, white, etc., then manifested themselves. In the present year, the crops are greatly beyond any former experience, and every available means of transportation is taken up to convey it to market. The realization of them depends upon the quantities that Europe may require, and this depends upon the events of a few weeks. The steamers now give intelligence in ten days, when formerly thirty were required. If the ocean telegraph had worked, the price of corn in Liverpool would have been known simultaneously in Chicago, and water transportation pressed to its utmost before the frost closed it.

The proportion which each of the cities named enjoys of the aggregate export trade of the whole country, is seen in the following table:—

EXPORTS OF THE LEADING ARTICLES OF DOMESTIC PRODUCE FROM THE CHIEF ATLANTIC CITIES.

	Boston.	Philadelphia.	Baltimore.	New Orleans.	New York.	Total.
Beef	$79,427	$281,010	$52,219	$170,715	$1,312,957	$2,081,856
Pork	379,998	205,154	317,737	154,101	1,169,707	2,852,942
Lumber	368,597	46,901	49,753	13,425	751,334	3,428,530
Furniture	328,654	24,274	22,704	3,894	331,281	922,499
Stoves, &c.	5,140	2,749	53,983	395,550	960,390	1,975,852
Butter	61,836	83,289	74,043	36,048	236,928	541,863
Cheese	15,113	9,742	21,797	9,626	561,451	731,910
Hams, &c.	34,559	68,072	75,056	184,634	1,485,958	1,957,423
Lard	144,047	163,319	254,713	1,962,121	1,172,950	3,809,501
Tallow	42,813	176,258	9,286	149,206	258,226	829,970
Cotton	815,968	87,512	10,985	73,152,768	8,368,500	131,386,661
Tobacco, manufactured.	404,569	52,138	55,965	5,929	1,113,428	2,400,115
" leaf.	143,653	78,019	3,430,287	7,564,247	1,482,970	17,009,767
Rice	92,128	76,834	72,743	18,097	664,969	1,870,578
Naval stores	34,076	34,419	22,577	7,161	1,219,553	1,464,210
Brass manufactures	45,024	34,398	1,205	973	1,705,426	1,985,223
Iron "	402,228	755,403	75,661	40,719	1,922,734	4,059,528
Cotton "	1,860,885	62,642	442,863	169,011	2,113,225	5,651,504
Wood "	584,685	193,578	156,614	23,233	413,806	2,234,678
Gold and silver coin	3,679,027	124,887	62,050		14,917,585	19,474,040
" bullion.	917,395			1,009	12,456,256	22,933,206
Corn	30,112	439,017	334,576	682,839	1,331,570	3,259,039
Wheat	3,491	251,991	308,657	632,221	5,451,491	9,061,504
Flour	955,257	1,293,228	2,909,679	2,257,152	7,017,790	19,328,884
Spirits	753,693	18,385	43,169	65,135	729.220	1.993,845
Other articles	3,191,437	1,050,005	1,220,064	570,710	14,253,857	30,513,151
Total	$15,373,812	$5,613,224	$10,078,386	$88,270,524	$83,403,562	$293,758,279

The opening of the Erie canal, in 1825, gave the first decided impulse to the city business, and produced a powerful effect upon its prosperity. The impulse was prolonged under the bank excitement that exploded in 1837. The effect of railroad extension at the west has, in the last fifteen years, had a still more powerful influence upon its growth. The following table gives the population, imports, exports, and taxable valuation, for a long period:—

	Population.	Imports.	Exports.	Valuation.
1684,	2,600	$4,579	$10 093	
1750,	10,381	267,130	35,632	
1790,	83,181	10,739,250	2,505.415	
1800,	60,489	26,201,000	14,045,079	$25,645,867
1820,	128,706	23,629,246	13,160,918	69,530,753
1830,	208,007	36,624,070	19,697,983	125,288,518
1840,	312,710	60 440,750	34,264.080	252,233,515
1850,	515,547	111,123,524	52,712,789	286,061,816
1855,	629,904	164,776,511	113,731,238	486,998,278
1860,	813,668	233,718,718	138,036,550	577,230,656

Up to the year 1840, the business of the west depended mostly on the canal, and by way of New Orleans. The city held then a kind of monopoly, but, like all monopolies, it cramped the producers. The large expenditure at the west for bank capital, in the years 1836–37, caused a great credit demand for goods upon New York, which was generally met. The facilities granted in those years by the American bankers in London, for the purchase of goods on credit, placed these within the reach of any dealer who could make a fair show; and the goods obtained on credit required to be sold on the same terms. The rivalry thus produced among those who could command goods, was very great, and the utmost efforts were made to obtain paper in exchange for goods. The banks showed the same eagerness to discount the paper that the merchants did to obtain it, and the mass grew in a rapid ratio, from the small country dealers to city jobbers and importers, and London bankers, until the

Bank of England, in August, 1836, issued a warning to those houses to curtail their credits. This was the "hand writing on the wall"—settling day had come. The business south and west had then been eagerly sought after by the jobbing-houses, who employed drummers to haunt the New York hotels and beset every new-comer with temptations to buy. The drummers of the day had usually no limit placed upon their expenses, which were intended to cover the "attentions" shown to the country dealer. These revelled in the dissipations of the town at the apparent expense of their entertainer, and they could do no less than buy of such attentive friends, when the bill, whether they discovered it or not, would often cover their own and other people's expenses. The mode of business then in vogue, when banks were multiplying so rapidly all over the country, was to take the paper of the dealers, payable at their own local bank. It was supposed that the dealer would be sure to keep his credit good at home. The result showed that the dealer, in order to pay the New York bill, got an accommodation note done at his bank, which thus became the debtor of the New York collecting bank. By this means, although the New York merchant got his money, the west was still in debt to the east; and this continued as long as capital was sent from the east to the west to start banks. The whole system exploded in 1837, and the bank capitals were sunk in these credits. From that date there was to be "no more credit," a threat which has often been repeated without being put in practice. The only permanent change seemed to be to require notes payable in New York. Those are given at dates longer or shorter, but the system is an improvement on the old mode. With 1840 also began the railroad building, which brought stocks and bonds to New York for negotiation, and the money being expended west promoted consumption of goods, which caused a greater demand in New York. The exports of produce increased at higher prices, and the sales of these gave the producers the means of buying more goods. In 1838, thirty-one years after the first successful steamboat, arrived the first ocean steamer, the Sirius, at New York, marking a new era in foreign trade, since communication with Europe was now reduced to half the time, a circumstance which was equivalent to an increase of capital engaged in commerce, because it could be turned oftener. From that date ocean steam navigation rapidly increased. The electric telegraph of Morse began a few years later to exert its influence in facilitating intercourse, and the express system was also introduced. It is somewhat singular, that with the breakdown of the old credit system and the adoption of the plan of making notes payable in New York, four important elements, having the highest centralizing tendencies, began to operate. These were, first, ocean navigation; second, the more extended construction of railroads; third, the invention and construction of telegraphs—there are now 25,000 miles of wires, that have cost over $2,000,000, consolidated in one company, and New York is the centre for the whole: and, fourth, the express system of intercourse. All these, centring in New York, came into active operation at the moment when gold was discovered in California, to give them an extraordinary impetus. The express business is peculiarly American, and has grown with a vigor which places it among the most important trading facilities of the country. In the spring of 1839, a year after the arrival of the Sirius at New York, W. F. Harnden, then out of employ in Boston, was advised by his friends to get a valise and take small packages and parcels from his acquaintances in Boston to their correspondents in New York, and return with what they had to send, making a small charge for his services. He did so, and discovered that a great public want was to be supplied. He soon contracted with the railroad to send a car through with his goods, and with business tact he opened offices, employed messengers, pushing the business with American energy. In 1840 an opposition was started by Adams. In 1841 new fields were explored by Harnden, who ran an express between Albany and Boston, and one between Albany and New York. Route after route was then opened to express agents, penetrating further and further, and multiplying their lines in the densely settled portions of the country; not only between cities, but between different portions of the same city. In 1845, Buffalo was reached by Wells & Co. In 1849, the gold fever brought California within the scope of express operations, and from San Francisco as a centre, "pony" expresses ran to the diggings with great success, placing the solitary miners of the Sierra Nevada in direct connection with the mint and with Wall street. As these busy agents continued to increase, and lessen the difficulty of communication, trade multiplied as a consequence. The telegraph had also penetrated most direct routes between cities, and that instrument came in aid of the express, which executed an order transmitted by telegraph. Instead of waiting the slow course of the post for a reply, the telegraph gave an instantaneous order for goods that the express conveyed. Thus, the three months that would once have been consumed in coming from Cincinnati for goods and returning, was reduced to three days. All the cities of the union were brought within similar speaking distance. In 1850 it was estimated that the expresses travelled twenty thousand miles daily, in discharge of orders, and the service has since doubled. Steam, the telegraph, and the express, had thus greatly facilitated trade, by making the long semi-annual expeditions to the large cities, for the purchase of goods, unnecessary. The small dealers could now buy frequently in small parcels the goods they found most in demand, instead of buying a six months' stock, and taking the risk of the goods being well selected for the market. This also brought with it another change. It had been the case, that most of the goods sent to America formerly were the surplus stock of the British manufacturers. That is, where patterns had been got up for the home consumption and the regular trade supplied, there would remain a stock that had become comparatively dead by age. This dead stock was "good enough for the American market," and was sent out almost for what it would bring, and being transported into the interior for six months' sales, became a sort of Hobson's choice for the consumers. When, however, frequent arrivals of new goods came to be laid before the customers, they immediately displayed a taste and exercised a choice. Ill-assorted goods would now not sell at all. English refuse became of no value, because American taste was developing itself with considerable strength. The customer was no longer to take what was laid before him; but in order to sell, the dealer was now to exercise his sagacity as to what would please his taste in selecting it, and his judgment in buying it. The manufacturer of dry goods was obliged to follow in the same direction, and the employment of designers became important. It was now that the sagacity and taste of the factory agents were felt to be an indispensable element in the success of a concern. The production of a design was promptly followed by the judgment of the public, and manufacturing became, as it were, one of the fine arts.

The joint operation of these new agencies manifested itself in 1850, when the west had become enriched with the large sales it had made of its produce during the famine years, and the railroads and canals, then in operation, had profited largely by the high freights and tolls paid by produce on its way to market. The gold of California was now in its turn adding a new stimulus to the business of the city. In 1852 the Michigan roads had opened through to Chicago, and New York was now, by rail, within thirty-six hours of that city. The projection and construction of railroads went on rapidly, constantly adding to the business of New York—the common centre, whence the means to build were drawn, and to which these means returned in the purchase of goods. The Crystal Palace, in 1853, drew great numbers of persons to the city, and gave a start to retail trade, which had an important effect upon the value of real estate and the location of business. In the above table we find that the imports into the city from abroad rose fifty per cent. in the five years to 1855, and the total valuation two hundred millions. This valuation followed the changed location of business. In the speculative times of 1836-7, the old Pearl street house, in Hanover square, was the headquarters of country dealers, and that square the centre of the dry goods trade, around which all others agglomerated. The great fire of December, 1835, by which the lower part of the city and a value of $18,000,000 was destroyed, broke up the location, which, however, was speedily rebuilt, and, with the rebuilding, the Merchants' Exchange was enlarged and reconstructed at an expense of $1,800,000. The usual fate overtook occupiers in the inordinate demands of landlords, and the leading firms pushed across Wall street and made Pine and Cedar streets the great centre. Gradually firm after firm ventured upon Broadway, which, in 1845, was visited by a fire that caused the rebuilding of the lower portion, no longer for dwellings, but for substantial stores. One firm went up to the corner of Rector street, one-quarter of a mile from the Battery, and took the site, long vacant, of the old Grace church, at a lease. "Too high up," said conservatism, as the crowd rushed by, and the great retail firm of Stewart & Co. took the old Washington hotel at the corner of Chambers, and occupied the block with a marble store which has no equal in any city. Here importing, jobbing, and retailing are carried on to the extent of $10,000,000 by one who, by his energy and enterprise, has increased a capital of a few hundreds to millions, and now employs two hundred and fifty clerks and others. There were handsome stores before this was built, but this may be said to have commenced the era of expensive structures. The demands of luxury have led to the erection on Broadway of elegant trade palaces of iron, marble, and freestone for the leading firms in the dry goods, jewelry, clothing, porcelain, and other branches of trade; while the wholesale dealers, invading the old college ground, have covered it with marble stores of great size and beauty. The centre of business which, twenty years since, was within a quarter of a mile of the Battery is now a mile distant, and the value of real estate has followed like a "ground swell," reaching incredible rates. A marble store on Broadway was rented in 1860 for $50,000 per annum, or nearly a thousand dollars per week. A lot on Broadway, near Broome, sold lately at private sale for $110,000; it had been bought at auction, in 1852, for $35,000. An elderly gentleman present remarked, "This lot was part of the old Colonel Bayard farm, and was given by the colonel to his barber for a hair-dressing bill. I have seen it sold at auction four times, and each time people decided the buyer crazy to give such a price." The "Central Park," to cover 800 acres, was projected, and has since been prosecuted, at a cost of $5,406,193, having employed, in the four years, over 10,000 men.

The city has spread toward the upper wards through the agency of railroads, which have enabled workmen and merchants to live further from their places of occupation than formerly. The importance of consuming as little time as possible in coming from and going to occupation made it requisite formerly, when roads were barely paved, and conveyances not to be thought of, that persons should live near their business. The old cities of Europe are thus built with narrow streets and very high houses, to accommodate many in a little space. Modern cities are built on a broader scale. Omnibusses first came into play to give a greater breadth to the dwellings of the people, and horse-railroads have still further expanded the area. The island of Manhattan, from the Battery, which forms a point, runs northerly between the North and East rivers. From the park the city spreads in a fan-like form east and west, and from that point radiate the railroads. Of these there are six, including the Harlem, which runs by the Fourth avenue to Albany. The five other roads run on as many avenues, and carry their passengers from three to eight miles, returning with them to a common centre every morning to business. These four roads cost $4,600,000, and the receipts for 1859 were $1,481,010. In 1858 they transported 27,900,388 people, and in 1859, 32,718,351. If the Brooklyn railroads are included, the receipts would be swollen to $1,978,340 for 1859, and the number of passengers to 39,560,000 per annum. The passengers on the Brooklyn roads are mostly coming to business in New York, and, therefore, are part of its trade. The telegraph also comes to play an important part in the city business. Many large firms, whose offices are in the lower part of the city, and warehouses and manufactories in the upper part, connect the two by telegraph, to transmit orders and for information. All the police stations connect by telegraph to give alarms of robbery, and fire alarms are also conveyed by the same means. The "time ball" also operates by telegraph. On the top of the Custom House, sixty feet high, is a mast on which slides a black ball some 20 feet in diameter. This can be seen from any part of the bay. It is hoisted to the top of the pole, and is so arranged, that the moment the sun reaches the zenith, by observation, at Albany, it is released by electricity and falls, marking twelve o'clock, by which every ship-master in the port may set his chronometer.

All the railroads, continually running night and day, aided by twenty-five stage routes, on which run four hundred and forty-four two-horse stages, bring the business and working population to their occupations, and back at night. By all these conveyances there travel in New York every year a number of persons equal to twice the population of the whole United States. This makes a much larger breadth of land possible to a great city than otherwise, and allows of the thorough concentration of business. The country dealer, in making his purchases of different goods, is prone to buy of those nearest to his most important bills. The dry goods are to be selected, and the hardware, earthenware, cutlery, millinery, and the thousand and one subdivisions into which business, formerly one, now branches, are also to be purchased to the best advantage, and much time spent in going from one to the other cannot be afforded. Hence the importance of concentration and the value of "business sites." Manufacturers of small wares also spring up in such locations. The transformation in trade itself is quite as noticeable as the change in its locality; and there are those whose heads are not yet silvered, who can remember when the mode of doing business bore less resemblance to its present fashions, than the pants now in vogue do to the knee breeches worn by our grandsires. Formerly, a young man engaged in business for himself only after a long course of training, and then usually by uniting himself with his seniors; now beardless clerks dash into trade as if it were a holiday sport, requiring only a full flow of animal spirits. Then the principals of every house were working men, who lived frugally, and waited until their fortunes were made before they spent them; now, a start in business gives sufficient warrant for a generous expenditure, and many are too impatient to wait for their income, but spend the fortune they have—in prospect. Then, the word of a merchant was as good as his bond, and, with a few exceptions, his honesty was proverbial; now, there is more finesse in the place of open dealing, and the exceptions almost balance the rule. Then, insolvency was a bitter word, and failures in business from recklessness brought overwhelming shame; now, the gazette has lost its terrors, and bankruptcy is to many but a slight annoyance. Perhaps, however, the greatest difference which purchasers who come to the New York market are called to observe, is in the division of the goods. Formerly, a dry goods jobber kept a full assortment of every thing in his line, and it required no little tact and exercise of memory to keep each line full. Now, one house confines itself to woolens, another to cottons, another to silks, and yet another to fancy articles; and even these are subdivided, as in woolens one will keep tailors' goods, another dress goods and women's wear; in cottons, one confines himself to prints, another to the plain goods; in silks, we have establishments for piece goods, and others for ribbons and smaller articles. The tendency is to a still more minute division, and thus we have a dealer in hosiery, a dealer in lace, a dealer in perfumery, a dealer in pocket handkerchiefs, a dealer in shawls, and one house keeps nothing but suspenders! Twenty years since the manufacture of clothing became a separate business, and it has since subdivided into many branches. In ten years more there may be an establishment for spool cotton, and another for corset-laces, if such instruments of torture shall then be in vogue. We are not prepared to say that the division of goods here noticed may not be a positive convenience, although it certainly increases the labor of the purchaser. It may, however, induce more method in the selection of goods, and we think it has already led to some change in this respect. Buyers now make, to a considerable extent, a corresponding division of their time, and one day is set apart for woolens, another for silks, and so on through the whole catalogue. Could some staid customer of the last century, awaking from a Rip Van Winkle sleep, be set down at this day in some of our thronged thorough-fares, he would get sorely jostled and footweary before he had made a black cross against all the articles upon his memorandum.

The supplies of goods for the country dealers are derived from various sources; small wares from city manufacturers; domestics from the mills or agents; foreign goods from importers or agents of foreign manufacturers. The local manufactures are generally purchased by the jobbers to make good their assortments, as is also the case with hardware, and most articles of domestic manufacture, except the productions of the large mills, which have agents in the city for their special sale. These grant more or less credits, and sell goods for paper to turn into money. The agents of foreign manufacturers tempt buyers by granting long credits for paper which may be converted into money at the banks. The regular importing houses remit for their goods when they give the order, and sell at six and eight months to the jobbers, the largest purchases being made in the spring and fall; sometimes through the auction houses, whose paper is a favorite means of raising money. The jobbers, in their turn, sell at eight and twelve months' credit, seeking custom in the country by means of agents, instead of the old system of drummers, and allure buyers by the liberality of credits, depending upon the mercantile agencies for information in relation to the reliability of the buyer. These agencies have ramifications in every town of the country, but their usefulness is not what was at one time expected from them. The jobbers grant credits far beyond their own capital, and when they buy at eight months and sell at twelve, their notes are to be discounted at the banks with the paper they have taken from their customers as collateral, to meet their own notes to the importers. In times of panic, like the fall of 1857, the banks refuse to do this, and then the importer must renew the paper or the bank grant the extension needed, to avoid absolute stoppage. The credits granted by foreign manufacturers at such times are not met. The lapse of time, with fair crops, generally brings up the payment of the country paper, and the "extensions" are gradually extinguished. The grocers who sell sugar, etc., do so generally at four months, and get their money before the dry goods people, who also come after the hardware and earthenware dealers. The supply of capital in the city, under these circumstances, brings to it the largest assortment of goods, and of course it is the best point at which to buy, the more so that at times there is an over-supply of goods, which being worked off at auction, realizes a loss sometimes of 25 to 30 per cent. to the importer and foreign owner, and of course to the advantage of the country buyer. The general attractions offered to buyers make it to the advantage of sellers elsewhere to send their merchandise to New York to meet the purchasers. Boston made recently an attempt to break up this, by establishing sales of her manufactures there, instead of sending them to New York. The force of centralization is, however, difficult to overcome, and the imports at New York show an increasing share of the arrivals into the whole country. Thus, in 1859, New York imported $220,000,000 out of an aggregate of $338,000,000; in 1840, $60,000,000 out of an aggregate of $121,000,000. The proportionate imports at the Atlantic ports, are as follows:—

IMPORTS OF CERTAIN GOODS INTO THE LEADING ATLANTIC PORTS, AND ALSO THE TOTAL IMPORTS INTO THE UNION.

	Boston.	Philadelphia.	Baltimore.	New Orleans	New York.	Tot'l into Union.
Gold bullion	$1,975,795	$1,115	$9,950	$275	$269,833	$2,286,099
" coin	306,113	76,785	..	424,542	8,096,651	9,279,969
Silver bullion	112,085	..	2,500	..	271,027	408,879
" coin	3,613	36,683	..	4,096,034	689,533	7,299,549
Coffee	1,091,146	2,163,947	2,766,095	4,360,432	6,730,168	18,341,081
Tea	142,889	..	..	..	6,414,700	6,777,297
Linseed	2,211,684	..	..	..	940,077	3,243,174
Guano	28,539	..	195,470	..	242,648	525,376
Wool, free	2,493,470	30,501	130,690	..	1,173,075	3,843,320
" dutiable	137,036	..	4,528	2,714	4,961	179,365
Watches	184,900	117	..	20,388	1,980,864	2,118,838
Coal	37,361	5,606	2,402	16,448	521,774	772,925
Woollens	1,453,519	1,547,052	263,320	514,020	21,987,784	26,489,091
Cotton hose	33,881	235,246	139,546	70,691	1,625,833	2,120,868
" goods	2,010,601	1,180,172	184,848	1,385,594	9,917,270	15,057,398
" laces	500,682	4,093	281	50,138	2,274,033	2,845,029
Silks	1,621,388	76,491	5,254	356,843	19,238,760	21,471,488
Linen	532,836	551,531	73,224	457,098	4,823,264	6,527,894
Gloves	36,777	11,709	4,005	19,127	1,362,096	1,449,672
Window glass	141,308	5,299	..	22,879	454,344	626,747
Gunny bags and cloth	1,108,730	31,847	..	57,118	147,571	1,437,767
Iron, bar	1,016,541	298,186	95,376	119,476	1,610,970	3,318,713
" pig	218,695	74,612	4,069	47,650	329,785	739,947
" railroad	8,862	7,397	35,743	340,699	1,556,538	2,987,576
Cutlery	85,920	42,609	15,475	142,456	1,155,761	1,489,054
Jute	1,294,026	5,009	..	8,738	970,723	2,298,708
Leather	46,338	2,495	1,953	..	1,205,714	1,259,711
Hides	2,784,442	377,635	422,466	55,670	5,629,029	9,884,358
Molasses	717,742	223,616	183,352	30,263	1,414,168	4,116,759
Sugar	3,154,026	1,955,243	1,712,744	761,708	13,514,098	23,317,435
Other articles	14,939,245	3,935,373	2,656,766	5,794,033	53,727,835	100,099,063
Total	$40,430,190	$12,880,369	$8,920,157	$19,155,034	$170,280,887	$282,613,150

The aggregate imports at these five ports are thus $251,666,637, which, deducted from $282,613,150, leaves $30,946,513, as the imports of all other ports of the Union. The imports of coffee at New Orleans from Brazil, to go up the river, are large; and at

Boston, coffee and hides, from the same source, figure high. But both Baltimore and Philadelphia receive much coffee direct; in fact, that is the largest item of import at those two cities. Boston imports many materials for her manufacture—linseed, free wool, jute, hides, etc. Philadelphia also imports similar articles. The great mass of the goods for the consumption of the interior passes into the port of New York. It is to be borne in mind, however, that many of the importations at New York are really for Philadelphia, Albany, and other cities, even western ones. They are entered at the custom-house by a broker, who pays the duty and forwards them by express to their destination, for a small commission. The express, the rails, and the telegraph, facilitate such operations.

The gold and silver imported at New York are from various sources, but in the last few years have consisted mostly of doubloons and Spanish gold from Europe, to re-export to Havana for the purchase of the sugar crop. In 1857, that movement was very large, early in the year, to the island, and subsequently, when the stock of sugar accumulated very largely in New York, the gold came back from Havana to prevent it from being sacrificed. The bulk of the gold that forms the amount exported, is direct from California, and has been annually since the discovery, in sums of nearly fifty millions.

The gold extracted from the earth by the miners of California has a considerable degree of purity, and before refining establishments were set up in the state, sold at from $16 to $20 per ounce. Much was used as a currency. It was carried in little leather pouches, and weighed out to shopmen in exchange for goods. A large portion of it was carried to New York, in the pockets of home-bound adventurers, and sold in New York at such rates as were possible. The buyers mostly had it sent to Philadelphia, by express, at an expense of 3-8 per cent. It was then assayed and coined at the public mint, and the proceeds returned to the owner. This expensive and round-about process led to the establishment of a mint in San Francisco and an assay office in New York, where the miners themselves could deposit the dust and get the full value in return. When the dust is deposited, a certificate of weight is given and the gold in bars returned. There are a number of private assaying houses in San Francisco, where the dust is cast into bars of large size. Most of these are connected with banking houses, and the bars are the basis of exchange. The express companies deal in this gold. The miner now having a lot of dust, sells it to an express agent, or sends it down to a banker in San Francisco, who has it assayed and cast into bars. The value is credited to the depositor, less the commissions. The bars are mostly shipped to New York, and the bankers draw bills against them in favor of those who have remittances to make to the bank. The competition among the bankers reduces the rate at which these bills can be sold to a point that leaves apparently no profit, and it is charged in some cases that they draw at a loss, in the view of monopolizing the business. The refining leaves a small profit. The cost of shipping the gold to New York may be thus stated: freight, etc., $1 57; state stamp on bill, 20 cents; insurance, $1 50—making $3 27 on $100. But the insurer gets from the Mutual companies scrip, worth on an average 35 cts., which reduces the cost to $2 92. The bars sometimes command a higher price in New York than in San Francisco. Thus, a bar of 100 ounces, 880 fine, is at this moment worth *par* in San Francisco, and 900 fine it is worth 87½ cts. premium in New York. This price has reference to the gold only of the bar. There is some silver in each. Thus, in the bar 880 fine there is 88 ounces of gold, 11½ of silver, and 1-2 oz. copper. In the other, 90 oz. gold, 9 1-2 silver, and a half copper. This makes the gold worth ½ per cent. more in New York than in San Francisco, and reduces the cost of the bill to $1 92 per cent. It is evident that he who sells his bills at 2 per cent, makes but 8-10 of 1 per cent, or, including other items, a small loss. If the house feels strong enough to insure itself, it saves the insurance; but this must be more or less a risk to those who take the bills. Thus the operation is one of mere cost of shipment of the gold; but the control of so much gold on paper issued is an object with large firms. The higher value of gold at New York arises from the fact that it is the financial centre of the Union. The exchanges of the country with Europe and with the interior of the states turn there. The south ships its cotton, and tobacco, and rice; the west its produce; and the Atlantic states their manufactures. These, as we have seen, give an aggregate value of over $300,000,000 sent abroad in a year. The shippers of these goods draw bills against them, and offer them for sale. The market of sale must be where the greatest demand for them for remittance exists. New York imports two-thirds of all the goods received into the country, consequently the demand is there the greatest for the bills, and they are sent there for sale. It happens that the great majority of bill-drawers are unknown to the buyers, hence there is hesitation in taking their bills. To obviate this, a number of large banking-houses connected abroad, and having great capital, buy the bills that have "bills lading" attached, and the goods are sent to their correspondents abroad. In the seasons of the year when shipments are most active, these bills are plenty and low. They are then purchased and endorsed, and sold with the endorsement at a higher rate when the season advances and the cotton-bills run short. If the demand is active, and the rate of money higher here than abroad, the bankers draw on their own resources, and lend them the proceeds of the bills they sell on stocks or other securities. They are also the buyers of the gold bars as they arrive from California, and pay such rates as the demand for exchange, or the rate of money, or the price of gold on the continent, present or prospective, will warrant. A demand for silver to go to Asia, causes a demand for gold with which to buy it on the continent, and this demand draws upon New York, and indirectly upon the whole country. It is obvious that the bill business is thus mostly in the hands of large bankers. This grows out of the fact that there is abroad no market for bills on New York. Thus, the New York importer of goods, in order to pay for them, buys a bill on ships' specie, instead of ordering his creditor abroad to draw upon him, which would be done if a bill on New York were saleable in the London market. It is understood, that when such amounts of bills from the south and elsewhere are sent to New York for sale, the proceeds of those sales form a large fund due by New York to those sections. These funds are deposited in the New York banks, and by them employed in loans upon stocks, or in such other ways as will pay an interest. Thus the whole country contributes to the supply of capital at that common centre. The New York banks, some fifteen years since, in order to encourage that centralization, allowed interest of 4 per cent. on the funds so deposited. This caused a greater sum to be so employed, and imposed on the banks the necessity of lending it, in order to make a profit. The amount of funds lying in New York varies from $16,000,000 to $35,000,000, according to the season of the year. The banks in all sections of the country that have such funds in New York do not draw against it directly in favor of those who want to remit to New York, but they use the funds to buy up their own or other paper cheap. The effect is to swell the supply of funds in New York, and at times foster speculation there.

The funds that accumulate in New York, make it also the mart for stock operations; and these are very large, as well for regular investments, as for merely gambling operations.

With the creation of any commodity whatever, there springs up almost simultaneously a class of persons to deal in it, and to appropriate more or less capital to its prosecution. This capital is most generally applied to the purchasing of it when it is thought to be cheap, in order to hold it until it can be disposed of to better advantage, or in advancing money to the needy seller. The persons so engaged, by devoting their time and attention to the subject of their traffic, reduce it to science, and soon determine and classify the kinds and qualities adapted to the markets and wants of the public. The dealing in stocks is comparatively of modern origin, and commenced with the credit system of the European governments, at the close of the seventeenth century, when William of Orange avoided the dangers that beset the throne of the Stuarts, by borrowing money instead of extorting it by illegal taxation like Charles I., or stealing it like Charles II. The moment that government stocks—or certificates of debt issued to the government creditors—made their appearance, they became subjects of traffic, and with the certificates of stock in corporate companies, formed the material for speculation, and the exchange markets, where the surplus wealth of communities seek investment, became the theatre for operations in securities. The American colonies had no stock debts or corporate companies, since little surplus capital existed for such investments. The paper money that they issued, however, afforded by its fluctuation many opportunities of jobbing at the expense of the public. When the revolutionary war broke out, the continental money of the federal government gave a larger field for these operations, which were based mostly on the rapid depreciation of their value. Thus, a person would borrow a sum, returnable in the same description in a fixed time. Its value in that time having fallen, he could return it at a profit. Supposing the money to be par, a person would pledge a bag of $1,000 for paper; a fall of eight or ten per cent. in sixty days would enable him to redeem his dollars with $100 profit. In the time of the revolution, a stage driver, having a talent that way, made money in the traffic, and subsequently became the head of the largest bank and stock house of his time in New York, ending a long and respected life by suicide. This paper soon perished, and was succeeded by the government stock, representing the public debt. This was soon accompanied by United States and other bank stock, insurance, canal, mining, railroad, etc., to an immense amount. Up to 1825 the majority of the stocks were banks and insurance, but there was no regular stock market. There were brokers who bought and sold stocks, but there was no concentration of operations. In that year the legislature of New York authorized the New York stock board, which has since continued to be the stock market. Within the last few years a board of brokers has been started in Philadelphia and also in Boston. Their operations are, however, to a very great extent, based upon those of New York, with which they communicate by telegraph. The board of brokers sits with closed doors from 10 1-2 A. M. to 12 M.; an irregular session is held about 2 1-2 P. M. There is a president, a treasurer, and a secretary; the latter keeps a list of all the stocks dealt in in the market; the members are admitted by ballot after notice of nomination by one of the board. He must have been at least a year a broker, and on his admission pays a fee of $450. When the members are assembled, the president proceeds to call the list, and as each stock is named in succession, those who have orders to buy or sell make their offers, and the transactions are recorded, when they become binding upon the members. If any of these defaults he loses his seat until he can pay or arrange the claim. The theory of the board is that it is the reservoir where all stocks held by the public are brought for sale, and where all buyers come, through brokers, to purchase. The number of brokers is some 150, and the commission charged is a quarter of one per cent., that is to say $25 on $10,000. The board requires each member to charge not less than a quarter, but as most of them sell again for their customers for nothing, the charge is practically one-eighth.

The quantities of stocks to be dealt in have rapidly increased of late years. A late report of the Secretary of the Treasury gives an approximation of the amount of stocks now in the country; to that return we have prefixed the amount of the same at a previous date:—

	1840.	1859.
United States stocks	$25,000,000	$55,155,977
State stocks	174,906,997	210,487,000
113 cities' and towns' stocks	13,107,000	85,382,201
350 counties' stocks	1,500,000	15,927,292
1562 bank stocks	290,772,091	421,880,095
150 insurance stocks	40,101,000	70,500,000
400 railroad stocks	45,102,208	506,746,898
" bonds	40,897,792	411,199,702
16 canal and navigation stocks	31,219,911	85,888,918
" " bonds	19,207,101	22,130,569
45 mining and other co.'s stocks	10,101,201	44,208,006
" " bonds	1,000,000	3,971,204
	$692,915,301	$1,883,477,862

This vast increase of stocks is manipulated mostly upon the New York stock board, and the stocks are to a considerable extent caused to float by the sums sent to brokers by their correspondents in the country and neighboring cities, with which to "operate." The speculative transactions far exceed those of other kinds. The actual investments of capital are not large at the board. Those who take stocks for income do so of the issuers when the proposals are put out, and they hold them like the United States and state stocks, which rarely come on the stock exchange. The mass of the transactions then are of non-dividend paying stocks, that are the foot-ball of speculation, and so pay the operators profits. The brokers are mostly cliques of operators, who, when the market is dull and prices are low, combine, as "bulls," to purchase, producing a rapid rise, in the hope, seldom disappointed, that the speculative community will be tempted by that rise to come in and buy; as they do so the brokers unload themselves upon the buyers, and then become "bears," combining to depress the market, and to compel a fall at least equal to the rise, skinning the outsiders in the process. The speculators generally buy on time, that is, to pay for the stock at their option, any day within thirty or sixty, as the case may be. In this way the buyer pays interest on the purchases. He may also sell to deliver at any day he pleases within a specified time, or "seller's option," or to deliver at the "buyer's option;" he may borrow stock and sell it in the hope of buying it back cheaper on delivery; he may buy a privilege to deliver a stock at a certain price at a specified time, or not, as it suits him; or he may sell or buy a privilege of taking and paying for a stock or not as it suits him; he may buy cash stock and sell on time. To produce a fall, cliques will sell for cash all the stock they have or can borrow, and then offer time contracts without limit, until other holders are frightened and sell. Confederates keeping up a clamor to alarm the public at such times, all offers to buy are smothered, and orders to purchase are suppressed. On the other hand, a combination for a rise is accompanied by the most astonishing prophecies of a "good time." Considerable quantities are bought on time, the sellers hoping to get them cheaper. Meanwhile the cash stock is bought up and pledged for more money to repeat the operation; the demand for the stock bought on time runs up the rate, and the public are expected to come in with sufficient strength to let the clique all sell out at a profit, when they will be ready for a bear operation. There are numberless modes of varying and combining speculative operations, which would fill a volume. All these time operations were illegal until 1859, when they were all legalized, and a stock debt may now be collected like any other.

The amount of the transactions is immense. In 1840, the aggregate of sales for the month of June was $3,684,460; of this one-half was bank stock and one-half Delaware and Hudson canal. In June, 1857, previous to the panic, the sales reached $250,000,000, mostly railroad stocks. In the present year the sales have been for June nearly $70,000,000, mostly non-dividend paying railroad stocks. In a speculative year the transactions will run to two or three thousand millions. Those transactions require a great deal of money to conduct them, and these funds come to New York to a considerable extent from neighboring cities, as well as from the west. They also employ a large portion of the funds of the banks put out "at call," and also the proceeds of bills sold by large exchange houses. Thus we may suppose a house sells on the departure of a steam-packet $500,000 of sterling bills. This money is paid into bank, and is loaned out on stock securities at 7 per cent. on call, until, by a succeeding packet, it may be called in and remitted in gold to Europe. This operation, on a large scale, will induce the banks to call in their loans to protect their specie, and the value of money will rise in the market. The rule in stock speculation is loss, and the experience of the most fortunate dealers is that the interest and commissions absorb the whole average profits. The funds sent to New York, therefore, for stock-dealing, only contribute to the central profits.

If we were to throw into a tabular form the new agencies of business centring in New York, we should have results as follows:—

		Cost.
Ocean navigation, 11 lines,	33 ships.	$22,000,000
Telegraphs	20,000 miles.	2,000,000
Express companies	30,000 "	3,000,000
Railroads	2,000 "	128,000,000
City railroads	19 "	5,364,360
Canals	395 "	26,000,000
		$186,364,360

The number of strangers that are drawn to the city in a year by ocean steamers is nearly 50,000, and they fill the hotels that have of late taken such splendid proportions, and have been carried up to Twenty-third street and Broadway, a distance of three miles from the old business centre. The march of hotels up-town has been steady. The Astor House was, in 1833, the up-town house. From the Astor House to Chambers street was a long remove, in 1849. In 1852 the St. Nicholas advanced a mile to Spring street, and became not only the up-town, but the "upper-crust" of all hotels. In 1854, Niblo's Garden, on Prince street, was occupied by the Metropolitan; and, soon following, the Everett House, taking ground a mile higher, opened on Sixteenth street; and last year, superior in distance, size, magnificence, and expense, the Fifth Avenue Hotel opened on Twenty-third street. These magnates were accompanied by a crowd of lesser note: the New York, St. Denis, St. Germain's, etc., etc., all followed, and with each new opening the visitors seemed to spring from the walls to people and to pay. Extravagance is only an allurement. Indeed, the hotel-keepers seem to have followed the advice of Boyden, when he first gave popularity to the Astor. His cracker-baker complained that the waiters were inattentive: "Kill me two of them, and put it in your bill," he briskly replied. And to his partner, who spoke of the exactions of guests, he replied, "Furnish a gold-dust pudding, with diamond plums, if they require, but charge accordingly." That is the secret of hotel-keeping in New York—let nothing be wanting, not even a sufficient charge. Immense waste, no doubt, attends the system, but it attracts. The splendid arrangements tempt many city families to take up their abode in them; and a small family, even at $2.50 per day per head, do better than to pay the extravagant rents demanded for fashionable houses, with the attendant expenses. That these things are not done cheaply, the bill of $91,000, presented to the city of New York by the Metropolitan Hotel for the entertainment of the Japanese ambassadors, is ample evidence. The numerous visitors to New York from the south and west, as well as the constant current of traders, better class of emigrants, and California passengers, fill the hotels of the lower parts of the city; and the whole mass, by their purchases for personal use, make an important part of the city retail trade, of which Broadway is the main locality. The records of arrivals show the average number per day at all the hotels is not far from 2,000, or the immense number of 730,000 per annum. This, at an average of $2, gives $1,460,000 for hotel-bills alone, but all the expenses cannot be estimated under $7,000,000. The facilities of railroads and ferries also induce a great deal of trade from surrounding cities and towns within a reasonable distance. Within an area of fifty miles there are few who do not do their shopping in New York, and very many of the small local shops send daily messages to the city to complete orders they may have received. On the other hand, a large quantity of manufactures that were formerly confined to the city are now sent long distances into the country, particularly in the winter, where they are done cheaply by those who are not dependent upon them for a living. The large circle of country thus loses its rural character, and partakes of the metropolitan nature. It follows that, as city localities become known for particular business, and visitors seek them to trade, all of that class of dealers seek business places there, and thus concentrate the business. The fixed population of the city is given by the census at 813,668, and, with the neighborhood more or less connected, the wants of 2,000,000 require to be met from the retail stores of the cities, in addition to the crowds of visitors from abroad. The retail trade is therefore a very important one, and its vigor, apart from the purchases of visitors, depends in some degree upon the cheapness of food. Where immigration has reached over 1,000 souls per day, composed of persons skilled in almost all employments, and all eager to obtain work, competing with those in the city who live by their occupation, and with those in the country, who are, so to speak, amateurs, it is evident the wages cannot be extravagant, and the amount that can be spared from them, after deducting house-rent and food, is not much in the average. Food is, however, the important item. When that is cheap, trade is more active. An indication may be afforded in flour. The quantity used in New York is 2,000,000 bbls. per annum. In some years the price has been as low as $4, in others as high as $15. The difference between these sums is $22,000,000 in one year. The tax, in years of dear food, thus thrown upon the city is enormous. It fortunately happens, that in years of dear food the food-sellers make more purchases. The influence of such times is very perceptible in the operations of the pawnbroker, whose business it is to lend small sums on the pledge of almost any conceivable article that may be offered. They charge 24 per cent. per annum, and the article, unredeemed at the end of a year, becomes forfeit by sale at auction. The amount of loans in one year was given at $3,000,000, and the number of pledges 4,875,000, which would give an average of about 68 cents each loan.

While cheap food is an important item in the ability to purchase, yet employment is the main consideration, and this depends upon the prosperity of those sources on which the city depends for its business. These in the long run are progressive, notwithstanding the reactions that sometimes take place, and the diffusion of employments which machine inventions tend to bring about.

The general prosperity of the whole country does not, however, depend upon any locality: all production and all business is constantly seeking the conditions under which it can best thrive. These cannot be dictated; but, being found, the general welfare is as a consequence the greater, and with the general prosperity the common centre must only become the more magnificent.

BANKS IN THE UNITED STATES.

CHAPTER I.

BILLS OF CREDIT—GOVERNMENT ISSUES—UNITED STATES BANK.

THE use of paper money is a modern invention, and may yet be considered but as an experiment, since, from its first emission in the colonies to the present day, paper money has constantly changed its form and the conditions of its circulation. It is not to be inferred that paper money originated on this continent, since it was used long before in the countries of Europe. Its nature has, however, been more developed here, and every phase of it has had full scope of action. The circulating paper is of many forms, such as bills of exchange, promissory notes, government bonds bearing interest, government bonds bearing no interest and not convertible into coin, but receivable for taxes and dues, and lastly, corporation or bank promises to pay coin on demand. There are many other descriptions of circulating paper, but these are the chief that are used. The last two are those which have figured most as money. The intention of paper money is to supply the place of coin where that article is not sufficiently abundant, as was eminently the case with the early colonies. The colonies were none of them rich, and had not been able to import and keep as much of the precious metals as would serve for a currency, that being as much an instrument of commerce as a road or a ship. In substituting paper for coin there is no difficulty as long as the quantity emitted does not exceed the demands of business for a currency. If there is no trade—that is, if no one wants to exchange his commodities for others—there is no want of currency. As the desire to trade increases, a want of money to represent commodities is experienced, and the want is proportioned to the numbers, wealth, and activity of the traders up to a certain point; because when trade is very active, money itself changes hands rapidly and performs more transfers than when it is sluggish. There must be, however, great confidence in the value of the money, because doubt in that respect instantly checks traffic. The early colonists were in that position. They had commodities which they had raised and made, but they had no currency, or not enough. In this position, in 1690, it became necessary for Massachusetts to send a military expedition to Quebec to drive the French out of Canada. The expedition failed, and the troops came back clamorous for pay. The colony had no money to pay with, and it adopted the expedient of issuing promises in convenient amounts. The faith of the colony was pledged for the payment of these, and they would be received for taxes and dues. It will be observed, that these bore no interest, and were not convertible into coin. They were, in fact, mere orders of the government upon farmers and others for food, clothing, etc., in favor of the soldiers, to be called in by taxes, not to be paid in money. The paper was worth nothing to export. Its only value consisted in its being good to pay taxes with. It is at once obvious that no man wanted more than would suffice for that purpose. The aggregate amount that could be issued was then measured by the sum of the taxes. In order to increase the amount, the colonial government made it a legal tender, that is, compelled creditors to take it for private debts. This was so palpably unjust, and was productive of so many evils, that the home government suppressed it. Nevertheless, the same necessities produced similar devices, and other colonies followed the example of Massachusetts with similar results.

In 1745, Massachusetts, to defray the expense of an expedition to Louisburg, again issued bills of credit to the extent of £3,000,000. This paper speedily depreciated to 11 for 1: that is, £1 in silver was worth £11 in those bills. The English government then sent out £180,000 in silver, to pay the cost of the expedition, and with this the thrifty colony bought up its own paper at 11 for 1. New York, during the period 1709 to 1786, made thirty-four issues of bills of credit, amounting in the aggregate to £1,563,407, and the depreciation was about 2 to 1; in other colonies much more. The evils attending these issues were very great, but the cause continued to operate, and when the war broke out in 1775, the Congress of the Confederation was forced upon the issue of $3,000,000 worth of "continental money," as distinguished from the state issues; and to give these issues some firmness, they made them a legal tender. This supply of paper, in addition to the colonial emissions, increased the difficulties, and some of the colonies went a step further and made *personal property* a legal tender, according to appraisals to be made for the purpose. Notwithstanding the general discredit, Congress was obliged to push the issues. In 1779 the amount outstanding was $160,000,000, and by 1780 it reached $200,000,000, when the value fell so fast that before the end of the year the bills ceased to circulate. There are those still living who remember giving $100 for "a cake of gingerbread," or $10,000 for a hat cocked in the fashion of the day. The whole amount issued by Congress was $359,456,000, and on the formation of the new government they were purchased at the rate of 1 cent for $1. The state issues met with similar fate. The entire absence of money thus brought about, with the attendant evils, mainly induced the adoption of the federal constitution, which at once prohibited the states from ever again issuing "bills of credit," or making "any thing but gold and silver a tender for the payment of debts." That is, those prohibitions are a record of the experience derived from the colonial experiments in paper money.

The condemnation of "bills of credit" was a great good. The important question was, however, what to do next; and this engaged all minds. Specie had vanished, and government paper money was dead. Mercantile sagacity had, however, on the death of the continental money, devised a partial remedy in 1781. This consisted of the substitution of private corporate credit in place of government credit, and took shape in the chartering of the Bank of North America, at Philadelphia; the Bank of New York, in the city of New York; and the Bank of Massachusetts, in Boston.

It is an erroneous idea, that was entertained for a long time, that banks, by the issues of credit, create capital, and on this idea many new banks were started, imparting much activity to trade. The good effects of their operation were due, however, rather to the concentration and application of capital to mercantile uses, than to an increase in the quantity of capital. Before the establishment of banks, individuals kept the money they received in their own houses, tempting robberies, and subjecting themselves to loss of interest, and to risk and trouble in seeking small investments. The shopkeeper and merchant who received money in the course of business in small sums, kept it by him until he made his wholesale purchases, when he paid it out altogether. The aggregate sum thus lying entirely idle was very large. On the establishment of a bank, the owners of money deposited it in the vaults. The institution thus became the common receptacle for all idle funds. Inasmuch as that, although all the depositors were entitled to draw their money whenever they chose, yet but a small proportion did so, the banks might safely lend the money so deposited on notes at short dates, sixty to ninety days, and still have as much within their control as would meet the probable demand of the depositors for payment. It was necessary, however, that the notes discounted should be promptly paid at maturity, in order that the bank, itself subject to be called upon to pay on demand, might have control of the means of payment. The discount of mercantile notes with two good endorsers then became the business of banks; and we may here remark in passing, that this wrought a change in the mode of borrowing money in the community. Up to that period, good character, industry, and sobriety were security for loans. An illustration of this is afforded in a bequest of Dr. Franklin in trust to the city (then town) of Boston, of a sum of money from which young mechanics of the above characteristics were to be loaned two hundred dollars to start them in business. They were to repay the money with interest, and the sum, with its accumulation, was to continue a fund for the same purpose. The fund still continues to exist, but without accumulation. Under the newly established banking system, character was no longer an element of credit. A note with two good names became indispensable. The capitals of the banks were seldom paid in loanable money. They were notes of the subscriber, or real estate, and were mostly designed to inspire confidence. A portion of it was requisite to be kept on hand in specie to meet the calls of depositors and note-holders. The banks, in order to increase their loanable funds, were permitted to issue their own promises to pay specie on demand, these promises to circulate as money. The old colonial issues of credit bills did not pretend to be payable on demand, and the application of that principle, it was now supposed, would obviate the evils that had grown out of the old system. The bills were freely taken and circulated. The institutions were not limited in the amount that they might issue, and they increased the currency almost at pleasure. It became obvious, however, that if one bank issued a larger quantity in proportion than the other banks, its notes, paid into the rival institutions, would immediately be sent back to it for redemption, and it would have to pay in specie the balance above what it held of their notes. Hence the laws of trade compelled each bank to keep its credits within a safe ratio to those of other institutions. This, however, did not prevent all from increasing their issues to any extent as long as their mutual balances were adjusted. When, however, the whole of them increased their circulation, the mass of currency became cheap, a fact which manifests itself in a rise in prices of all commodities. The effect of this is, that the produce of the country ceases to be exported, because it is too high to pay a profit to the merchant, while, on the other hand, goods are imported to avail of the high prices. This state of affairs involves an export of specie, which drains the banks, and forces back upon them their bills for redemption. Hence, if the banks regulate each other by their balances, the foreign trade becomes the common regulator of all. Kept within a certain limit, governed by produce and business, the bank circulation is useful. Although it does not in any degree create capital, it supplies the place of the precious metals as currency. If we suppose a miller wishes to purchase grain; he gets a note or acceptance at sixty days, on New York, discounted at a local bank, which pays out to him circulating notes. With these he purchases wheat of the farmer, flours it, and forwards it to New York for sale, and the proceeds are applied to the taking up of his draft that the bank had discounted. In the mean time the farmer has paid away the notes he took for his wheat, probably to the storekeeper in discharge of his bill. The storekeeper has now to remit to New York to pay a note that falls due for merchandise previously purchased, and furnished to the farmer. To do so he goes to the bank, and buys of it the draft on New York that the institution had discounted for the miller. This he remits to his merchant, who gets it paid from the proceeds of the flour. The transaction is thus closed, and by it farm produce has been got to market, and merchandise, in return, has passed from the manufacturer to the consumer, effecting an exchange of commodities without the use of any money at all. The notes that the bank put out on a draft, after performing the functions of money, returned to it in exchange for the draft, and all obligations were cancelled. This is the operation of paper when confined to actual business transactions. The number and kinds of these are almost infinite, but the principle is the same when the paper is only issued on actual commodities, the exchange of which cancels the obligations that grow out of them. There is, in this, no creation of capital, only the facilitating the exchange of that already created. Under such circumstances, the quantity of currency rises and falls with the quantities of produce and merchandise. The moment the banks lend their notes to speculative operators, who seek to borrow capital itself, rather than credits with which to interchange capital, it becomes insolvent, because it lends what it has not got to spare. The early banks mostly confined themselves to sound rules, and with the rapid increase of business which followed the formation of the new government, their business being profitable, stimulated the increase of institutions, mostly in New England, where commerce was concentrated. The three original state banks were eminently successful, and they suggested a resource to the federal government. This was developed in the celebrated report of Alexander Hamilton, Secretary of the Treasury, in favor of a National Bank. The proposition at once called up the right of Congress to charter a bank under the constitution. After a warm congressional debate upon the subject, President Washington demanded written opinions of his four cabinet officers. The Attorney General and the Secretary of State declared the bank unconstitutional. The Secretary of War and the Secretary of the Treasury were of a contrary opinion, and the celebrated paper of the latter upon the subject decided Washington, who signed the bill, and the bank went into operation with a capital of $10,000,000, of which $2,000,000 was subscribed by the government, and $8,000,000 by individuals. Of this latter amount, $2,000,000 was to be paid in specie and $6,000,000 in six per cent. stock of the United States. The charter was to continue until March 4, 1811. Immediately on the organization of the bank, the shares rose 25 to 45 per cent. premium, and the institution paid 8 1-2 per cent. dividend. The creation of this bank was attended by the rapid multiplication of banks in the various states, becoming rivals to each other, and gradually consolidating an interest which was strong enough in 1811, with other interests, to defeat the recharter of the Bank of the United States. The recharter was opposed on the grounds: 1st, that it was unconstitutional; 2d, that too much of its stock was owned by foreigners; 3d, that state banks were better. It is singular that at a time when capital was scarce in the country, objections should have been made to its coming in from abroad. Nevertheless, the bank was closed, and on settlement paid $108 1-2 to each share of $100. From that date, gold and silver only were by law receivable for government dues. The winding up of the National Bank was the signal for creating state banks to fill the vacuum. The old bank and its business was purchased by Stephen Girard, who conducted with it a large private banking business with great success on a capital of $1,000,000. In four years, to 1815, 120 banks, with an aggregate capital of $40,000,000, went into operation. Pennsylvania alone, by act of March 21, 1814, created 41 banks. The amount of notes emitted by these institutions was never known with certainty, but was estimated by Mr. Jefferson, in 1814, as high as $200,000,000. A large portion of these, in the middle states, were issued as loans to the government; and the war pressure became such, that in September, 1814, all the banks out of New England stopped payment. The bills immediately depreciated 20 per cent. in Baltimore, and 15 per cent. in New York. The news of peace, in February 1815, caused some improvement, but in 1816 the difficulties were greater than ever. The discount in Baltimore was 20 per cent., Philadelphia 17, New York 12 1-2. This kind of paper being the only currency, the government was compelled to take it for dues, in violation of law. This caused the greatest injustice, since the funds received in one place were more depreciated than in another, and New England, where the currency was sound, had great cause of complaint. In such a state of affairs, although the state banks had multiplied to 246, with $89,822,422 capital, a new National Bank became inevitable, and Congress, by act of April, 1816, again chartered a National Bank, which went into operation January 1817. Its charter was to last until March 4, 1836; its capital was $35,000,000, of which the United States subscribed $7,000,000 in a 5 per cent. stock, and the remaining $28,000,000 was to be subscribed by individuals—one-fourth in gold and silver and three-fourths in the funded debt of the United States. The debts of the bank, in excess of its deposits, were not to exceed $35,000,000. The bank was to pay a bonus of $1,500,000, and perform the money business of the government free of charge. In return it received the public funds on deposit, and nothing was to be taken for public dues except specie, treasury notes, notes of specie paying banks, and the National Bank notes. When the bank went into operation it became necessary for the state banks to resume or wind up. Those of New York, Philadelphia, Baltimore, and Virginia resumed, and those which did not were gradually purged off. From 1811 to 1830, 165 banks, with a capital of $30,000,000, closed business. The loss of the government by these was estimated at $1,390,707, and the public lost much larger sums. The bank, in the first few years of its operation, encountered many perils, growing out of the foreign trade. Imports poured into the country in prodigious amounts, and an active demand for silver sprung up for Europe and Asia. The institution had, however, in the public stock and in its own stock, forming its capital, the means of drawing specie from Europe, which it did to an extent that subjected it to a loss of over half a million dollars.

The institution was of much service to the government, and enjoyed great facilities from the use of the public funds. The principal bank was at Philadelphia, with branches in most of the large cities. This organization of the bank made it very powerful as a means of exchange, and this power was likely to grow with the increasing wealth of the country, up to the time when railroads and telegraphs made communication more rapid. The power of the bank was based upon the federal finances, of which it was the agent, and it operated through the growing business of the country, which was conducted largely upon the credit system. As the country increased in prosperity, other banks, under state charters, sprung up, and these became the recipients of mercantile deposits, or, in other words, of the money which each merchant received in the course of his business, and also of private funds. The merchants who thus placed their funds with the banks were constantly debtors of the government for duties and taxes; these they paid by checks on their respective banks. The United States Bank, being the common recipient of all these checks, was thus always the creditor of the local banks, and could always force them to contract their loans by compelling them to pay, or could permit them to increase their loans by being indulgent in regard to balances. The government funds thus collected by the United States Bank were paid out by it wherever the government required. Thus the Boston and New York branches would collect the largest amounts, but the branches in Richmond and elsewhere, or the parent bank in Philadelphia, would pay the drafts of the government. In the first year of the old bank it received $3,652,000 of the public money. As business prospered, the amount rose annually, until it reached $17,038,859 in 1808, before the embargo. Thus the receipts and payments on government account were thirty-four millions in a year, when the whole population was 5,200,000 souls. The new bank in 1817 received $32,786,662 for accounts of the government. The sum declined year by year to $21,347,000 in the year of crisis, 1825, and subsequently continued at about twenty-four millions per annum, until 1833, when the deposits were removed by the government. These large sums annually flowed in and flowed out of the bank on account of the government, and a large proportion of the payments were on account of the public debt. This reached $127,334,934 in 1816, and was by annual payments extinguished in 1835, a period of nineteen years; the average amount paid off annually by the government was thus $6,700,000. The government bank, being furnished with such machinery, was necessarily the best medium of collecting bills; thus the New York merchants, as an instance, sold their goods to the shopkeepers all over the Union, and they took notes payable at the local banks. The credits thus granted could be collected by the United States Bank cheaper than by any other bank. Hence, in New York, the "branch" would be the receptacle for accounts to be collected in all other cities; the bank would forward these to its appropriate branch, say Richmond; the branch there would notify the local merchants of the notes it held against them; these would pay in checks upon the local banks where they kept their deposits, and all these checks collected by the United States branch would make it the common creditor of all the local banks, whose specie it thus controlled; it would notify the New York branch of what collections had been made, and these would credit the mercantile owners with the amounts. The power of the bank from this source, operating through all its branches, was much greater than from the use of the government funds, and the state banks complained loudly of the tyranny that they alleged it exerted over them. A stormy opposition was thus formed against it, while, on the other hand, a generation of merchants had grown up under its administration of the exchanges, and they feared the results of a change. Meanwhile, the question became political, and a great party, as early as 1829, gave indication that the recharter in 1836 would not be granted. A struggle between the bank and the government ensued, and in 1833 the President removed the public deposits from the bank and placed them with numerous state banks. These ran a race of expansion with the United States Bank; the consequence was an immense speculation, which resulted in general bankruptcy in 1837. The government, on removing the deposits to the state banks, enjoined them to be liberal to the merchants. This was done in the view of counteracting the stringency which the closing up of the United States Bank was expected to cause. This did not occur, however, since that institution also was liberal with its loans. A rapid expansion resulted from this rivalry, and speculation ran wild, particularly in public lands. In the midst of this excitement, the government issued the famous "specie circular," by which the lands were to be sold for cash, gold and silver only. The effect of this would be either to kill the speculation or to drain all the specie into the land offices;

it did the former. This was followed by a resolution of the Bank of England to cut off credits to American merchants, and the revulsion was precipitated. The charter of the United States Bank was not renewed by Congress, but the same institution obtained a charter from the State of Pennsylvania, February 18, 1836, under the name of the United States Bank of Philadelphia. The terms of this charter were very onerous, such as no institution could pay from profits; the bank consequently failed, in common with all others in the Union, in 1837. It resumed its payments, following those of New York, January, 1839, and struggled on until October 1839, when it finally failed. On going into liquidation, it was found that more than the whole of its large capital, $35,000,000, had been swallowed up, subjecting the stockholders to a total loss. This disaster was no doubt brought about by its abandonment of sound principles in the vain hope of compelling the government to recharter it. But the institution had outlived its usefulness; the country had outgrown the circumstances for which such a bank was fitted. We have thus sketched the outline of that bank before glancing at the progress of the state institutions, because, up to 1840, that bank was the controlling power. The progress of banking among the states has been step by step with the growing wealth, population, and commerce of the country. This growth was manifestly too vigorous to permit of the continued existence of any regulating power.

The relative growth of the state banks, and the business of the country proportional to the national bank, was as follows:—

	No.	State banks. Capital.	National bank. Capital.
1791,	3	2,000,000	10,000,000
1811,	89	52,601,601	10,000,000
1817,	246	89,822,422	35,000,000
1837,	634	290,772,091	35,000,000
1860,	1,562	421,880,095	

Thus the national bank, which began with a capital five times as large as all the state banks, was only one-fifth of their aggregate in 1811. In 1817 the state capital was two and a half times the new National Bank capital, and in 1836 it was eight times that capital. Had it then been rechartered, with the same amount, it would now have been but one-twelfth of the capital of the state banks.

CHAPTER II.

STATE BANKS—SUFFOLK SYSTEM—SAFETY FUNDS—FREE BANKS.

The growth of state banks has fluctuated from time to time, under different circumstances of local trade, and the general nature of banks has changed in obedience to similar conditions. The nature of the banking systems of each locality has, however, undergone repeated modifications, and the general tendency is to the circulation of less paper. We shall endeavor to give a sketch of each. The first attempt at banking in New England was the creation of a land bank in 1740. At that time about eight hundred persons subscribed a capital in real estate, and having appointed ten directors, agreed to issue one hundred and fifty thousand pounds in paper, to circulate as money. This was dissolved by Parliament, and the stockholders held individually liable for the bills. In 1784 a bank was chartered by the Massachusetts Legislature, and the other New England states followed the example from time to time. In 1805 there were in existence forty-seven banks in the six New England states, with an aggregate capital of $13,353,000. In 1815, at the close of the war, these had risen to sixty-three banks, and $19,053,902 of capital, and the circulation had become large. In 1860 the number of banks in those states had risen to five hundred and five, with a capital of $90,186,990. In the course of this increase, the system of banking there had undergone less changes than in other states.

The paper currency of New England was generally of small denominations, and emitted by a larger number of banks with small capitals than that of most other sections. These institutions were scattered over the six New England states, and the bills of each bank forming the currency of its neighborhood, would, in the course of trade, ultimately find their way to Boston, the common centre of business. There being no provision for their redemption, they circulated at a discount, and this discount was increased in proportion to the issues of each bank, inflicting loss upon the community. To remedy this, the Suffolk Bank of Boston, in 1825, undertook to receive all the bills and send them home by an agent to the issuing bank, requiring each to redeem in specie at its own counter. This compelled each bank to keep a large amount of specie on hand, at an expense which ate up the profits of the circulation. They all agreed, in consequence, to keep at the Suffolk about three thousand dollars deposited, to redeem any balance of notes that might be there found against them. To keep down that balance each was then compelled to restrict its circulation to the actual business wants of its locality, that there might be no surplus currency; in other words, that the course of trade might carry to Boston no more of its bills than would be paid by the produce of the locality sent thither for sale, and also to send promptly to the Suffolk any bills of other banks that might come into its hands, as an offset to its own balances. Thus all the banks in New England are actively engaged in running each other, and five hundred streams pour country money daily into the Suffolk receptacle, to be assorted and sent back to the issuers. This keeps down the volume of the currency in that section. Since the creation of railroads and telegraphs, the difficulty of keeping out an excess of circulation is the greater. To be "thrown out of the Suffolk," or, in other words, not be able to meet a balance there, is fatal to the reputation of a bank. The system has worked well to the present day. It has been the case, however, that although those institutions cannot put out an excessive circulation in New England, many of them lend their notes on securities, on condition that the notes shall be paid out at the far west, whence they will be very slow in returning for redemption. The Suffolk mode of regulation by the laws of trade has, upon the whole, been very successful.

In New York the same evils manifested themselves as in New England, and in 1829 a remedy was attempted in the shape of the "safety fund." This did not undertake to restrain the issues of the banks, but to protect the public from loss by failure. Under it all the banks doing business in the state were required to contribute one-half of one per cent of their aggregate circulation to a fund to be called the "Safety Fund," out of which the notes of a broken bank were to be paid in full. This worked very well during a number of years of prosperity, but in the revulsion of 1837 a number of banks failed under disastrous circumstances, and the fund was found to be entirely insufficient—besides being wrong in principle, since it called upon the honest and well-conducted banks to pay the debts of the dishonest ones. It is hardly worth while, in a short history like this, to enumerate all the restrictions as to discounts, specie on hand, and emission of bills, that the various states have incorporated in bank laws. It may suffice to say, that all are powerless to prevent evil. On the failure of the safety fund system of New York, however, a radical change took place in the policy in regard to banks. The privilege of issuing notes to circulate as money at their own will and pleasure, had been found to be dangerous to the public, and the law of April, 1838, called the "free banking law," was passed, by which the power to issue bills directly was taken from the banks. Under that law, the Comptroller of the state prepares the plates, and delivers the bills to the banks, upon their lodging with him such securities, mostly state stocks, as amply secure the redemption of the bills. The name, "free banking," is given to the law, because it removes from the banks the restrictions relative to discounts, and the necessity for a charter. This law has been altered in some respects almost every year of its existence, but its main features remain the same, and it has in New York become the sole law to regulate banking. All the old banks, as their charters expire, reorganize under it, since the state constitution provides that no new charters can be granted or old ones renewed. The working of this law has been so efficient and popular, that it has spread into most of the northern and western states. The progress of banking in New York has been as follows:—

NUMBER OF BANKS AND AGGREGATE CAPITAL.

	No.	Capital.	
1801,	5	4,720,000	
1811,	8	7,522,760	Expiration of first U. S. bank.
1816,	27	18,766,756	Recharter U. S bank.
1836,	86	31,281,461	Expiration of U. S. bank; suspension.
1838,	94	36,401,460	Free banking law; resumption.
1857,	294	107,449,143	Suspension.
1860,	303	111,441,370	Recovery.

The New York law requires the banks to issue the bills at the place of their location, and to redeem them at not more than one-half per cent. discount in the city of New York. These institutions, however, have an arrangement with the Metropolitan Bank, in New York, by which they are redeemed at a less rate.

Pennsylvania, in the early part of the century, was slow to create banks, and it had but three up to 1814, in which year 41 new banks were incorporated. Subsequently, it created numbers, and has probably suffered more than any other state from its abused bank credits. The progress of affairs there was as follows, exclusive of the United States Bank, which was situated at Philadelphia:—

	No.	Capital.	
1801,	2	5,000,000	
1811,	4	6,15[illegible],000	Expiration of U. S. Bank.
1815,	42	15,068,000	Low credit; 41 new banks.
1820,	36	14,681,000	Twenty-two banks failed.
1836,	49	23,750,338	State charter of the U. S. Bank; supension.
1839,	49	25,255,783	Resumption.
1859,	87	24,565,805	

There was, up to 1830, a great number of unauthorized banks doing business in Pennsylvania, and they presented a constant succession of bankruptcies. The authorized capital down to the present time has not kept pace with that of other states, taking the wealth and population of Pennsylvania into consideration.

Maryland chartered its first bank in 1790, the Bank of Maryland, capital $300,000, and continued to increase them moderately up to the present time. The progress of capital there has been as follows:—

	No.	Capital.	
1801,	2	$1,600,000	
1811,	6	4,835,202	U. S. Bank expired.
1814,	17	7,882,000	Banks suspended.
1820,	14	6,708,180	
1837,	21	10,438,655	Suspension.
1859,	32	12,560,635	

New Jersey has been influenced to some extent in her banking operations, by the state of things in New York and Pennsylvania, and in 1850 it adopted the general banking law of New York. Its progress has been as follows:—

	No.	Capital.	
1805,	2	$1,000,000	
1811,	3	789,740	U. S. Bank expired.
1815,	11	2,121,933	Suspension.
1820,	14	2,130,949	
1837,	25	3,970,090	Suspension.
1850,	24	3,565,283	Free law.
1855,	32	5,314,885	
1857,	48	7,494,912	Suspension.
1859,	46	7,359,122	

The multiplication of banks in New Jersey, under the new law, was mostly for the benefit of circulating their issues in New York at a discount, and they were of but little service to New Jersey.

Delaware has created banks in proportion to its size, in the following ratio:—

	No.	Capital.	
1801,	1	$110,000	
1815,	5	966,000	Suspension.
1819,	6	974,000	
1837,	4	817,775	Suspension.
1849,	2	210,000	Gold discovery.
1859,	12	1,638,185	

Ohio has been, of all the states, the most diversified in its policy in regard to banks. Its first bank was chartered in 1803, but it did not increase charters much until migration set thither after the war of 1812, when the new United States Bank established two branches, one in Cincinnati and one in Chillicothe. The progress of banks was then rapid up to the explosion of 1837, when about 36 of the banks of that state failed, under disastrous circumstances, leaving but few in existence on the resumption of specie payments in 1840. In 1845, a new system of banking was introduced, designed to restore that confidence in banks which had been so rudely shaken by the previous failures. It was called the "safety fund system," being composed of some forty banks which, together, form the State Bank, under a board of control, composed of delegates from each bank, which furnishes the notes to all for circulation. Each bank must deposit with the board 10 per cent. of its circulation in securities. Of 42 banks started under this law, 36 remain, with capital of $4,034,525. The same law created the "independent system," by which the banks doing business under it must deposit Ohio or United States stock with the State Treasurer to secure the circulation. There are 12 of these banks. There remained the old chartered banks, of which the Ohio Life and Trust—whose disastrous explosion in 1857 precipitated the panic which had been prepared for the public mind—was the last. In 1851, the free banking law of New York was adopted in addition to the other systems, and under this 13 banks were started. In the same year, by the new constitution of the state, the legislature was deprived of the right to grant banking powers until the law for so doing should be approved by the people. The general progress in Ohio has been as follows:—

	No.	Capital.	
1805,	1	$200,000	
1811,	4	895,000	
1816,	21	2,061,927	New U. S. Bank.
1837,	32	10,870,089	Suspension.
1845,	8	2,171,807	State bank law.
1851,	56	7,129,227	Free law.
1854,	66	7,166,581	" "
1859,	53	6,701,151	Recovery.

Indiana became a state in 1816, and in 1819 there were two banks, with a capital of $202,857, and so continued until 1834, when the State Bank of Indiana was created, capital $1,600,000, and with ten branches, which were mutually liable for each other's debts, and notes under $5 were prohibited. The bank stopped, partially, in 1837, and resumed payment October, 1841. In 1852 the general banking law of New York was adopted, and under it ninety-four banks were speedily organized, and fifty-one of them soon failed. The charter of the State Bank of Indiana having expired, the legislature chartered a new one, with capital of $6,000,000, and twenty branches, which buys out the state interest in the old bank, the charter to be paid up January 1, 1857. The progress of the state has been as follows:—

	No.	Capital.	
1819,	2	$202,857	
1835,	10	800.000	State bank.
1837,	11	1,845.000	Suspension.
1839,	11	2,216,700	Resumption.
1841,	11		
1852,	44	5,554,552	Free banking law.
1854,	59	7,281,934	New state bank.
1859,	37	3,617,629	

There are of these 17 free banks, capital $1,236,070.

Illinois came into the union in 1818, and in 1819 there were two banks, capital $140,910—one of which had been chartered in 1813, under the territory. It stopped in 1815 and remained so until 1835, when the legislature revived it and increased its capital to $1,400,000. The constitution of the state in 1818 forbade the creation of any new banks except a state bank, which was chartered in 1819, with a capital of $4,000,000. This was repealed and a new bank chartered, which speedily failed. In 1835 a new bank was chartered, capital $1,500,000 to $2,500,000. These banks suspended in 1837, going into liquidation in 1842, and no banks existed in the state until the adoption of the free banking law in 1851. The general progress has been as follows:—

	No.	Capital.	
1819,	2	$140,910	
1835,	2	278,739	State bank charter.
1838,	2	5,473,050	Failure.
1843,			Liquidation.
1854,	29	2,513,790	Free banking law.
1857,	45	4,679,325	Suspension.
1859,	103	8,900,000	Recovery.

Michigan was admitted as a state in January, 1837, but there had been already a number of small banks authorized by the territorial legislature. These rapidly multiplied under the state, during the speculative year 1837. In the early part of that year there existed 20 banks, with a capital of $1,918,361. These were a total wreck, and in March, 1838, a general banking law was passed, in order, as was alleged, to throw the business open. In one year, 49 banks, with a capital of $3,915,000, were projected. Of these, 43 went into operation. Those banks were not required to redeem their issues on demand. The result was utter insolvency, inflicting a heavy loss upon the public. In 1849, the "free banking law" was adopted, with personal liabilities to stockholders. The progress was as follows:—

	No.	Capital.	
1835,	8	$658,980	Territorial gov'nment.
1837,	9	1,400,000	State and general law.
1838,	43	2,317,765	Revulsion.
1844,	3	202,650	Liquidation.
1849,	5	392,530	Free law.
1859,	4	755,461	

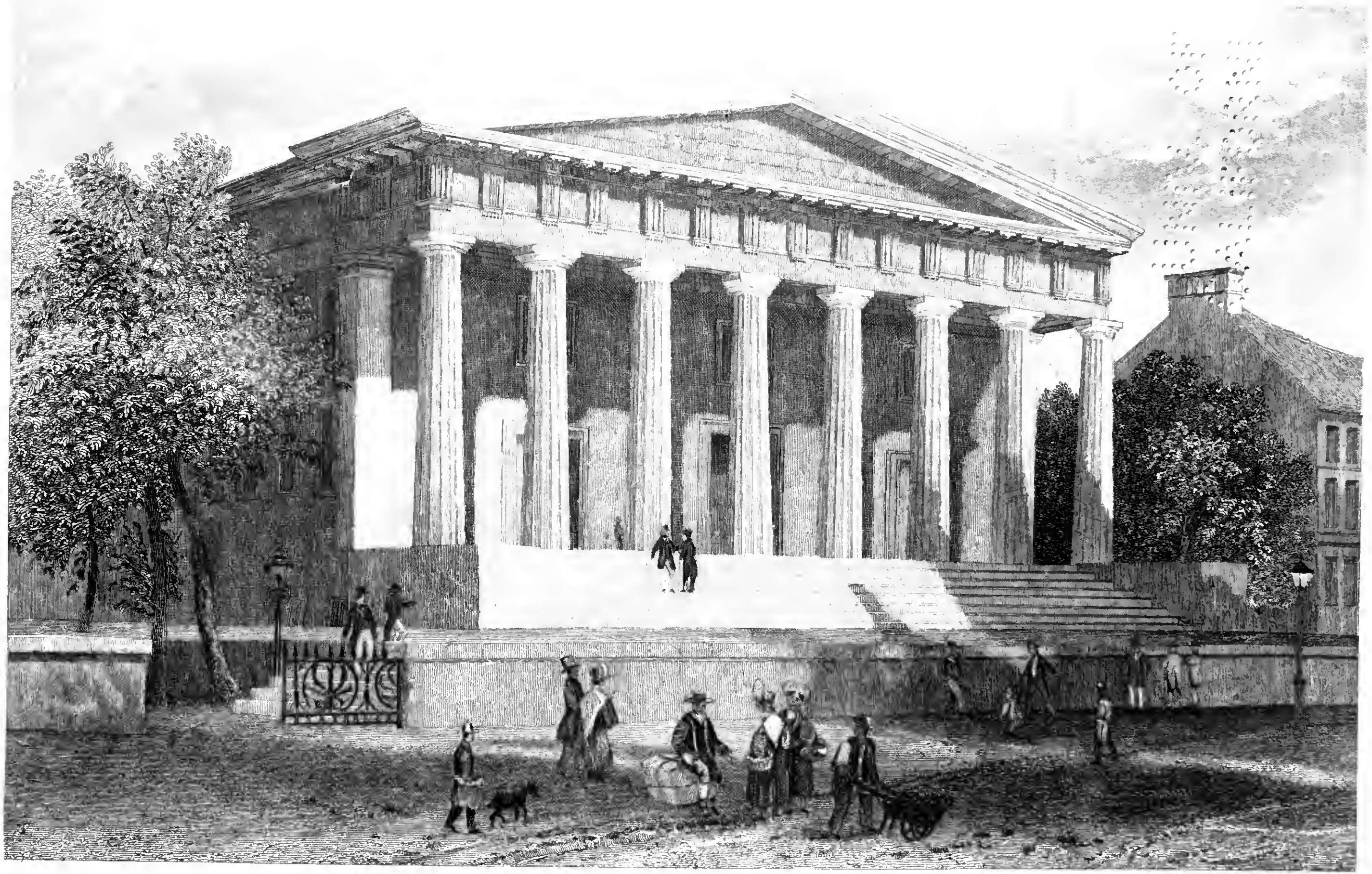
Iowa was admitted into the union in 1846. It had at Dubuque the Miners' Bank, chartered by Wisconsin before the erection of Iowa territory, in operation since 1838, but with little credit. In 1858, the free banking law was adopted, and also the State Bank of Iowa was authorized. The latter, with twelve branches, went into operation in 1859.

Wisconsin was admitted into the Union in 1848. It had, during some ten years, two banks, that of Mineral Point and the Bank of Wisconsin; these came to grief, and in 1851 a new bank was started at Milwaukee. In 1854 the free banking law was adopted; since that time the progress has been rapid, as follows:—

	No.	Capital.	
1837,	2	$119,625	
1839,	2	139,125	Suspension.
1848,			State admitted.
1854,	10	600,000	Free law.
1857,	38	2,635,000	Suspension.
1859,	98	7,995,000	Expansion.
1860,	108	7,620,000	Expansion.

The operation of the free law, by retarding the convertibility of the bills of the Wisconsin banks, causes, at a time when crops are short, the rate of exchange on the east to rule high, in other words depreciates the currency. The bank circulation is about $5,000,000.

Minnesota has made, as yet, little progress in banking. It adopted the free banking law in 1858, and two banks have been started under it; the Bank of the State, at



CUSTOM HOUSE, PHILADELPHIA.

St. Paul, capital $25,000, and the Exchange Bank, at Glencoe, capital $25,000.

Nebraska has also two banks, the survivors of a number recently started, but they were swept down by the ruin of 1857; the capitals are $56,000.

	No.	Capital.
Jan. 1857,	4	$205,000
" 1858,	6	15,000
" 1859,	2	56,000

Kentucky was admitted into the Union in 1792, and in 1801 it authorized a bank, with a capital of $150,000, under the guise of an Insurance Company, authorized to issue notes. In 1804 it chartered the Bank of Kentucky, capital $1,000,000; this bank failed in 1814, but resumed in 1815. In 1817 a batch of forty banks, with $10,000,000 capital, was authorized to redeem their notes by paying out Kentucky bank-notes for them instead of specie. The result was a flood of irredeemable paper, which stimulated all kinds of speculation and jobbing, and ended in a general explosion and distress within the year. To "relieve" the people, the state chartered the Commonwealth Bank, capital $3,000,000, pledging lands south of the Tennessee river, in addition to the faith of the state, for the redemption of the bills, which creditors were required to take at par for their claims, or wait two years for their pay. The bills fell at once to fifty cents on the dollar, and which proportion of their debts creditors were thus required to lose. This gave rise to party strife, which, at the end of five years, resulted in the repeal of the law and the suppression of the paper. The United States Bank had two branches in the state, one at Lexington and one at Louisville. When, in 1833, it became evident that that institution would not be rechartered, three new banks, with branches, were authorized, capital $7,030,000; subsequently another was started. These went into operation, but suspended in 1837, resuming in 1839 with the United States Bank, and again suspended on the final failure of that concern. In 1842, the banks again resumed, and since then the number has gradually increased, as follows:

	No.	Capital.	
1819,	18	$4,307,431	Irredeemable.
1833,	2	792,427	New charter.
1835,	4	4,106,262	With ten branches.
1837,	4	8,499,094	Suspension.
1851,	26	7,536,927	
1857,	35	10,596,305	Suspension.
1859,	37	12,216,725	Recovery.
1860,	45	12,835,670	

Tennessee commenced banking in 1807, with the Bank of Nashville, which soon failed with great loss. In 1811 it again chartered ten banks, and a number of others were from time to time started, but failed disastrously. In 1852 the free banking law was adopted, and the progress of affairs has been as follows:—

	No.	Capital.	
1819,	3	$1,545,867	Disastrous failure.
1820,	1	737,817	State bank charter.
1835,	3	2,890,381	Four branches.
1837,	3	5,293,079	Suspension.
1852,	23	6,881,568	
1857,	45	9,083,693	Suspension.
1859,	39	8,361,357	

Arkansas had two banks that were started upon state bonds. These the state issued to the extent of $3,500,000 to the banks to form their capitals. The bonds were sold through the United States Bank, and the money obtained for them was loaned out pro rata to the stockholders, who became so by filing mortgages on their plantations and lands. Speedy ruin, of course, overtook both banks. These are now in liquidation, owing the state some $3,000,000 on the bonds, which are not paid. There have been no banks started since.

Mississippi is a state in which banking for a long time ran riot, but which has had but little in the last ten years. When the state came into the Union in 1817 it had one bank, which continued with an increased capital to 1830. In that year the state chartered the Planters' Bank, with a capital of $3,000,000, two-thirds to be subscribed by the state in stock, which was issued, and the bank went into operation. Other banks were then chartered, and in 1837 there were seventeen, with eighteen branches, and a capital of $16,760,951. In that year the Union Bank was chartered, with a capital of $15,000,000 in state stock; of this amount $5,000,000 was issued, and repudiated on the ground of illegality of sale, and in 1852 the people refused, by a large vote, to pay those bonds. All the banks of Mississippi failed, and there has since been but little movement, as follows:—

	No.	Capital.	
1820,	1	$900,000	
1830,	1	950,600	Capital increased.
1834,	1	2,666,805	
1837,	17	16,760,951	18 branches.
1838,	11	19,231,123	Suspension.
1840,	18	30,379,403	Failure.
1850,	0		Liquidation.
1851,	1	118,460	
1859,	2	1,110,000	

Missouri had one bank when it came into the Union in 1821, but it failed disastrously. The State Bank of Missouri and branches continued to be the only institution up to 1856, when a law was passed authorizing others, and the progress has been as follows:—

	No.	Branches.	Capital.	
1819,	1		$250,000	
1837,	1	1	533,350	State bank.
1839,	1	1	1,027,870	
1856,	1	5	2,215,405	
1857,	5	5	2,620,615	Suspension.
1859,	17	5	5,796,781	Expansion.
1860,	9	29	9,082,951	

Louisiana came into the Union in 1812, with one bank, having a capital of $500,000, This was increased to three banks in 1815, capital $1,432,000. The progress subsequently was not great until after 1830, when the speculative spirit of those years was largely developed in Louisiana, and the progress was as follows:—

	No.	Branches.	Capital.	
1830,	3		$4,665,980	
1837,	16	31	36,769,455	Suspension.
1840,	16	31	41,711,214	Failure.
1843,	6	22	20,929,340	Liquidation.
1851,	6	22	12,370,390	Free bank law.
1857,	6		22,800,830	Suspension.
1859,	12		24,215,689	

The free banking law was adopted in 1853, and four banks have been started under its provisions, which require the banks to keep one-third of their liabilities in specie on hand.

Alabama has had experience of a disastrous nature in state banking, and there has been little enterprise in that direction since the failure of the State Bank. When she came into the Union in 1819 she had one bank, with a capital of $321,112. In 1830 she had two banks. It was then supposed that by embarking in banking, the state might derive profits enough to pay all the state expenses and dispense with taxation. Accordingly, state bonds were issued to form the capital of the State Bank, which, however, soon failed, and the state was saddled with a debt of some $11,000,000. The progress was as follows:—

	No.	Capital.	
1819,	1	$321,112	
1830,	2	781,010	
1837,	3	10,141,806	Suspension.
1840,	3	14,379,255	Liquidation.
1843,	1	1,500,000	Bank of Mobile.
1851,	1	1,500,000	Free banking law.
1857,	4	2,297,800	Suspension.
1860,	8	4,901,000	

Virginia chartered a bank as early as 1804 for 53 years, the Bank of Virginia, capital $1,500,000, since enlarged. In 1830 there were four banks, and the change was not great down to 1851, when the free law was adopted, but the charters of the old banks are renewed as they expire. The course of events was as follows:—

	No.	Branches.	Capital.	
1819,	3		$5,112,192	
1830,	4	18	5,571,181	
1837,	5	18	6,732,500	Suspension.
1839,	5	20	7,458,248	
1840,	6		10,363,362	
1851,	6	20	9,731,370	Free banking law.
1857,	22	40	14,651,600	Suspension.
1860,	24	41	16,005,156	

North Carolina began her bank career in 1804, in granting a charter for $250,000 capital. From that time the number and amount of capital has been steadily increased, without any material deviations from a steady course, which has been as follows:—

	No.	Branches.	Capital.	
1819,	3		$2,964,887	
1830,	3		3,195,000	
1837,	3	7	2,880,590	Suspension.
1850,	3	12	3,789,250	
1859,	12	16	6,525,200	

South Carolina has been more variable in its banking movement. Its first institution was the State Bank, owned by the state, and had more the character of a loan office than a bank. In 1820 the capital of the bank was pledged as security for the state debt, and it became a regular bank. The progress of the state has been as follows:—

	No.	Capital.	
1792,	1	$675,000	
1811,	4	3,475,000	
1820,	3	2,475,000	
1836,	10	8,636,118	
1837,	4	4,100,000	Suspension.
1839,	11	9,153,498	Eight new charters.
1850,	14	13,179,131	
1859,	20	14,888,451	

Georgia has had a regular supply of banks since the expiration of the first United States Bank in 1811, when she chartered an institution with $215,000 capital. In 1820 this had increased to four banks, with a capital of $3,401,510, and the progress has been as follows:—

	No.	Capital.	
1811,	1	$215,000	Old U. S. Bank expired.
1816,	3	1,502,000	New " chartered.
1820,	4	3,401,510	
1833,	13	6,534,691	Deposits removed.
1837,	16	11,438,828	Suspension.
1840,	39	15,098,694	
1846,	22	8,970,789	
1857,	30	16,015,256	Suspension.
1860,	29	16,689,560	

District of Columbia banks were established as early as 1792, in the district, and increased pretty rapidly, as follows:—

	No.	Capital.
1792,	1	$500,000
1802,	2	1,500,000
1811,	4	2,341,395
1815,	10	4,078,295
1820,	13	5,525,319
1830,	9	3,879,574
1837,	7	2,204,445
1844,	6	1,649,280

Most of the charters expired, and not being renewed, the concerns are in process of liquidation.

Florida came into the union in 1845, with a load of five banks that had been chartered by the territory in 1838, with an aggregate capital of $2,113,000. These were mostly based upon $3,500,000 territorial bonds, issued to the banks for capital, and sold in London. The concerns failed almost as soon as they got the money, and went into liquidation, when the state repudiated the bonds, and there have since been no banks in Florida, until this year two are started, with $300,000 capital.

From this sketch of banking in each state, it is to be observed that the creation of banks has been due more to the desire to borrow money through their operation than to lend it. The mistaken idea that they could supply capital, has been the temptation to their creation, and disastrous failure has everywhere attended the experiment. Gradually a principle of sound banking vindicates itself amid numerous disasters, and actual capital has come to be employed in the business.

CHAPTER III.

BANKS OF THE UNITED STATES—CLEARING HOUSES—PRIVATE BANKING.

Having sketched the course of events in each state, we may recapitulate the leading features of all the state banks:—

BANKS OF ALL THE UNITED STATES—TOTAL OF IMPORTS AND EXPORTS—POPULATION.

	No.	Capital.	Loans.	Circulation.	Specie.	Deposits.	Imports & exports.	Population.
1791,	3	$2,000,000	..	..	..	..	$48,212,041	3,929,827
1800,	32	23,550,000	..	..	..	..	162,224,548	5,305,925
1811,	89	52.601,601	..	$28,100,000	$15,400,000	..	144,716,833	7,449,960
1815,	208	82,259,590	..	45.500,000	17,000,000	..	165,599,027	8,353,338
1816,	246	89,822.422	..	68,000,000	19,000,000	..	229,024,452	8,595,806
1820,	308	137,110,611	..	44,863,344	19,820,240	$35,950,470	144,141,669	9,638,131
1830,	330	145,192,268	200,451,214	61,323,898	22,114,917	55,559,928	144,726,428	12,866,020
1837,	634	290,772,091	525,115,702	149.185,890	37,915,340	127,397,185	258,408,593	15,681,467
1840,	901	358,442,692	462,896,523	106,968,572	33,105.155	75,686,857	239,227,465	17,069,453
1843,	691	228.861,948	254,544,937	58,563.608	33,515,806	56,168,628	149,100,279	18,713,479
1846,	707	196,894,309	312,114,404	105,552,427	42,012,095	96,913,070	235,180,313	20,515,871
1854,	1,208	301,376,071	557,397,779	204,689,207	59,410,253	188,188,744	582,803,445	26,051,890
1857,	1,416	370,834,686	684,456 889	214,778,822	58,349,838	230,351,352	723,850,823	28,406,974
1860,	1,562	421,880,095	691,945,580	207,102,477	83,594,537	253,802,129	854,500,000	31'429,891

This table shows the number of banks, with their aggregate capital, at important eras. As in 1791, when the national bank and mint went into operation; 1811, when the bank charter expired; 1815, when the numerous banks that had sprung into being on the dissolution of the National Bank, were all suspended; in 1816, when the peace, bringing with it large imports of goods, and a heavy drain of specie to Europe and Asia, increased the confusion and aided the re-establishment of a national bank; 1820, when that bank, in full operation, was staggering under adverse exchanges and the operation of local banks; 1830, when five years of successful working, after the revulsion of 1825, and under a high tariff, had given confidence to the public; 1837, when the rivalry between the state and the national banks had, aided by the state of affairs in Europe, stimulated speculation, which resulted in the revulsion of that year; 1840, when the number of banks had reached the highest point, under efforts to restore prosperity by paper credits; 1843, the lowest point of depression after the failure of those efforts, and the liquidation of the unsound banks; 1846, when the bank capital was at a low point, but bank credits had begun to multiply under the effects of the famine abroad; 1854, when the activity growing out of the gold discoveries was in full blast, and five hundred new banks were, through the medium of credit, urging the public toward the panic of 1857. In the last two years there has been a renewed movement.

The mere figures, showing the magnitude of the bank movement, do not indicate the changes in the manner of doing business, nor do they indicate any unsafe expansion, except as in connection with the business they represent. Thus, in 1837, the bank loans were $525,000,000, and their circulation $149,000,000. Events proved that those loans were of the most speculative and unsafe character. In 1860, the loans were $691,900,000, and the circulation $207,000,000. Yet these larger figures were very far from being excessive. They represent but $6 circulation per head of the people, while that of 1837 was nearly $10 per head. The business of the country, as represented by imports and exports, was, in 1837, but half the amount of bank loans. In 1860 they exceeded the amount of bank loans. It is thus evident, that the larger sum of bank loans represents actual business, while those of 1837 represented only speculative values. This fact of the nature of loans made is the key to sound banking. It is a matter which depends upon the judgment and skill of the banker, and it cannot be regulated by law. Hence the futility of all the laws that have been devised to prevent banks from breaking. It is to be remembered, that the bank loans form but a portion of the credits which are the great purchasing power in trade. Almost all the wholesale business of the country is done with the notes of individuals, running for a longer or less time. These are entirely independent of law or banks. In a time of great mercantile confidence and speculative activity, business men are disposed to buy on credit, and their competition for produce and merchandise causes a rise in prices. This rise stimulates greater activity, which reacts upon prices until revulsion is brought about. The agency which the banks have in this matter is to discount a portion of the notes which a dealer takes in exchange for the merchandise he sells. The bank in discounting does not actually lend any money. It merely operates a canceling of credits by book accounts. Thus, a merchant buys goods and gives his note at six months. He then deposits what money he receives in the course of business to await the maturity of the note. As the period approaches, he finds that he has not money enough, but he has in his pocket-book a number of notes that he has taken for goods. These he takes to the bank and offers as collateral security for his own note, that he offers for discount. The bank making the discount places the amount to his credit. He draws a check against that credit in favor of the note he has to pay, and the two entries cancel each other. There has been no money used, but one kind of promise has supplanted another. As the crops come forward from the country, the drafts drawn against them pay the notes held by the merchant and lodged as collateral. Dearness or scarcity of money in the market depends mainly upon the disposition of the banks to facilitate the canceling of credits, and in this the institution affects to be governed by the state of the foreign trade. If the disposition to buy goods has been very active and prices are consequently so high as to pay good profits on imports, the arrivals of merchandise will be large and the exports proportionably small. This involves a demand for specie which the banks avoid, by refusing to come under new obligations. A competition in curtailment sets in. The bank that curtails the most rapidly will have the balances in its favor from the other banks, and will command their specie. Each endeavors to attain such a position. The pressure becomes great, the public alarmed, and individual depositors draw their specie, which exhausts the banks, and they stop. This was the state of affairs in 1857.

The general tendency of the banks has been, under the teachings of experience, to equalize balances and to insist on prompt payment. In the case of circulation this is done in New England by the Suffolk system, and in New York and most other states by the free law, which requires a deposit of state stocks of dollar for dollar of the circulation. It is obvious, however, that these regulations in no degree affect discounts and those operations where circulation is not in question; as in the checks of individuals, by which a large portion of credits are transferred. In New York city there are some fifty banks, each of which receives checks on all the other banks, and has checks drawn upon it in favor of all others. There are also drafts and bills from abroad, constantly coming to each to be paid by others. Up to 1853, all the banks employed each a man to go round and collect all these checks and drafts each day, and each bank kept fifty accounts open. To obviate this and to enforce settlement, the "clearing house" was devised. By this system, each bank sends thither every day a clerk, with all the demands it has against all other banks. The fifty-four clerks thus assembled make a mutual exchange of all claims, and the balance, if any, is struck, and each bank pays in cash the amount of that balance. This occupies an hour, within which all accounts are adjusted. The amount of accounts depends upon the activity of business. The clearing house has been in operation since October, 1853, and its operations have been as follows:—

	Amount exchanged.	Balances paid.
1854,	5,750,455,987	297,411,493
1855,	5,362,912,098	289,694,137
1856,	6,906,213,328	334,714,489
1857,	8,333,226,718	365,313,901
1858,	4,756,664,386	314,238,910
1859,	6,448,005,956	363,984,682
1860,	7,180,000,000	351,000,000

The emergencies of the war required the issue of demand notes by the Government, of small denominations to serve for circulation, as well as the putting forth of bonds, treasury notes, and loans of various kinds. At first these demand notes were the equivalent of gold and silver, and were receivable in payment of customs duties, as well as all other moneys due to the United States; but the gradual advance in the price of gold made them so valuable as to take them out of the circulation, and cause them to be hoarded as gold. Congress then authorized the issue of legal-tender notes of small denominations, receivable for the payment of all dues to the United States except customs, which must be paid in gold, the coin being needed to pay the interest on that portion of the national debt upon which interest in gold was guaranteed. Of this currency, usually known as *greenbacks*, four hundred and fifty millions of dollars was authorized, but only about $431,000,000 was issued. Beside this, Congress authorized the issue of postal and fractional currency, to the extent of fifty millions of dollars, but there have never been more than thirty millions in circulation, and the amount Jan. 1, 1866, did not exceed twenty-three millions.

It was soon found, however, that to prevent financial disorders and panics, it was necessary that the Government should be able to control the banking operations of the country to some extent. For this purpose the National banking system was devised. The act providing for the National banks was based, with such modifications as the circumstances and experience required, upon the New York Free Banking system. The capital on which circulation was granted consisted of the bonds, treasury notes, &c., of the United States, and these being deposited with the Controller of the Currency, National bank notes of different denominations, having the name of the bank and the coat of arms of the state inserted, were delivered to an amount not exceeding ninety per cent. of the bonds. No banks could be organized with a less capital than $50,000, and in places of more than 6,000 inhabitants the capital must be $100,000, or more. The amount of circulation to be issued to these National banks must not exceed in the aggregate $300,000,000. The National banks in the larger cities were required to keep on hand at all times an amount of coin and legal tender equal to one-fourth of their circulation and deposits; the country banks an amount equal to fifteen per cent. The bills of the National banks were receivable, like the legal tenders, for all dues to the United States except customs, and such arrangements were made for their redemption as made them virtually at par in all parts of the country. At first they had, in some sections, a severe struggle with the state banks, but it was not of long duration, and in the autumn of 1864 the state and local banks began to come under the National banking law, and by July, 1866, there were not more than 500 of the old banks throughout the United States which had not either become National banks or closed up their affairs. On the 1st of January, 1866, the number of National banks was 1,579, their authorized capital $403,357,346, and their circulation $213,239,530. Of these, 218 banks, with an aggregate capital of $172,-498,545, and a circulation of $73,964,619, were located in the large cities. The average loans and discounts of the National banks for the last quarter of 1865 were nearly 500 millions of dollars, about four times the amount of the loans of all the banks in 1859. Their deposits in the last quarter of 1865 averaged 513 millions. The circulation of the state banks was, after August, 1866, taxed by the Government ten per cent.

Private banking, which, previous to the war, had attained to very considerable proportions, has since greatly increased. The private banks, having no circulation to take care of, and dealing with their customers at the market price of money, conducting at the same time large transactions in Government securities, railroad bonds, &c., have possessed remarkable facilities for a profitable traffic, and many of the bankers have realized gigantic fortunes.

UNITED STATES MINT.

CHAPTER I.

ESTABLISHMENT OF MINT—STANDARD OF COINS—LAWS REGULATING COINAGE—PROGRESS OF COINAGE—PRECIOUS METALS IN THE COUNTRY.

THE currency, or circulating medium of a country, is of itself a very simple matter, although complicated at times by the theories of financiers, and the efforts to make promises of a thing pass for the thing itself. In the early stages of society the products of industry constitute the wealth of the people, after they have ceased to be merely herdsmen. These products being exchanged against each other, the transactions form barter trade. As wealth increases and wants become more diversified, as well as the products of industry, by being subdivided, some common medium of value becomes requisite to meet all the wants of interchange. The precious metals have generally been adopted as this medium, because the supply is the most steady, the equivalent value most generally known, and the transportation most convenient. Hence all trade comes to be represented by a weight of pure gold or its equivalent of pure silver, and all commodities come to be valued, or called equivalent, to certain quantities of these metals. To ascertain the purity and weight of the metal offered in payment at each transaction would, however, involve difficulties that would neutralize the value of the metals as a common medium of exchange. Every man would require to be an assayer, and to be provided with scales. To obviate this the government steps in, and by means of a mint assays the metals, and weighs them into convenient pieces, placing on each a stamp, which soon becomes universally known, and this is called "money." Every nation makes the pieces of different weights, and puts in more or less pure metal. To ascertain the "*par* of exchange" between two countries, the coin of each is assayed, and the quantity of pure metal in each being ascertained, the *par* of exchange is known. When this continent was discovered, its inhabitants were savages, who had no idea of property, and no trade beyond the mere exchange of, perhaps, a skin for a bow or a bunch of arrows. Money was unknown, and the value of the precious metals was not understood. The little gold and copper that they had was twisted into rude ornaments; but no man would work for a piece of these metals. When the first emigrants landed, they commenced the cultivation of the earth and the interchange of its products. The accumulation of industrial products formed wealth. Their first exchanges were mere barter. As late as 1652 the payment of taxes and other dues was made in cattle, skins, and other products in Massachusetts; and tobacco was a medium of trade in Virginia. Some money existed, but this was mostly the coins brought by the immigrants from the mother country, and did not suffice for the daily wants. Massachusetts, therefore, established a mint for the coinage of shillings, sixpences, and threepences of sterling silver, which were "two pence in the shilling of less valew than the English coyne." This "pine tree shilling," so called from a pine tree on the reverse, was worth about twenty cents. This coinage gave umbrage to the mother country, and when Governor Winslow was introduced to Charles II., that usually good-natured monarch took him roughly to task for the presumption of the colony in assuming to coin money, at the same time producing the coin with the pine tree upon it. The ready wit of the governor, however, turned the rebuke, by assuring his Majesty that it was an evidence of the devotion of the colony, which struck these medals in commemoration of the escape of his Majesty in the Royal Oak, which was executed as well as the poor state of the arts in the colony would permit. The coinage was nevertheless suppressed, and the example of Massachusets was followed by Maryland with the like results. Carolina and Virginia struck some copper coins, but without much effect. There being no mint, therefore, in any of the colonies, foreign coins were circulated freely as a legal tender. The country produced none of the precious metals, but as the trade of the colonies increased, and they began to have a surplus of fish, provisions, food, tobacco, etc., beyond their own wants, to sell, they built vessels, and carried these articles, mostly fish, to the West Indies and the catholic countries of Europe; and as the mother country did not allow the colonies to buy manufactures except from herself, money was mostly had in exchange for this produce. Guineas, joes, half joes, doubloons, and pistoles of various origin constituted the gold currency, while the silver was mostly the Spanish American dollar and its fractions: the half, quarter, eighth, and sixteenth, with the pistareen and half pistareen. This silver coin flowed into the colonies from the Spanish West Indies, in exchange for fish and food; and the Spanish dollar thus came to be the best known and most generally adopted unit of money. The coin had upon its reverse the pillars of Hercules, and was known as the pillar dollar; hence the dollar mark ($), which represents "S," for "Spanish," entwining the pillars. Inasmuch as the "balance of trade" was in favor of England, the largest portion of the coin that flowed in from other quarters was sent thither, and this tendency was increased by the pernicious issues of paper money by the colonies. This paper displaced the coin, and drove it all out of the country. The exigencies of the several colonial governments caused them to make excessive issues of this "paper" or "bills of credit," and it fell to a heavy discount as compared with coin. Not being convertible at the date of the Revolution the depreciation in the several colonies was nearly as follows:—

VALUE OF THE DOLLAR AND THE £ STERLING IN COLONIAL PAPER MONEY.

	£ sterling.			Dollar.	
	£.	s.	d.	s.	d.
New England and Virginia ...	1	6	8	6	0
New York and North-eastern .	1	15	6¼	8	0
Middle states................	1	13	4	7	6
South Carolina and Georgia...	1	0	8¾	4	8

On the formation of the new government, the terrible state of the currency first attracted attention. The country had been flooded with "continental money," which had been issued to the extent of three hundred and sixty millions for war expenses. The states had issued "bills of credit," which were depreciated as in the table; and the debased and diversified foreign coins that circulated were very few in number. Private credit hardly existed. Frightful jobbing took place in the government paper, and industry could with difficulty get its proper reward. The first effort was to give the federal government alone the right to coin money, to prohibit the states from issuing any more "bills of credit," and to get the continental money out of circulation by providing for its payment. Robert Morris had been directed to report upon the mint and a system of coinage, and he did so early in 1782. Many plans were based upon his report, and finally that of Mr. Jefferson was adopted. It conformed to the decimal notation, with the Spanish dollar as the unit: A gold piece of ten dollars, to be called the eagle, with its half and quarter; a dollar in silver; a tenth of a dollar in silver; a hundredth of a dollar in copper.

In accordance with the plan of Mr. Jefferson, a law of April 2, 1792, enacted regulations for a mint, located at Philadelphia, and the coinage proceeded. It was found that, owing to the rise in the value of copper, the cent had been made too heavy, and, January 14, 1790, it was reduced to two hundred and eight grains, and January 26, 1796, it was again reduced to one hundred and sixty-eight grains, at which rate it remained until the late introduction of nickle. The mint being established at Philadelphia, the work of coinage went on slowly, for two principal reasons. The first was that the material for coin—that is, gold and silver, no matter in what shape it may be—was obtained only, by the operation of trade, from abroad, and nearly all of it arrived at New York, the property of merchants. Now, although the government charged nothing for coining, yet, to send the metal from New York to Philadelphia during the first forty years of the government, when there was none but wagon conveyance, was expensive, and accompanied with some risk. It was not, therefore, to be expected that the merchants would undertake this without any benefit; the more so, as the same law, in the second place, still allowed the foreign coins to be legal tender. The merchant who received, say ten thousand dollars in gold coin at New York had only to lodge that coin in the local bank, and use the paper money issued by the bank. There was no necessity to send the coin to Philadelphia merely to be recoined without profit. It was also the case that in the course of the newly developed commerce between the United States and the countries of Europe, it was found that silver had been valued too high at the mint. It was coined in the ratio of fifteen to one of gold, when its real value was nearer sixteen to one. This relative value of the two metals depends upon the respective demand and supply in the markets of the world. At about the date of the discovery of America it was ten to one; that is, ten ounces of pure silver were equal to one ounce of pure gold. When Peru and Spanish America poured in their large supplies of silver, the rate gradually fell to fifteen to one. At the close of the eighteenth century, and with the greater freedom of commerce in the first half of the nineteenth century, it was found still to decline. The reason of this is obvious, since, in any locality, the relative value of the metals will be proportioned to the local supply of either, influenced by the expense of sending either to other localities. Thus, silver may have been really fourteen to one in one place, and sixteen to one in another, and the difficulties of transportation prevented an equalization. As soon as communication became prompt and cheap the equalization took place, and the general relative value was found to be somewhat changed. The effect of this was that silver came here and gold went away. Nearly all the coinage of the mint was silver. This evil attracted the attention of the government, and a remedy was sought. This was finally found in changing the relative value of the silver to gold in the coinage by simply putting less pure gold into the eagle, and letting the silver remain as it was. The quantity of pure gold in the eagle was, therefore, by the law of June 28, 1834, reduced from 247.5 grains to 232 grains, or rather more than six and five-eighths per cent, and the quantity of alloy was slightly increased, so as to make the fineness of the gold nine-tenths, or nine grains of fine gold to one of alloy in each piece.

This was found not to be exact, and in 1837 the pure gold was slightly increased, and this regulation remains. Under all the laws the gold coins have been as follows:—

	Pure gold. Grains.	Alloy. Silver.	Alloy. Copper.	Total Alloy.	Total weight. Grains.	Fineness.
1792,	247.5	5.62½	16.87½	22.5	270	916.7
1834,	232.0	6.50	19.50	26.0	258	899.2
1837,	232.2	6.45	19.35	25.8	258	900.0

These proportions remain now the same for gold. In order to bring the silver to the same standard, the law of 1837 reduced the alloy in dollars three and a half grains, making the dollar weigh 412 1-2 grains instead of 416.

In all this period, up to 1838, there had been but one mint, and that at Philadelphia. In 1831, under the desire of the government to enlarge the metallic basis of the national currency, three branches were authorized, one at New Orleans, one at Charlotte, North Carolina, and one at Dahlonega, Georgia. These two latter were in mining districts, where gold began to be produced to some extent, and all three went into operation in 1838. The coinage progressed down to 1853, when, in consequence of the change brought about by the gold discoveries in California, a new law in relation to the silver currency was enacted. Before giving an account of that change, we may take a table of the coinage at the mint since its organization for several periods.

UNITED STATES COINAGE.

	Gold.	Silver.	Copper and Nickel.	Total.
1793 to 1820,	7,431,545	10,980,431	421,795	18,833,771
1821 " 1834,	4,394,345	25,314,647	236,795	29,945,787
Total to 1831,	11,825,890	36,295,078	658,590	48,779,558
1834 to 1837,	11,424,450	12,560,115	137,323	24,121,888
1838 " 1848,	53,329,965	24,351,769	513,376	78,195,570
1849 " 1852,	60,211,315	6,014,509	311,207	166,567,031
1853 " 1860,	318,169,102	42,803,767	553,365	371,526,234
	$564,960,722	122,025,288	2,203,821	689,190,281

In the first twenty-seven years of the mint operation, the gold coinage was about seventy-five per cent. of the silver coinage. That whole period embraced the European war, and the first operations of the mint were to coin as much of the metals already in the country as came within their reach. In the second period, from 1821 to 1834, the effect of the change in the relative value of the metals of which we have spoken, became manifest, and the gold coinage was about one-sixth only of the silver coinage. In 1834 the new gold bill produced a change, and the gold coinage became nearly equal to that of silver. Soon after the passage of this law, the payment of the French indemnity, enforced under the administration of General Jackson, took place, and it was paid in the form of gold bars, of weight varying from twenty-five to six hundred and fifty ounces each. The first of them were received at the United States mint September, 1834, and from that date to September, 1838, six hundred of these bars were deposited at the mint; the value was $3,500,000. In 1838 the branches came into operation, and the coinage was increased by their operations and by 13,705,250 of gold of domestic production, to the close of 1848. In 1849 California gold began to make its appearance, and $7,079,144 worth of it was coined in that year. The great influx of gold bullion upon the mint by far exceeded its capacity to do the work, and Congress authorized, by the act of March 3d, 1849, the coinage of double eagles, or $20 pieces, and also one dollar pieces to supply the place of the silver coin, which had been drained off to California in exchange for the gold, which sold as low as $15 and $16 per ounce, although worth $20 and $21. The law of May, 1852, authorized the coinage of $3 pieces.

In ten years, to the close of 1848, the gold coinage had amounted to double the silver coinage, and the new influx of gold excited fears that the value of silver would rise rapidly as compared with gold. From 1848 to 1857 the coinage of silver was very small, while the demand for it was large. To avoid inconvenience from this cause, a new bill was passed, to take effect April 1st, 1853. By this bill it was enacted that gold or silver deposited with the mint, might be cast into bars or ingots of pure metal, or standard fineness, at the option of the depositor, with a stamp designating the weight and fineness; no pieces less than ten ounces shall be other than of standard fineness; the charge for this is one-half per cent. Inasmuch as most of the gold arrives at New York, efforts were made to procure the establishment of a mint at that point. Instead, however, of a mint, an assay office was established there, and a branch mint at San Francisco, in 1854. The law allows the depositor to draw either bars or coin in return, the description desired to be stated at the time of the deposit. The production of bars and coins under all these regulations has been large, for gold as well as silver.

Until the law of 1834, the quantity of gold coin in circulation was not large. The banks supplied so large a quantity of small bills as to fill the channels of circulation for sums above a dollar, and under that amount the circulation was almost altogether small Spanish coins, which, being much depreciated by wear and tear, passed for more than their intrinsic value, and consequently flooded the country, greatly influencing retail prices. This was particularly the case with the pistareens, which, up to 1827, were taken at twenty cents, or five to the dollar, although they were really worth but eighteen and a half cents, consequently there was little other change to be had. In consequence of a report of the Mint Director of that year, they were refused at more than seventeen cents, and they very speedily disappeared from circulation, and have not now been seen for a quarter of a century. The quarters continued to circulate at twenty-five cents, although the average value was twenty-three and a half cents; the eighths were taken at twelve and a half, although they were worth only eleven and one-eighth; the sixteenth was taken at six and a quarter, although worth but five cents. It resulted that these coins became very abundant, driving out the dimes and half dimes, and in 1843 the post-office and the banks refusing them altogether, they were supplanted by the American coin, until the gold discoveries of 1848. After that event, owing to the increased production of gold, and the fact that some of the European states changed their monetary policy, making silver the sole standard of value, the latter metal became worth more in market than its nominal value in United States coin, and was gradually withdrawn from the currency, until, in 1852, silver coin became very scarce, and there was not sufficient left in circulation for the purposes of change. A premium of four per cent. was paid for dollars and half dollars for export, and the smaller coins commanded, in many cases, a still higher price, for use among shop-keepers and small traders. It was easy to see that, unless the weight of our silver coin was reduced, there would soon be none left in the country. Already the eating-houses and drinking saloons had issued their tickets, or shinplaster tokens, in place of coin; and the poor, who purchased the necessaries of life in small amounts, were put to great inconvenience, or obliged to submit to ruinous shaves upon their paper money. To remedy these evils, Congress passed the act of February 21st, 1853 (to take effect the 1st of April following), authorizing the coinage of half dollars, quarter dollars, dimes, and half dimes, weighing about seven per cent. less than the old coin. The change will be better understood by comparing the weight of the several pieces under the old law, with the weight of the new coin:—

	Old coin.	New coin.
Half dollar, grains ...	$206\frac{1}{4}$	192
Quarter dollar, do. ...	$103\frac{1}{8}$	96
Dime, do. ...	$41\frac{1}{4}$	38 2-5
Half dime, do. ...	$20\frac{5}{8}$	19 1-5

The dollar was not changed, and the weight of that piece is 412 1-2 grains, the weight which it has borne since 1836; this reduction of weight being fourteen and a half grains in the half dollar, or nearly seven per cent. The silver currency was not *debased*, in the ordinary sense of the word, the same fineness (nine hundred parts pure silver, and one hundred of alloy) being retained, and the only change in the coin itself being in the weight. A very important provision, however, was made in regard to it; it is not a legal tender in payment of debts in sums exceeding five dollars. The old silver coins have been mostly taken out of circulation. A few dollars are kept to pay depositors at the mint, who are entitled to silver coin, but the silver extracted from California gold is paid for in gold coin at a premium to the depositor. To prevent the government from forcing this silver currency upon the people, the right to make payments in it was restricted as above noticed; but to go further, and to prevent the mints from coining more than was needed, the purchase and coinage of the silver was placed under the control of the Secretary of the United States Treasury. The law went into operation at the date fixed, and the supply of coin was very acceptable to the people.

The continued active operation of the mint is, however, producing an excess of these coins. The quantity of silver coined at the mint and branches, under the law of 1853, has been as follows:—

	Philadelphia. Pieces.	New Orleans. Pieces.	S. Francisco. Pieces.	Total pieces.	Value.
Dollars	335,250	200,000	15,000	550,250	$ 550,250
Half dollars	15,038,208	22,440,000	1,099,950	38,578,158	19,289,079
Quarter do.	55,685,220	5,940,000	961,400	62,586,620	13,146,655
Dimes...........	31,838,010	6,030,000	120,000	37,988,010	3,798,801
Half dimes.......	36,495,020	9,226,000		45,721,020	2,286,051
3-cent pieces	16,314,000	720,000		17,034,000	511,020
	155,705,708	44,556,000	2,196,350	202,458,058	$39,581,856

This is a curious table, inasmuch as that it indicates the large amount of silver money in the hands of the people. This coin, it will be borne in mind, is undervalued six per cent., and is a legal tender only to the extent of five dollars. These two conditions prevent its export, and also its retention by the banks. It appears, then, assuming the number of people to be thirty millions, that there are nearly seven pieces of silver coin for every soul, and in value, a dollar and thirty-three cents each person. There are more than two quarter dollars for each person; nearly three half dimes for every two persons. In addition to this small silver coin, there has been coined since 1849, $17,046,053 in one dollar gold pieces. These have not been a popular coin, however, and do not remain in circulation. The remaining coins are of a large amount, but the quantity that remains in circulation cannot be ascertained.

The main source of supply of the precious metals to the mint was, until the discovery of California gold, from abroad, through the operations of commerce. Since that event, the Pacific state has been the leading source. The Atlantic states had, however, previously supplied important sums. The quantity of domestic gold deposited at the mint, up to 1851 and since, has been as follows:—

DEPOSITS OF DOMESTIC GOLD AT MINT AND BRANCHES.

	To 1851.	1851 to 1859.	Total 1859.
Virginia	1,197,338	327,977	1,525,315
North Carolina.....	6,707,458	2,236,951	8,944,409
South Carolina	817,692	462,913	1,280,605
Georgia	6,018,603	782,270	6,800,873
Tennessee	76,574	4,337	80,911
Alabama	186,627	10,131	196,758
New Mexico.......	88,963	9,709	48,672
California..........	81,838,079	419,472,761	451,310,840
Kansas		4 172	4,172
Oregon		69,272	69,272
Other places	41,103	33,121	79,224
Total........	$46,922,437	$423,418,614	$470,341,151

This large amount, $423,418,437, of raw material of money, was supplied to the mint in the past nine years, but after supplying the money required for circulation, it flowed off to Europe as an export, in the shape of bars. The domestic silver which has been supplied to the mint, has been $23,398 received from North Carolina, for the first time, in 1859; $45,745 from Lake Superior, and $3,221,225 parted from California gold. In the past few months the Washoe mines begin to furnish supplies.

The amount of specie actually in the country cannot be ascertained with any great degree of accuracy. The amount coined, the quantity imported and exported, afford data by which to estimate it, and these estimates have been made from time to time. Taking the amounts coined, the amounts in bank, and other data, the officers in the treasury estimated the amount in the country in 1821 to be $37,000,000. The calculation, then, up to 1849, upon official figures, would be as follows:—

Specie in the country in 1821,		$37,000,000
Product of U. S. mines to 1849,		13,811,206
Imported 1821 to 1849,	242,239,061	50,811,206
Exported " "	180,596,664	61,642,397
Specie in the country in 1849,		$112,453,603

Of this amount, $43,619,000 was in the banks and $5,700,925 in the federal treasury. Of the remainder, $32,133,688 was estimated to be in circulation, and $31,000,000 in plate and ornaments. From 1849 to 1859 the amount has been as follows:—

In the country in 1849,		$112,453,603
Coinage, 1849 to 1859,		529,619,919
Supply to 1859,		$642,073,522
Import of the metals, 1849 to 1859,	78,838,864	
Export " " "	435,023,906	
Excess export,		356,185,042
In the country in 1859,		$285,888,480

This gives an increase of $173,434,877 of specie in the country in ten years, to the first of 1860. The distribution of this money was nearly as follows:—

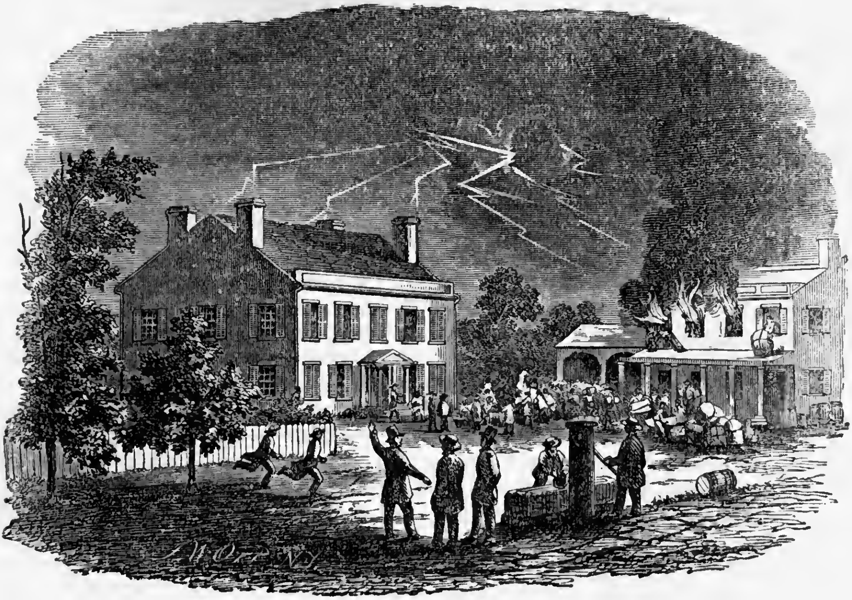
Stock in the country,		$285,888,480
United States treasury,	$10,000,000	
In all the banks,	104,537,818	
In plate, ornaments, &c,	50,000,000	
In general circulation,	121,350,662	
		$285,888,480

There are large sums of money and metals that come into the country in the hands of emigrants. As these are no longer a legal tender, they find their way either to the mint or to the broker for export. We may now, on this basis, ascertain the amount of money that circulates in the country, as follows:—

	1849.	1859.
Bank circulation....	$128,506,000	$193,306,818
Less notes on hand	16,427,000	18,858,289
Bank notes in circulat'n	112,079,000	174,448,529
Specie in circulation	32,133,688	121,350,662
Total mixed circulat'n	$144,212,688	$295,799,191

The specie, as we have seen, is one-third in small silver coins, and the mixed mass is largely of the precious metals. The country, as a whole, has had its specie capital, which is a "machine of trade," increased over $173,000,000 in the last ten years.

The mint operates upon the various forms of the metals brought to it, and these are of great variety, from the most delicate plates and ornaments down to base alloys, and these are all included under the general term bullion, except United States coins. The bullion is either unwrought or manufactured. The first description embraces gold dust, amalgamated cakes and balls, laminated gold, melted bars and cakes. The "dust" is the shape in which it is derived by washing in North Carolina, Georgia, South Carolina, Virginia, and various states, besides California. In South America, Russia, and elsewhere, amalgamated gold is that which has been procured by the use of quicksilver, which combines with it, forming a lump. Laminated gold is that which is combined with silver, and derived mostly from Central America. Bars and cakes of six inches in length, and from one-half to one inch in breadth and thickness, are the forms into which the metal is cast at the mines. A bar of fine gold, six inches long, three wide, and one and a half thick, would weigh two hundred and seventy-five ounces, and its value would be five thousand nine hundred dollars. These are mostly the forms of unwrought gold received at the mint. The manufactured is mostly jewelry, plate, and coin. The first mentioned is received at the mint in every variety of article into the manufacture of which gold enters. These are of every form and fashion and degree of fineness. The value of all depends upon the quantity of pure gold in them, and this requires to be extracted by the melters' and assayers' art. The range of fineness of most jewelry is 300 to 600, or from 1-3 to 2-3 the value of coin of the same weight. In other words, where coin is 94 cts. per dwt., jewelry is worth 31 to 60 cts. the dwt. A good deal of "fair" jewelry is found to be worth 4 to 10 cts. the dwt. All this mass of metal must, by the melters and refiners, be reduced to a uniform material, containing the exact proportion of alloy allowed by the law. They are then in the shape of bars, twelve inches long, half inch thick, and from one to one and a half in breadth, according to the size of the coin to be struck. They are subjected to a test to see if they are of the legal fineness. They are then annealed, or heated to a red heat. This is to soften them for rolling, which is done into long thin strips by the power of a steam engine. These strips are then passed through plates of the hardest steel, by which they are "drawn" to their proper thickness. This being done, they are by a steam press cut into "planchets" or pieces of the exact size of the coin wanted. This "press" cuts one hundred and sixty per minute. The strip remaining full of holes is rolled up and sent back to the melting pot to be reformed into a bar. The planchets are then cleaned, annealed and whitened, and their weights accurately adjusted. They are then placed in a tube, which slides them one by one into a steel collar, in which they fit. The piece is then instantly pressed on both sides by the dies, and is instantly pushed away with perfect impressions on both sides, to be followed as promptly by another piece. The "dies" that make these impressions are of alabaster work. The devices are first cut in soft steel, those parts being sunk which are raised on the coin. This "original die" is then hardened, and is used to impress a piece of soft steel, which is then like a coin with the figures raised, and is called a "nub." This being again hardened, is used to impress dies, with which the coining is done, and a pair of them will do two weeks' work. The coining presses are of sizes proportionate to the work. That which impresses a half dime is a toy compared with the massive structure required for a dollar. The dollar and half dollar are struck at the rate of sixty per minute, the quarter dollar seventy-five, and the dime and half dime ninety per minute.



INSURANCE.

CHAPTER I.

FIRE—MARINE—LIFE.

When industry and commerce began, in modern times, to develop themselves, after the "age of chivalry" was gone, capital augmented itself in the hands of individuals, for the prosecution of various enterprises. It soon became evident, however, that the capital in these employments was exposed to entire loss from the accidents of fire, storms, and other vicissitudes, over which the owner had no control, and which his utmost foresight or sagacity could not prevent. This fact was a drawback upon enterprise, since every undertaking involved the chance of total ruin to the projectors; but when the commercial spirit became more largely developed, in the fifteenth century, some of the inventive spirits of that age devised the principle of insurance, by which a possible loss would be divided among a great number of persons, in such a manner that each would feel it but in a small degree. The individual merchant would thus be enabled to embark in his adventures secure from ruinous accidents. The principle of insurance thus devised was that of "average," or an application of the law of chances, which, it was discovered, obey certain rules. Nothing is more uncertain than winds and weather, or the accidents of fire, which occur in the face of the utmost care to prevent them. Births and deaths, and many other contingencies, seem to obey no law whatever, yet, taken in great numbers, it is found that the average that occurs in a given time is almost certain. If we look at single families, we find that some are all boys, others all girls, and many are of both sexes, without any apparent proportion. Yet the census returns of all civilized countries show that there are twenty-two males for every twenty-one females; and that, notwithstanding the uncertainty of death, this proportion will hold good through the lives of generations. The number of houses burned in a year, in any given locality, obeys the same law of average as do all the accidents of life. The number of ships engaged in any trade, that are lost, comes under the same rule. To fix the rate of average, however, a very large scale of experience is necessary, and the rate of premium is adjusted on the basis of the average. Thus, if there are forty ships engaged in a particular trade, and of them one is lost every year, then the chance of loss is one to forty, and the owner of the ship insured should pay one-fortieth part, to cover his risk, exclusive of the sums required for the expenses and profits of the insurers. Upon this principle the whole community came, as it were, to be responsible for the losses of individuals, and commerce received an impulse in consequence, since enterprises could be undertaken with more confidence. Toward the close of the seventeenth century, the same principle was applied to fire risks, and any description of property came to be protected from loss by the payment of a rate of insurance which experience showed, properly improved, would cover the average losses. Some half a century later, the principle was applied to life insurance, by which a person, on the payment of a certain sum annually, at a rate fixed by the largest experience, will insure to his heirs the sum covered by the amount he pays.

These three descriptions of insurance have flourished greatly in the United States in the last fifty years—the marine and fire risks particularly. Before the formation of the present government, insurance in this country seems to have been confined to individual underwriters, who took risks in their own names. In 1792, their was however, incorporated in Philadelphia, the Insurance Company of North America; in 1799, the Providence Company, at Providence; in 1806, the Eagle Company, of New York, and some were chartered at Boston. All these companies were organized as stock companies, and are, with many more, still in existence. The fire insurance of the country has naturally grown more than either of the other branches, since every citizen in the country is more or less interested in protection against fire. The immense quantities of goods that are sent from the factories and merchants, to be distributed in the interior, and all the produce which seeks a market, require protection against the accidents of fire, as well as those of internal transportation. The multiplication of houses and stores, with their contents, in all parts of the country, involves a growing necessity for insurance; and this every prudent man effects, not only to protect his own property from loss, but as a means of credit. The credit system, on which so much of the business of the country is transacted, makes it necessary that the utmost security should be given to the goods sold, and insurance is insisted on very generally by the sellers. A man who does not keep his goods insured has far less standing than one who does. The object of being insured is, of course, safety. The premium is paid annually, in the hope of receiving back the amount of loss in case of fire. At the same time, the insurer seeks to get this done at as low a rate as possible; nevertheless, there is a point below which the premium cannot be reduced without involving the solvency of the company. The law of average fixes the rate which the company must charge, in order that its income, improved at compound interest, shall suffice to meet the liability it undertakes; but this charge is "loaded" with a sum to meet profit and expenses. The great competition among companies guarantees that the charges shall be kept at a low point, and inducements are sometimes held out, of lower rates, to attract business. There are three modes of organization of insurance companies; these are the stock companies, the mutual companies, and the mixed companies. The first mentioned have a capital subscribed by any number of persons, who become incorporated in a company. This capital is a guarantee that the company is able to pay if losses occur. The capital must be safely invested in such a manner that it can be called in, if wanted. They then issue policies on certain terms, at certain rates of premium, dividing all the profits of the business among the stockholders. The premiums paid in, if fixed on sound principles and well employed, will generally suffice to make good all the liabilities until the reserve, or surplus profits retained, have grown into a guarantee fund. Out of this fact, resulting from experience, grew the mutual system of insurance. This was contrived after the "great fire" in London, 1666, and was introduced in New York after the great fire of 1835. By this system the company has no capital—the premiums paid in become the fund from which all losses are paid. The rates are charged on a sound principle, and the aggregate improved at compound interest. After the expenses and losses are paid, a certain portion of the surplus remains to increase the assets of the company, and the balance is divided among the insured according to the amounts they have paid. Thus the profits, instead of going to stockholders, go back to those who paid them into the company. This system, on its face, is by far the most economical in its action and beneficial in its results. It has been objected to it, however, that in a new company, with the small business incident to beginners, before there has been any accumulation of profits, the security is insufficient. To meet this objection, among others, mixed companies are sometimes started. They have a capital paid in, and this draws dividends from their first profits, to a certain extent, the insured getting a share of the remainder of the profits. Where the business is skilfully conducted on sound principles, the mutual system seems to command the most advantages. The stock companies assert that nothing is gained by the insured paying in money, in the shape of a premium, for the chance of getting it back again as profits. The object is, however, security; while the funds are in the hands of the company, the liabilities are well covered, and they are not divided until replaced by new accumulation. In the case of the stock companies, the accumulations are paid over to stockholders, the insured getting nothing. In some of these companies, the stockholders get their whole capital back every four years! yet the means of the company do not grow. The funds of a company require to be invested in securities of the utmost safety, and these, for the most part, only give the lowest rates of interest. It is only when a sum sufficient to meet all incurred claims is set apart in the best securities that can be had, that a company is justified in seeking, for the remainder of its means, second-class securities that give a higher rate of interest. The mutual system has been a favorite in some states, but in New York its reputation has been sadly damaged by the explosions of fraudulent companies. Thus in 1849, a general law for the organization of insurance companies was passed, and under it, forty-two companies were organized and reported in 1853. Of these, thirty-three have gone down, under circumstances of outrage and wrong inflicted upon citizens, which have gone far to destroy the reputation of that class of companies.

In Massachusetts the mutual principle has been more successful than the stock organization. The amount at risk in the former is $214,725,821, and in the latter it is $132,854,841. The movement does not appear to be entirely safe, however. There are sixty-nine mutual fire companies in the interior of Massachusetts, most of them so small as to make the policies of little value, since to pay losses, assessments would be required, and these are fatal to the standing of the companies. The losses by fire in Massachusetts were, last year, $1,241,669; of this, two-thirds was borne by the stock companies, and it is a sum double the losses of the previous year.

The laws of New York, where the largest amount of insurance has been done, indicate the changes which have taken place in the course of business. Up to the revision of the state constitution in 1846, it was usual to grant special charters for the incorporation of companies, and fire, marine, and life powers were often granted to a single company. In 1849 a general insurance law was passed, by which any number of persons exceeding fifteen might organize into a company for fire and marine insurance, but it was expressly ordered that no company insuring lives should take any other kind of risks. In 1853 another act was passed, by which it was ordered that no fire company should be incorporated to take any risks but fire and internal navigation. In 1836, when the great fire in New York had swept down nearly, if not quite all the existing companies, there were started eleven mutual companies, that still exist. In 1837, four more were started, and the number was increased by four more up to 1849. Under the act of that year, forty-two were started, of which nine remain. The mutual fire companies now in New York state compare as follows:—

	No.	Assets.	Cash on hand.
1853,	62	$11,621,914	$766,284
1859,	28	4,793,506	161,802
1860,	27	4,128,101	

This shows the decline of the mutual principle in New York; and a number of those now existing show such returns as point to winding up. The stock companies, on the other hand, showing a rapid increase, are most of them in the city of New York, while the mutual companies are all in the interior. Of the existing stock companies, twenty-one were organized prior to 1838; under the act of 1849, thirty-eight; and under that of 1853, thirty-seven were organized, making ninety-six now in operation, with a capital of $20,007,000. Of these companies, eleven, with a capital of $1,900,000, were organized in 1859. In addition to the New York state companies doing business in New York, there are companies chartered in other states, and English companies, doing business within the state. Formerly, or up to 1836, foreign companies could do business in New York by paying a tax of ten per cent. of the premiums. This assessed them about $2,369 per annum. The tax was then reduced to two per cent., which, in the ten years ending in 1846, amounted to $3,183 per annum, being an increase in amount of $813 per annum arising from one-fifth of the tax. The capitals and premiums of the New York fire companies were as follows:—

	No.	Capital.	Premiums.	Risks.
1844,	20	$5,710,000	$837,000	$119,571,000
1859,	92	19,407,000	7,692,635	701,215,624
1860,	96	20,007,060	8,032,493	719,267,809

In the year 1845 again occurred a large fire, which, burning the lower end of Broadway, and a large amount of property, swept into bankruptcy many of the fire companies. The law of 1849 favored the establishment of new ones, causing great progress in the fire companies in New York in the last eleven years. This large and increasing business has been of great profit to the companies, as appears from the handsome dividends declared. In the last eight years, the twenty-one companies organized prior to 1838 have declared dividends ranging from 106 to 236 per cent. The average is 142 per cent., or 18 per cent. per annum on the stock. The dividends of the other companies are not so large, but they show a handsome investment. Some of the companies are mixed; these declare dividends in cash on the stock, perhaps 5 per cent. semi-annual, and 20 or 30 per cent. in scrip on the earned premiums of the participating policies. All the policies are not participating. The plans are much diversified. The policies participate to a greater or less extent, as declared upon their face. The principle is this: if the year's business is $100,000, and of this, $40,000 is found to be profits, one-fourth of this will go to the stockholders, and there remains $30,000 for the participating policies. These policies may compose a greater or less proportion of the business. Under the supposition that it is six-tenths, or $60,000, then the dividend is called 50 per cent.

The law of 1853 permitted companies of other states to do business if possessed of the *active* capital required of companies in New York, and on compliance with certain conditions prescribed. Under this permission, many companies of Rhode Island, Connecticut, Philadelphia, New Jersey, Massachusetts, and Georgia have transacted business to a considerable extent.

In New England the insurance business has taken dimensions second only to those of New York. The Ætna Company of Hartford is one of the most successful companies of the world. It was founded in 1819. It has a capital of $3,000,000, and its whole assets are 1867, $4,478,000; while its risks are $285,000,000 on fire, and $46,000,000 on inland navigation. This company, in the last year, added $500,000 to its capital from accumulated profits, and divided $200,000 cash.

The amount insured against fire by these companies, the annexed table gives at nearly $2,000,000,000. The companies of other states than those mentioned, and of which we have no returns, would add, probably, $500,000,000 to this amount; and there are some risks, probably $50,000,000, taken by the English companies doing business here. This vast sum of property insured against fire, is the growth of the last fifty years, and we may compare it with the insurances of some of the European countries. Thus, in Great Britain, the fire risks amounted to $3,905,432,665, or double those of the annexed table; in France, the fire risks are $6,500,000,000; in Germany, the fire risks are $4,075,000,000. Thus the United States have already a fair proportion of property covered by policies, and the system extends itself gradually.

In New York the company having the largest risks is the Home, of $51,045,691. If we bring together the returns of the leading companies of the several states, as far as returns are obtained, we have the following figures:—

CAPITAL, PREMIUM, AND RISKS, OF FIRE COMPANIES IN THE UNITED STATES.

	No.	Capital.	Assets, including capital.	Cash premiums.	Fire risks.
New York Stock	96	$20,007,000	$26,323,384	$6,421,342	$719,267,809
" Mutual	28	..	4,793,506	..	87,310,910
Massachusetts	99	6,353,100	..	1,266,183	347,580,662
New Hampshire	23	..	..	33,000	39,784,084
Providence	6	900,000	1,519,688	552,153	26,648,143
Connecticut	12	4,550,000	5,364,686	3,715,320	279,322,184
Philadelphia	10	2,908,181	6,510,601	1,913,417	139,229,374
Jersey City	1	150,000	179,713	36,109	5,231,061
Peoria, Ill	1	300,000	363,995	89,375	6,806,377
Augusta, Ga	1	375,000	952,588	194,407	7,000,000
Charleston	2	833,558	..	472,000	98,000,800
New Orleans	9	4,500,000	6,738,031	2,910,000	221,100,000
			$52,746,192	$17,603,306	$1,977,281,404

The Illinois company has $1,572,387 marine risks, in addition.

The losses by fire in the United States in 1859, where the damage was $20,000 and upward, amounted to $16,058,000, and the estimated total losses incurred by the underwriters was $22,000,000—burned up in a single year. The losses above $20,000 amounted in six years, ending with 1859, to $98,197,000; and the total estimate was $127,500,000—an enormous amount to be destroyed. This amount is apparently borne by the insurance offices, but it is really paid by all those who get insurances. It is their aggregate premium which forms the fund which pays not only this loss, but the large profits derived by the stockholders in insurance companies. The companies contribute nothing toward it. The extent of their services is to collect the premiums from the insured, and, after paying salaries and expenses, meet the losses and divide the surplus among the shareholders of the companies. This service is, of course, an indispensable one. It brings all the property of the community to guarantee individuals against serious losses.

Marine insurance differs from both fire and life insurance, both in the mode of transacting the business, and in the diversified nature of the risks against which security is sought. The great emporium of marine insurance for the commercial world is London, and it is there done through the medium of individual underwriters, who congregate at Lloyd's, which may be considered as the focus of the commerce of the world. There is not a seaport of any consequence, where it has not an agent to give intelligence of all departures and arrivals, ships spoken, wrecks, accidents, weather, and every item that affects navigation. In this way they are supplied with information from all quarters, and almost all vessels that float are registered, with every minute particular in regard to them; and vessels of all nations are more or less thus insured. In the United States, marine insurance was the first that engaged the attention of the eastern states, and it has, as a matter of course, been confined mostly to the great cities. In New York there are seven companies incorporated by special charters before 1849; one of these is at Buffalo. There are also seven which are organized under the act of 1849; of these, two were started in 1859. There are no companies organized in other states or foreign countries, that do business in New York, none having complied with the provisions of the law of 1859; and a fine of $500 each offence is imposed upon those who transact business without being authorized. The fourteen marine companies of New York have assets, $20,932,067, and received premiums during the year, $13,730,438; losses and expenditures during the year, $9,446,293. In the marine companies, after the profits of the year are made up, certificates are issued to each of the insured for his proportion of the profits; these bear interest, and have a market value. When the funds accumulate, these certificates are called in and paid off. As an example, the Atlantic Mutual was organized in 1842. The profits, as they were earned, were yearly paid to the insured in the shape of the certificates. Thus, a dividend of thirty-five per cent. was declared Dec. 31st, 1859, and, for this, certificates bearing interest were issued. It was then found, after paying all expenses and interest on the outstanding certificates, that the reserve fund of the company amounted to $3,809,250 after paying off the certificates issued previous to 1858; and it was resolved to pay off those of that year. The whole account stood thus:—

Profits, July 1, 1842, to June 1, 1860,	$10,428,470
Certificates redeemed previous to 1858,	6,619,220
Net earnings on hand, Jan. 1,	$3,809,250

The dividends of scrip of the marine insurance companies of New York, as shown by the official returns, were as follows:—

	Capital and assets.	Premiums marked off.	Scrip rate per cent. 1859	1860
Atlantic	$6,002,732	$4,497,468	40	35
Anchor	372,559	49,127	—	—
Commercial	928,783	603,571	40	15
Great Western	3,396,258	2,801,664	20	10
Mercantile	1,125,102	894,775	20	11
New York	1,002,637	812,519	35	12
Orient	1,316,552	566,092	21	20
Pacific	1,005,966	823,655	43	30
Union	1,647,181	581,544	45	36
Columbian	1,264,443	755,142	12	—
Sun	1,914,230	1,025,167	30	—
Neptune	268,161 (new)	43,133	—	—
Washington	150,201 (new)	—	—	—
			264	169
Average			33	21⅛

The totals and average are exclusive of the Columbian and Sun, which have not yet issued scrip.

In Massachusetts, the marine risks for the past year were $101,972,974; of this, $45,545,105 was in stock companies. The marine losses reached $3,905,186.

A large proportion of the risks taken in the eastern cities, is for internal navigation, and the loss by steam and sail in 1859 was $1,020,100; about two-thirds sail. The aggregate marine losses are very nearly $40,000,000 for the year.

Life insurance has taken large proportions of late years, and the amounts now at risk involve many millions. In 1825, the first company chartered, the Massachusetts Hospital and Life Insurance Company, commenced its business. In 1829 the New York Life Insurance and Trust Company was chartered. Though of the highest standing, and possessing fully the public confidence, both of these institutions found the trust business authorized by their charter to be more attractive than life assurance; and for several years neither of these companies has made any effort to increase the number of its policies. Most of the remaining companies in this country are of recent date, and very few of the number have seen the period of half a generation, yet the magnitude of this business is such that the following facts appear in the reports: In New York there are twelve companies doing business. The oldest of these was organized in 1830; two in 1859; and two more were established in the present year, 1860. These companies have a capital, with accumulation, amounting to $12,090,815, and the outstanding risks are $72,147,436; the annual premiums are $2,762,366. There are a number of companies of other states doing a life business in New York, and three English companies. These are required to comply with the New York law of 1853 in relation to security. This requires that a sum of $100,000 shall be lodged with the insurance department for the security of the policy holders.

In life insurance the principle is based on the average continuance of life, than which nothing is more uncertain as regards individuals or a limited number of persons. Nevertheless, in a large number, the average of those who arrive at a certain age is ascertained with much precision. To ascertain this, Mr. Milson, of the Sun Life Office of England, constructed a table at Carlisle from observations made upon 10,000 persons born nearly at the same time; the number of these that were alive in each subsequent year, until the whole were extinct. These are called the "Carlisle tables," and are supposed to give pretty accurately the average English life, and they are used mostly in this country, although it is supposed that life here is really shorter than in England. The tables show that of 10,000 born at the same time, 4000 lived to be 56. The number of those who died at 66 was 124. Hence the probability that a person now 56 will die in his 66th year is as 124:4000. The probability of life being ascertained, it remains to find what sum per annum a person must pay in order to obtain a fixed sum, say $1,000, for his heirs at his death. It is to be borne in mind that insurance creates nothing; all that it does for the individual is to take his money, and improve it at compound interest into a sum that it agrees to pay his heirs. The time of payment is the uncertain part, and this in a company where great numbers are insured, is fixed by the principle of average. Suppose a person 35 years old wants to be insured for $1,000. The tables say his expectation of life is 31 years. The company assume that as a fact, and with them it is an agreement to pay $1,000 at the end of 31 years. What sum paid annually and improved at 4 per cent. compound interest will come to $1,000 in 31 years? This would be $17, but the company add to or load this with a certain per-centage to defray expenses and for profit, and the charge will probably be $27. This amount per annum for 31 years will, without interest, amount to $839, and improved at 6 per cent., will amount to $1,560 in 31 years. Thus, if the individual lives the whole time, and improves his own money, he will have 50 per cent. more than the company agrees to pay. The company have many sources of profit, however. The first is that they put the expectation of life lower than the fact. This is necessary in young companies. Thus, if among 10,000 persons, 4,000 live to be 56, it will not do to take that as the rule for 200 persons; but a less rate must be assumed, and a higher charge made. If the company's business increases, so that they get out 10,000 policies, they will have the full benefit of the average, or, in other words, the insured pay more than they ought. In the second place, the company calculates the premiums improved at 4 per cent., when they get really from 6 to 7. This makes the amount at the end of a year's time 50 per cent. more than the estimate. In the third place, the calculation of expectation of lives is for ordinary lives, whereas the lives taken are only those carefully selected. Those that are less likely to die are only chosen. Hence, this makes the rate of premium higher than the tables justify. In the fourth place, the profits of a company are increased by the forfeiting of policies by persons who do not pay up. There is also a profit when a policy is purchased from those who surrender. All those sources together tend to make the profits far larger than the simple compounding of the rates indicated in the tables would show. In the mutual system it is claimed that these profits are paid over with the amount insured at the end of the time, or at the death of the insured. There is no limit, however, on the expenses, which are an item in making up profits. It is apparent, from all these facts, that the money does not accumulate with the company faster than it would if the individual improved it himself, since the advantages of the company, in lapse of policies, etc., only offset the expenses they incur. The advantage is in the security offered for the repayment of the money. The idea that money will grow by the operation of interest any faster in the hands of a company than in those of an individual is a fallacy, which was some years since applied to building associations. These drew in large amounts of money in small payments from numbers of persons who were to obtain house lots, through some magical mode of making money grow. Disappointment generally attended them. In the case of the life companies, however, the contingency exists that the person insured may not live to accumulate his money. He *may* die as soon as he has made his first payment, in which case the operation is a good one for his family. This is the chance feature which is the great attraction, since the payment once made, there is the certainty that the family will not be destitute in case of death. It is only those in the best of health, however, that can avail themselves of this opportunity for security, since the lives in any degree doubtful are rejected.

In Massachusetts there are five life companies, which have issued 7,007 policies, and the risks are $17,408,713. The Mutual Benefit Company of New Jersey has outstanding risks, $22,559,177, and the Connecticut Mutual, $22,701,294.

The largest life company in the world is the Gotha, of Germany; it has 15,000 policy holders. The united German companies have insured for $35,000,000. The Equitable, of London, has the largest accumulated capital, having been in operation more than ninety years. It received, during a period of eighty-six years, premiums and dues to the amount of $95,338,180, which accumulated at compound interest to such an extent, that the company has been enabled to pay out $126,683,158 to families of deceased members and other policy holders; and for expenses, $2,091,180, retaining in hand an accumulated fund of $44,000,000 to meet running policies, and claims outstanding to the amount of $70,500,000. During one period of ten years, the Equitable paid out about $40,000,000. Its annual income is $2,850,000, and the number of policy holders about 5,200. The profits are divided among the oldest 5,000, in the order of their admission. The amount of life insurance effected in great Britain, is $750,-000,000.

The usual method adopted by the Life Insurance companies has been to base their estimates of the cost of insurance on the Carlisle tables, which are explained on a previous page, and taking their statement of the sum, which, placed at compound interest at four per cent., would, on the average of duration of human life, produce $1,000; add to that a "loading" of a per-centage sufficient to cover commissions, expenses of rent, salaries, &c., failures, depreciation of stocks, and the prevalence of any fatal epidemic. These several items are supposed to be fully covered by an addition of about thirty-one per cent. to the amount given by the Carlisle tables. Thus, by these tables, a healthy man of thirty years old could be insured safely at $17.50 per annum, that sum compounded at four per cent. producing $1,000 at the average duration of life. The additional "load" of thirty-one per cent. makes the amount $22.92; and, in order to be safe, the mutual companies charge from $23.02 to $23.60 per $1,000 for insurance to a man of thirty years.

But further and more careful observation has demonstrated that the Carlisle tables are inaccurate, the error being largely in favor of the companies; the average chances of life under forty-five years in selected lives being at the present day nearly forty per cent. better than those tables show. There is also no difficulty in this country in compounding the amount received for premiums at six per cent., and but little at seven per cent.; so that there is a gain of at least fifty per cent. from this source. Added to this, is the large per-centage of gain from the lapsing of policies. The Mutual Insurance companies might therefore make their terms considerably lower than they now are, and still, if they were managed judiciously, retain a sufficient reserve to reinsure all their patrons. But most of them pay very large commissions to their agents, the competition being very strong, and expend large sums in fitting up elegant offices, paying high salaries, &c. The joint-stock companies, which make dividends only to their stockholders, and none to the insured, insure at much lower rates, some of them even putting the rates of insurance to persons under forty-five years below those of the Carlisle tables. The following table shows the comparative rates of the two classes of companies:—

COMPARATIVE RATES OF DOMESTIC LIFE INSURANCE.

I.—PARTICIPATION, OR MUTUAL SCALE FOR INSURANCE OF ONE THOUSAND DOLLARS.

AGE.	Knickerbocker Mut. Life.	Manhattan.	New York Mutual.	Mutual Life of N. Y.	New England Mut., Boston	New York Life.	Connecticut Mutual.	Mutual Benefit, N.J.	Girard, Philadelphia	American Life & Trust, Philad'a.
20........	17.26	17.80	17.30	19.89	17.30	17.70	17.30	17.70	17.70	17.70
25........	19.85	20.40	19.89	19.89	19.80	20.40	20.40	20.40	20.40	20.40
30........	23.08	23.60	23.02	23.02	22.70	23.60	23.50	23.60	23.60	23.60
35........	26.82	27.30	26.87	26.87	26.50	27.50	27.50	27.50	27.50	27.50
40........	31.71	32.00	31.73	31.73	31.50	32.00	32.00	32.00	32.00	32.00
45........	37.76	37.40	38.04	38.04	38.00	37.30	38.00	37.30	37.30	37.30
50........	45.91	45.40	46.42	46.42	47.00	46.00	47.70	46.00	46.00	46.00
55........	57.75	57.80	57.58	57.58	59.40	57.80	59.40	57.80	57.80	57.80
60........	74.30	74.60	..	..	76.40	..	..	..	..	70.00

II.—NON-PARTICIPATION, OR JOINT-STOCK SCALE FOR INSURANCE OF ONE THOUSAND DOLLARS.

AGE.	Knickerbocker non-participation	Manhattan.	N. Y. Life.	N. Y. Life & Trust.	Ætna Life, Hartford.	American Life & Trust, Philad'a.	Baltimore Life.	Conn. General.	Universal Life, N. Y.	Travelers' Life & Accd't Hartford.
20........	15.54	16.00	14.14	16.50	14.80	14.70	16.50	13.70	..	12.16
25........	17 96	18.40	16.44	19.00	17.10	17.00	19.00	15.30	14.92	13.86
30........	20.77	21.30	19.20	21.90	19.90	19.60	21.90	17.42	17.02	16.06
35........	24.14	24.60	22.20	25.30	23.00	22.90	25.30	20.50	19.78	18.92
40........	28.54	28.80	26.28	29.70	27.30	26.70	29.60	23.98	23.47	22.75
45........	33.98	33.70	30.72	34.70	32.00	31.00	34.70	29.80	28.48	28.04
50........	41.32	40.90	37.68	42.10	39.10	38.40	42.10	37.51	35.38	35.18
55........	51.97	52.10	48.60	53.60	50.60	48.20	53.50	..	..	44.80
60........	66.87	67.20	..	67.50	66.20	58.40	66.80	..	..	57.74

Within the past four or five years most of the Life Insurance companies have granted what are termed *Ten years non-forfeitable policies*, in which the insurance premiums are paid in ten annual payments, and the policy is paid at death; and when, from any cause, the premiums are paid for only a portion of the time, the party, for whose benefit the insurance is effected, receives an amount proportioned to the number of payments which have been made. By this plan it is claimed that a man can effect an insurance for life, and bring the payments for it within the most active business portion of his life, when the premiums can be paid with least inconvenience to himself. The following table shows the rates of insurance on this plan of several Mutual and Joint-Stock companies.

TEN YEARS NON-FORFEITABLE PLAN FOR ONE THOUSAND DOLLARS INSURANCE.

	Mutual System.			Joint-Stock System.			
Age.	Mutual Life of N. Y.	Connecticut Mutual.	Mutual Benefit, N.J.	Ætna Life, of Hartford (without profits).	Connecticut General.	Universal Life, N. Y.	Travelers' of Hartf'd, Life Department.
20............	41.95	42.00	42.10	30.00	29.02	. .	26.14
30............	46 51	52.65	52.34	38.40	36.22	36.44	32.66
40	57.44	64.61	64.78	48.80	45.70	45.51	42.44
50............	72.31	82.35	79.72	62.00	61.73	59.19	57.90

Several new features have been adopted by the new companies organized during the past two or three years. One of these, adopted by the Universal Life Insurance Co., is the insurance of invalids, or persons of impaired health or constitution, on the payment of a larger premium than that of selected lives, the rate being fixed by the report of the medical examiner. Another, is the reduction of the rate in first-class cases to that of an age two, three, or five years younger, and the advance in doubtful cases to a corresponding degree, above the normal rate for their age.

Accident insurance, though no novelty in England—companies having been organized there in 1848 and 1849—had never been attempted here till 1864, when the Travelers' Insurance Company of Hartford was chartered by the Legislature of Conn. It had a capital of $500,000, and its surplus in October, 1866, was $242,000. At first it confined itself to insuring against death or disability from accidents, paying a weekly compensation to those totally disabled, or a sum agreed to the heirs, in case of the death from accident of the insured party, or both, where the policy was issued with that provision.

At the end of two years, it organized a department of general life insurance, on the joint-stock plan, and put its rates of premium lower than the other companies; which it was able to do by having lighter expenses, its accident business defraying the larger share of expenses, and by paying smaller commissions; while it scrutinized very carefully the chances of life of all applicants, and rejected many whom other companies received. It combined with this, when desired, at a small additional premium, weekly compensation for total disability caused by accident.

Other Accident Insurance companies have since been formed, one of them on the mutual plan; but none of the others have combined a general life policy with accident insurance. The Accident Insurance companies sell tickets of insurance from the danger of railroad and steamboat travel, viz., from accident or injury from the destruction or partial injury of the vehicle in which the passenger is travelling, at a given rate per day. The ordinary accident policy pays a weekly compensation for all injuries from any accident producing a temporary total disability, however it may have occurred, or a fixed sum on death induced by accident, or both, as may be provided in the policy, according to the premium paid.

The application of the insurance principle to other objects has recently been attempted. Thus we have one or more Live-Stock Insurance companies, protecting the owners of live-stock against losses by debt or theft, based on the experience of English companies, where this description of insurance has been conducted for fifty years; a company to insure the owners of steam boilers against their explosion; and a Fidelity Insurance company, to furnish bonds for men who are appointed to positions of trust and responsibility.

IMMIGRATION.

CHAPTER I.

GENERAL MIGRATION—COLONIES AND UNITED STATES.

At the date of the last national census, in 1850, more than one-tenth part of all the inhabitants of the United States were foreign born, that is, one soul in every ten had been born in a foreign land. Since that census, viz.: from 1850 to the close of 1859, two million five hundred and fifty thousand more aliens have arrived in this country, which, added to the number then reported as foreign born, would make very nearly one foreigner out of four citizens at the date of 1859. The natives have, however, since progressed in numbers, as have also the emigrants, and the progeny of these latter will class as "natives" in the forthcoming census.

The term "native" has been used to distinguish the born citizen from the newly arrived foreigner, as well as the former from the "red man," who was also an emigrant in the view of the lost races that preceded him, and of which monumental traces alone remain in evidence that they ever existed. The history of the human race, adopting the Mosaic account, is a history of migration. Twice has the race comprised only a single family, occupying a single point on the earth's surface, and twice has it spread in all directions, forming nations and founding empires. The antediluvian world was swept away by the deluge, and all traces of the race of Adam had been washed away by the obliterating waters from the earth's surface when the ark gave up its freight. From its door migration was resumed, and three continents owe their populations to the several sons of the patriarch. Asia, Africa, and Europe were settled by Shem, Ham, and Japhet and their descendants, who have stamped their characteristics upon each. From that day to the present the same recurring circumstances have from time to time produced the same results. As each locality became overcrowded by increase, the most adventurous sallied forth in quest of new homes, which, in their turn, filled, and overflowed into some more distant region. These successive waves rolling on until the remotest shores of each continent were occupied, were succeeded by more formidable hosts of armed invaders, who came, sword in hand, to dispossess occupiers and seize accumulated wealth. Successive empires have gone down before these barbarian hordes, and modern Europe has but lately recovered from the shock that attended the fall of the Roman empire amid a deluge of barbarians. With the growth of modern civilization migration has no longer a destructive character. It seeks to build up by bringing industry in aid of natural resources, rather than to destroy by seizing what others have produced. It is more steady, penetrating, and effective in its commercial character—having industry for a means and prosperity for an object—than in its old turbulent military form, plundering by force and leaving desolation in its train.

The British Islands were the last subjects of European incursions. The Britons, of mythic origin, were plundered by Norse enterprise, and the Saxons alternated with the Danes in dominating the nation on the withdrawal of the Romans, to be in their turn subjected to the Normans. Since then 800 years have been spent in amalgamating the races and in peopling the islands. Even at that date the adventurous Norsemen, in search of the whale, had discovered the new continent and formed a colony on what is now known as Newfoundland. It required long centuries, however, in that barbarous age, for the people to struggle successfully against the effects of feudal oppression, civil wars, and their consequences, famine and plague. Nevertheless, progress was made and commerce a good deal developed, when, at the close of the fifteenth century, the discovery of the West Indies by Columbus was followed by an influx of the precious metals into Europe, giving a renewed impetus to industry and enterprise. The Spanish were attracted by gold, and the commercial Dutch by the desire to found colonies, and their example was followed by the English and French. In both these cases, however, the desire of civil and religious freedom was a powerful incentive to the emigrants. These motives were more strongly developed when the English revolution began to operate in the first half of the 17th century. The new world was then looked upon as the place of refuge, and Cromwell himself, with his companions, were only prevented from migrating by the interposition of that government that they afterward overthrew. Of the four leading nations that planted colonies on this continent, the English alone became permanently successful. The Spaniards sought gold only. The French settlement of the Mississippi was more a financial bubble of Law than a movement of settlers. The Dutch had not sufficient breadth at home to sustain the undertaking; and the English necessarily absorbed the whole, with their steady industry and abiding religious faith. The numbers of the colonists were continually reinforced by new settlers, and a trade soon sprang up which gave prosperity and wealth to the provinces.

The disposition to emigrate to America gradually gained ground as the eighteenth century advanced, more particularly in Ireland and the north of Scotland, which already enjoyed the advantage of some intercourse with friends in America, and whose descriptions of it formed a strong contrast to the distress at home. Just before the Revolutionary war, this disposition to emigrate showed itself strongly. The linen weavers in the northern part of Ireland were, by the decline in that trade, induced to migrate. For the two years, 1771 and 1772, sixty-two vessels, of seventeen thousand three hundred and fifty tons, left with eighteen thousand passengers for America, paying passages seventeen dollars each. Most of these were linen weavers and farmers, possessed of property, and they carried with them so much money as to attract the notice of the government. The movement, however, continued in 1773 and extended itself to the north of Scotland, whence the highlanders migrated in great numbers. There were then no means of ascertaining the actual numbers, nor were there, as since, in existence any of those admirable arrangements by the government or private companies for the comfort and aid of emigrants. Knox, in his view of the British empire at that time, asserts that in the twelve years ending in 1775, above thirty thousand highlanders emigrated, exclusive of the lowlanders; and it was computed that there were sixty thousand highlanders citizens of the United States in 1799. In the report of the committee on the linen manufactures in the Irish Parliament in 1774, it is stated that the whole emigration from the province of Ulster was estimated at thirty thousand people, of whom ten thousand were weavers, who, with their tools and money, departed for America ; thus adding to the numbers and wealth in the new world, in the proportion that the British Islands lost from the same cause.

The breaking out of the War of Independence, naturally interrupted the communication between America and the old world; but with the return of peace, in 1783, the migration revived, notwithstanding the incredible hardships which at that time attended the transit. The shipping was little adapted to the trade, and no special laws protected the rights of the poor emigrant. As an instance of this, it is related that in September, 1784, a ship left Greenock with a large number of passengers, who had paid twenty-five dollars each for their passage. They were robbed of their chests and provisions by the master, and one hundred of them turned ashore on the Island of Rathlin, coast of Ireland. Another vessel rescued seventy-six emigrants from a desert island, where they had been turned adrift by the master of a brig, who had engaged to carry them from Dunleary, in Ireland, to Charlestown. In the same year there were great numbers landed at Baltimore, Philadelphia, and elsewhere. The movement continued with more or less vigor to the close of the century. Blodget's Statistical Manual, published in 1806, states that from 1784 to 1794, the arrivals were four thousand per annum. In the year 1794, ten thousand persons were estimated to have arrived in the United States. Adam Seybert, a member of the House of Representatives, in his "Statistical Annals," admitting the number for that year, states that so large a movement did not again occur until 1817.

When the colonies separated from the mother country, the population of the latter was, for England and Wales, 7,225,000, and about 2,000,000 for Ireland, making together 9,225,000 souls, or about one-third the number of whites now in the United States. The population of the newly formed United States in the year 1790 was 3,174,-167 whites, or about one-third the numbers in England and Wales. The founders of the nation were then not unmindful of the fact that these three millions of people, occupying 163,746,686 acres of land although possessed of a vast territory, had little else to depend upon. Capital was scarce, and manufactures had not been permitted under imperial rule, hence skilled artisans were not to be found. While all these things were indispensable to the new country, crowds of poorly paid and oppressed operatives on the other side of the Atlantic were impatient to enjoy the privileges that our new form of government held out to them. The French, German, and English troops, that returned home after the war, had not only left a portion of their numbers here as settlers, but had carried home favorable reports of the advantages to be here enjoyed. It was manifestly to the interest of the new government here to invite and encourage these settlers, at the same time to guard against possible political abuse of the privilege. The new Constitution therefore required Congress to pass uniform laws for naturalization. This was not done until April 14th, 1802, when the regulations that have since mainly continued were enacted. By that law, those aliens who were in the country prior to 1795 might be admitted to citizenship on proof of two years' continuous residence in the United States, sustaining a good moral character, and abjuring allegiance to foreign nations. Any alien arriving in the United States after the passage of the act was to comply with the following conditions:—

1. He shall, before some competent court, swear, at least three years before his admission, that it is his *bona fide* intention to renounce forever all allegiance to any sovereign state to which he was a subject.

2. He shall swear to support the Constitution of the United States.

3. Before he can be admitted he must show that he has resided within the United States five years, and within the jurisdiction of the court one year. He must also show that he has been of good moral character, and well disposed to the happiness of the United States.

4. He must renounce all titles of nobility. The law of March 3, 1813, required that the residence of five years should have been continuous in the United States. This restriction was repealed Jan. 26, 1848. The law of May 26, 1824, reduced the term of notice of intentions from three to two years. These were the chief regulations of the federal government in relation to naturalization. Many of the states have, however, from time to time, passed laws relative to immigrants, importation of paupers, convicts, lunatics, etc. New-York and many other states have laws requiring of the owner, or master, or consignee of the passenger ship, a well secured bond to the people of the state against loss for the relief or support of such passengers. In lieu of this bond, commutation money may be paid.

The federal government having smoothed the way, the migration proceeded until unfriendly relations between the United States and Great Britain, growing out of the wars of Europe, checked intercourse. The claim enforced by Great Britain to the principle, "Once a subject always a subject," served to take from emigrants the security they sought under the American flag; and in 1806 Great Britain declared France in a state of blockade, and France retorted upon the British Isles. These proceedings being succeeded by others, compelled the United States, in 1809, to prohibit intercourse with France and Great Britain. In 1810 Napoleon annulled his decree, but Great Britain continued her vexations, seizing American seamen, and riding rough-shod over their rights. The embargo was then succeeded by the war of 1812, during which migration was very limited. In February, 1815, peace was concluded, and the stream of migration, long pent up, resumed its flow with greater force. The accommodation was, of course, limited, and the more restrained that a law of Parliament restricted the number that might be carried to the United States to one for every five tons, although one for every two tons might be carried to any other country. In the year 1817, 22,240 persons arrived in the United States, including Americans who returned home. This large migration, at a time when the business was not systematized, and when shipping was not built with a view to its accommodation, was attended with immense suffering. The attention of Congress was called to it, and a law was passed, March 2, 1819, to regulate the transportation of passengers. That act limited the number to two for every five tons of measurement, and provided for an ample allowance of food and fuel. When the famine of 1846–7 gave a new impulse to the movement, more complete laws were found requisite, and a number were passed: that of Feb. 22, 1847; March 2, 1847; May 17, 1848; March 3, 1849; and finally, March 3, 1857, the present passenger act was enacted, repealing all former laws upon the subject, and establishing the regulations now in force. This regulates the space for each passenger, the number and construction of the berths, requires a house upon deck, the ventilation of the ship, regulates the number and size of cooking-stoves, obliges the ship to furnish each passenger with food, viz.: twenty pounds bread, fifteen pounds rice, fifteen pounds oatmeal, fifteen pounds peas and beans, twenty pounds potatoes, one pint vinegar, sixty gallons water, ten pounds salt pork, ten pounds beef free of bones; this food is to be dealt out one-tenth part weekly, and if any passenger is put on short allowance, the master or owner shall pay him three dollars each day of short allowance; enforces perfect cleanliness. There are also a number of other rules in relation to the mode of carrying out and enforcing these requisitions. The laws and regulations in the United States have come in aid of the efforts of foreign governments in ameliorating the difficulties of the emigrant; and these laws have, no doubt, tended to swell the numbers of the passengers.

The first authentic accounts of the numbers of immigrants, therefore, commenced in 1820, under the law of 1819. These accounts have been continued down to the present moment with great regularity, and the aggregate results are seen in the following table, showing the birth-places of the emigrants that have arrived in forty years:—

NUMBER OF ALIENS ARRIVED IN THE UNITED STATES.

From	1820 to 1835.	1836 to 1845.	1846 to 1850.
England	21,595	10,327	23,608
Ireland	50,304	29,430	138,892
Scotland	5,658	680	3,221
Wales	347	115	1,154
United Kingdom	108,362	405,481	613,597
Great Britain	186,266	446,033	780,472
France	26,638	51,488	53,588
Spain	3,565	2,232	1,153
Portugal	891	202	466
Belgium	33	1,008	4,083
Prussia	433	13,321	2,771
Germany	52,868	197,729	326,667
Holland	1,757	2,631	6,402
Denmark	467	959	365
Sweden & Norway	509	5,521	9,168
Poland	164	310	21
Russia	325	263	329
Turkey	23	31	33
Switzerland	6,020	5,155	1,597
Greece	29	50	6
Italy, Malta, &c.	2,339	1,136	1,200
Europe	2	48	3
British America	6,677	20,735	30,421
South America	1,004	918	3,055
Central America	147	38	334
Mexico	9,033	4,232	1,423
West Indies	9,528	12,115	8,184
Asia	46	50	49
Africa and Australia	546	174	329
All other	87,707	10,388	50,796
Total	397,017	776,767	1,282,915

From	1851 to 1855.	1856 to 1859.	Total 40 years.
England	151,592	82,172	289,294
Ireland	529,304	170,799	918,729
Scotland	25,000	11,718	46,277
Wales	3,916	2,544	8,076
United Kingdom	221,242	61,823	1,410,505
Great Britain	931,054	329,056	2,672,881
France	57,020	15,377	204,511
Spain	4,301	4,065	15,316
Portugal	490	443	2,492
Belgium	1,867	2,818	9,809
Prussia	19,450	20,692	56,667
Germany	627,823	229,211	1,434,298
Holland	6,793	3,645	21,228
Denmark	1,268	1,939	4,998
Sweden & Norway	14,253	7,390	36,841
Poland	823	259	1,577
Russia	21	371	1,309
Turkey	36	43	166
Switzerland	13,349	5,749	31,870
Greece	23	7	115
Italy, Malta, &c.	3,670	3,249	11,594
Europe	473	10	536
British America	33,866	20,929	112,628
South America	463	553	5,993
Central America	121	320	960
Mexico	1,281	1,568	17,537
West Indies	5,490	3,786	39,103
Asia	16,693	19,296	36,134
Africa and Australia	1,074	1,843	3,966
All other	19,772	23,531	192,194
Total	1,761,474	696,150	4,914,723

The returns gave the number from Great Britain in many cases without distinguishing the particular divisions where all the passengers were born. A very large portion of the whole, however, came from Ireland. The return shows, then, that Ireland and Germany furnish the largest proportion of the emigrants. Other nations have supplied a greater or less number, but irregularly. Since 1850, or the era of gold discovery, Asia—that is to say China—has sent a considerable number to California. Those do not, however, as a general thing, intend remaining. They are for the most part fitted out with small sums borrowed of friends and neighbors, who share in the profits of the adventurer on his return. Numbers of those who come from other countries, as France, West Indies, and Southern Europe, as well as to some extent from England, are merchants and travellers, who are not to be embraced in the aggregate of settlers in new homes. The great sources of migration are, then, British and German, and the latter are confined mostly to the valley of the Rhine. The people of the north of Europe do not migrate much. They seem to have lost the nomadic character of their ancestors. It is true that then they were led by chiefs and tempted by plunder to overrun the richer countries of the west, while at the present day migration has no object but to seek an honest living in countries where labor is in demand, and where hospitality and protection await the worker. The Russian, unless in charge of his master, cannot quit his native soil, of which he is, as it were, a portion. Whoever should penetrate into Russia for the purpose of recruiting emigrants, would be treated as a robber of property, and the Russians in the table are mostly merchants and travellers. The Swede and the Norwegian are more free in their choice, but the greater freedom they enjoy is an inducement to remain at home; nevertheless, they figure as high in the tables as the Swiss. These latter are to a considerable extent free and thrifty in their mountain homes, but great divisions exist in respect of religion as well as politics, and there is among them a want of nationality. The cantons of Vaud and Geneva are mostly French, and threaten to become quite so. On the side of the Tyrol the Swiss become Italians. The German Swiss are mostly connected with Baden, and are embraced in the German movement. Although the Swiss is attached to his country, he is enterprising, and is to be found in almost all countries. Every important city has Swiss firms among its most considerable merchants, and one of the early secretaries of the United States treasury, A. Gallatin, was a Swiss. The Hollanders migrate to some extent, and often from motives of religion. The Moravian Brethren thus founded colonies in Pennsylvania. Gold seems, since its discovery in California, to have stimulated Dutch enterprise. The Italians and Spanish do not migrate in the true sense of the word; they leave their homes to some extent for the countries that border the Mediterranean, but they do not, unless under the ban of exile, cross the Atlantic. The Sardinians and Basque Spaniards go to some extent to the La Plata in South America; they do not frankly abandon their country to adopt a new one. The French are more markedly attached to their native soil and national character, and colonise little; they migrate hardly at all. Even Algiers has grown but very slowly under thirty years of governmental fostering care, and there are now but 60,000 French in that colony. Of those French who arrived in the United States up to 1850, but 14 per cent. remained in the country according to the census.

The great continental movement is, then, on the part of the Germans, and of these the valley of the Rhine is the chief source.

CHAPTER II.

EUROPEAN MIGRATION—FRENCH AND GERMAN—NEW TRADE.

The peace of 1815, in re-establishing the liberty of the seas, so long suppressed, opened new countries to European commerce. On the other hand, many interests underwent adverse changes; numerous armies were newly disbanded, and great numbers of men were forced to leave home in search of a useful application of their talents and energies. America was to them the chief point of attraction; those who knew only the trade of arms, offered their swords to the Spanish colonies then fighting for emancipation. Of these a majority found early graves from excess, fatigue, and misery; many turned their attention to agriculture, and the wisest sought refuge in the United States, where services were well requited, and the broad territories offered a limitless field for activity. At first the emigrants were isolated individuals; soon entire families went in quest of new homes, and their success was a tempting example to other families, each of whom drew others in their train, until a regular and continuous movement was established from the valley of the Rhine to America.

This developed a new era in the international commerce. The cotton of the southern states had up to that time found a limited market in Havre, but being carried thither in American ships, there being little return freight for those vessels, the cotton was charged with freight both ways, out and home. The moment that considerable numbers of passengers offered themselves for the return, that trade of itself became an object, affording a profitable home freight. It was then apparent that the light and elegant models of the American ships, which had so well answered the purpose of speed and efficiency during the war, were not adapted to the transportation of passengers. A different style of construction was needed, allowing of greater stowage of cotton out, and better accommodation to passengers, in accordance with the provisions of the law prescribing the room to be allowed to each passenger. This change causing greater attractions to the American ships, drew increasing crowds from the valley of the Rhine across France to Havre. Many of these poor people could raise only the sum needful for the passage, and depended upon begging their way across France to the port. These crowds of beggars alarmed the government, and it took measures to stop them. It was ordered that no one should be admitted to cross France unless he had previously paid his passage in the ship, was possessed of $150 for every member of the family over eighteen years of age, and had his passport signed by the French embassador at Frankfort. The effect of these absurd regulations was to destroy the trade of Havre, and turn the migration down the Rhine to Antwerp, Bremen, and Hamburg. The Havre merchants made great efforts to remedy the evil by sending agents to aid the emigrants, lending them the money to pass the frontier, and to be returned immediately after. A great rivalry was thus engendered between the northern ports and Havre, which still had great advantages in respect of the number of American vessels that arrived with cotton, and finally the obstacles interposed by the government were removed. The city of Bremen was prompt to take advanvantage of the error of the French government, and used every effort to attract the emigrants to that port, by granting facilities and protecting them from imposition. A law was passed regulating in the most minute particular the accommodations to be given to emigrants on shipboard. They are not to be taken on board until the moment of departure. To accommodate them prior to shipment, an immense building was constructed to hold 2,000 people; it has a front of 200 feet, and is 100 in depth. It has public rooms, sleeping apartments, kitchens, baggage-rooms, etc., and is warmed by steam throughout. There are also chapels for catholic and protestant worship, and a hospital, with thirty-three beds. The price charged with board is fourteen cents per day. By these and other means Bremen has acquired a large share of the emigrant business. Hamburg did not make the same efforts; and it is only recently that societies for the protection of emigrants have been there formed.

One-third only of the Germans leave German ports. The expense of reaching there is about the same as to go to Havre. They, indeed, find in the language greater facilities, but the voyage thence is longer and the vessels are mostly German, whereas at Havre they find Americans, where the accommodations are better, and once on board of them, they feel as if they had already reached the country of their adoption. The passage across France is also greatly facilitated by the freight agents. The Bremen vessels have not the same facilities for return freight as the Americans at Havre. The Germans go nearly all to the United States, that is from Havre to New York or to New Orleans. There are numbers who go from Rotterdam, Ostend, or Hamburg, to England, and depart thence to their final destination. From Bremen the destinations are more numerous than from Havre. The United States is, however, the ultimate destination of nearly all.

The motives that impel German migration are variously understood. The reports of the numerous emigration societies give evidence of the highest traits of character. The German is described as a persevering worker, seeking to ameliorate his condition. He is always ready to go where his services will be the best paid, and certain professions have long been pursued by him in all countries. If his feeling of nativity is strong, his love of family is still stronger. And, moreover, the Teutonic race may now be said to be at home on half the entire globe. There are, however, other motives, and these are evidently the desire to find civil, political, and religious liberty, of which they have not the perfect enjoyment at home. The Germans have never succeeded in founding colonies of their own under good government, but they are a valuable acquisition where others have established liberty and order. They seek exemption from military service. They wish to contribute in just proportion to the public expenses, of which they enjoy the benefits, as equal citizens. They seek to escape the trammels of corporations. They wish also freely to dispose of the fruits of their own industry, and by so doing to avoid the misery of destitution. All this that they seek is evidently that which they have not got, or at least very imperfectly, at home.

The emigrants belong to many different states, and the same reproaches do not attach to all governments, neither in the same proportion to all. The very divisions of Germany are an injury to industry. They cause the proportion of the general expenses to be heavier for each individual, and destroy the spirit of nationality. The idea of "German unity" cannot be strongly impressed on the minds of people who leave the soil annually by tens of thousands.

The German governments have all, more or less, occupied themselves with the question of migration, and in some cases have sought to check it. Among these attempts was that by Prussia to found agricultural colonies. The king offered lands in the duchy of Posen, and agents were sent among the emigrants from the valley of the Rhine. The conditions were, that the settlers should not leave the country without permission, and never without having performed military service.

These, it may be supposed, were without success. Emigrant agents are, by some governments, required to submit to regulations; sometimes the number is limited, and sometimes they must give security. In Bavaria only two houses are authorized to treat with emigrants for their passages across France, and the contracts must be inspected by the consul at Havre. There results a large clandestine emigration to avoid these restrictions, and at the frontiers numerous agents are ready to assist—a sort of underground railroad. The governments of Wurtemberg, Baden, and the two Hesses, are less rigorous, but nowhere can passports be obtained until every effort has been made to dissuade the emigrant. In case he persists, he must renounce all rights of citizenship and nationality. On the other hand, measures are taken to aid the emigrant. When the cause of departure is destitution, the communes and the government subscribe, while stipulating that the emigrant shall renounce all right to ulterior aid. All the persons so aided go from one canton together. When the emigrants pay their own expenses and have a small capital, bands of numerous families from divers points assemble and depart together. Political exiles are very few, but these have generally considerable means.

It is melancholy, however, to reflect in how great a degree destitution becomes the cause of migration. Singularly enough, the valley of the Rhine, of which the German poets sing the beauty and the fertility, is precisely the spot, of all Europe, where the misery of Ireland is most nearly reproduced. From the Lake of Constance to the frontiers of Holland, that famous valley has so long felt the oppression of feudalism and been the battle-field of contending powers, as to have become completely impoverished. In the duchy of Baden the day's wages of a skilled workman is twenty-eight cents—a sum which may sustain life in a year of good harvest, but which is utterly insufficient in time of dearth, as in 1846, when potatoes became diseased. The insurrection of 1849 added to the calamities, and in 1852, of a population of 1,356,943 souls, 14,400 emigrated, or one per cent in one year. The thrift and endurance of the Germans are well developed in a land of such hardships, and on their arrival in the United States they are not slow in turning their persevering industry to account. It is singular that the distress and destitution which centuries of misrule have produced in Ireland, so famed for its natural advantages, should be reproduced in Europe only in the Rhine valley, the garden of Europe. The two localities best endowed by nature are precisely those where man is most anxious to escape by migration from an accumulation of miseries. The highest migration from Germany, by the four ports of Hamburg, Havre, Antwerp, and Bremen, rose to 203,537 in 1854. The movement has since declined, fluctuating with the harvests. There are, however, considerable numbers who go, by other conveyance from those ports than the emigrant ships, to Liverpool, and embark thence for America. This aggregate German movement has come of late years to rival, and in some cases to exceed the broad stream of British migration. The migration from Great Britain has always been largest in the years of dear food, and it has again subsided when good harvests have diminished the prices of bread. The number that went abroad in 1843 was 57,212, and it continued to augment year by year until it reached 368,764 in the year 1852. Several causes concurred to produce this increase. The first was the famine of 1845–46–47, and the consequent means adopted by the British government for the relief of Ireland; the second was the gold fever, which carried off thousands; and the third was the prosperity of the emigrants in the United States, where railroad building and other employments gave the means to send for friends in unusual numbers. The most important cause was, probably, the condition of Ireland. The conquest of that country, which was commenced seven centuries since, is but now being completed. We now see the insubmissive Celts quitting, with the aid of their conquerors, the disputed country, to seek new homes beyond the seas. They cannot assimilate to the conquering race, and not being able to defend themselves, they abandon the country rather than submit. During all the time of religious persecution, from the reign of Henry VIII. to George III., the economical condition of Ireland was deplorable, and misery made incessant progress. The landed population became involved in debt, and a fatal subdivision of the land was introduced in the mode of culture. Farms were subdivided as fast as the people multiplied, which was fully equal to the proverbial fecundity of a state of extreme poverty, and the potato came to be the sole dependence of all for food. The sudden destruction of that dependence by rot was an overwhelming calamity, that brought matters to a crisis. It was felt that migration could not remedy the evil, but that a radical change in a wrong system was become indispensable. The system pursued had been for the landlords, mostly in debt, to absent themselves altogether. The land was then taken by "middle men," at a rate which hardly met the interest on incumbrances. This land was then parcelled out to the poor cotters in lots down to one-fourth acre or less, mere patches, at rates which gave a large aggregate rent to the "middle man." Those patches were planted with potatoes, which were the sole dependence of the family for food in the year. They were gathered, when ripe, into a pile, and that pile diminished by daily consumption until an approaching new crop found it exhausted. The supply of food for the year depended entirely upon the amount of the crop. Its yield was the sole dependence of the family to sustain life. The cotter had no property or capital of any kind to be made available in case of emergency. His only means of paying rent was an annual migration to England in harvest time to earn the necessary sum. That done, the balance of the year was idly spent in watching the sinking pile of potatoes. It may well be imagined how great was the horror that seized such a people when the sole barrier between themselves and starvation was found rotten, suddenly perishing under their eyes. The scenes that followed were awful to contemplate. All that could, fled, and these were mostly the robust males, leaving the infirm, the old, and the young to encounter the slow death that was gradually approaching, and which overtook multitudes. The greatest efforts were made by the British government to purchase and distribute food, and to employ hands upon roads. At one time over 500,000 were so employed. The introduction of the Indian corn was attempted as a substitute; but it was nearly impossible amid a people entirely ignorant of its use. Hand-mills were furnished to grind it, and the priests and others used great exertions to teach them to cook it. It was frequently the case, however, that the grain did not agree with the people, but exhibited poisonous effects on being eaten. The body swelled, and severe illness ensued. Migration and famine did its work in spite of all efforts of humanity, and the census of 1851 showed how awful had been the havoc.

The population of Ireland has been as follows, per official reports:—

1821,	6,801,827	1851,	6,553,291
1831,	7,767,401	1859,	5,988,820
1841,	8,175,124		
	Decrease from 1841....		2,186,304

In the ten years ending with 1831, the increase was one and a half per cent. per annum. From that date to 1841 it was nine-tenths of one per cent, and that was a period of much comparative prosperity. The crops were still good, and the failure of the English wheat crops in 1837 raised the prices of Irish grain, and gave much employment to its agriculturists. If it had continued the same rate up to 1847, the famine year, the population would then have been 8,616,680 souls, when the migration took place in large numbers, and continued the succeeding thirteen years down to 1859. The same increase in that thirteen years would have made the population 9,651,678 persons, or as follows:—

Population in 1841	8,175,124
Ten years' increase at 9 per cent	735,761
The population should have been in 1851	8,910,885
Actual population	6,553,291
Loss by famine and migration	2,357,594
Number emigrated	1,422,000
Population in 1851	6,553,291
Ten years' increase at 9 per cent.	595,500
The population should have been in 1859	7,148,791
Actual population	5,988,820
Loss by migration, etc.	1,159,971
Number emigrated	1,742,260

In the famine years, up to 1851, 935,594 persons disappeared more than were accounted for by migration. From 1851 to 1859, there migrated 582,289 more persons than should have been lost by the census. This shows that there were numbers returned, and that the natural increase was large. The numbers who have returned have been, it is known, upwards of twenty thousand per annum, and these have carried back much larger sums than they brought with them. In this view the emigration reacts upon the northern states, the emigrants carrying off all that they have created. The whole operation above was as follows for thirteen years:—

Population in 1847	8,616,680
" 1859	5,988,820
Decrease	2,627,860
Emigrated	3,163,260
Excess	535,400

If this was all natural increase it would be in the ratio of one-half per cent. per annum. This year the failure of crops in Ireland has given a renewed impetus to the movement, and migration promises to be larger this year than for several previous ones.

The first reformatory efforts of the English government were to throw the support of the Irish poor upon the parishes, and as the tax became onerous the forced sale of the encumbered estates was authorized. The two measures have succeeded. The land has passed into thrifty hands; the bankrupt landlord is dispossessed, and the extortionate "middle man" is abolished; and the excessively poor population has been purged off by migration. The "clearing of the lands" was in many cases conducted with much barbarity. The little huts of the peasants were pulled or burned down, and the hapless people driven forth to seek homes beyond the seas as they best could. In other cases the landlords, the government, or societies furnished the means of shipments. The government soon found the necessity of interposing by law, as the United States had done, to protect them from the rapacity of shippers and their agents. The law of 1849 was passed with that object. By its provisions no ship shall carry more than one person for every two registered tons; nor shall there be more than one person for every twelve superficial feet on the main deck and below it. The size, number, and construction of the berths are regulated, and the captain is required to issue food as follows to each person twice a week:—

Bread	2½ lbs.
Wheat Flour	1 "
Oatmeal	5 "
Rice	2 "
Tea	2 oz.
Sugar	½ lb.
Molasses	½ "

A surgeon must be carried where there are one hundred or more passengers, and many other regulations that experience has pointed out as necessary, are enforced upon the carriers. The food is to be furnished entirely irrespective of the price of the passage, which fluctuates almost daily between $16 and $24 each adult, and half price for children. The starving and destitute race each year sends forth crowds from all parts of Ireland to embark at Liverpool. The means are mostly furnished by Irish in America, who consider it their duty to appropriate their first earnings in their new homes to the rescue of their relatives, and small remittances, aggregating millions in a year, find the way into every cabin and workhouse as messengers of life to the despairing. Those poor people, once started on their travels, encounter numerous perils before reaching their destination. As soon as a party of emigrants arrives in Liverpool, they are beset by a tribe of people, both male and female, who are known by the name of "man-catchers" and "runners." The business of these people is, in common parlance, to "fleece" the emigrant, and to draw from his pocket, by fair means or by foul, as much of his cash as he can be persuaded, inveigled, or bullied into parting with. The first division of the man-catching fraternity are those who trade in commissions on the passage money, and call themselves the "runners" or agents of the passenger brokers. The business of the passenger broker is a legitimate and necessary one. Under the passenger act of the 12th and 13th Victoria cap. 3, the licenses of all the passenger brokers expired on the 1st of February, 1850, subject to renewal after their being approved of by the government emigration agent, and to their entering into bonds, with two sureties, in the sum of $1,000, for the due fulfilment of all the requirements of the act of Parliament relating to the comfort and security of emigrants. The passenger brokers at Liverpool, in common with the unwary and unsuspecting emigrants, have suffered greatly from the malpractices of the "runners," who pretend to be their agents. These man-catchers procure whatever sums they can from emigrants as passage money—perhaps $25 or $30, or even more—and pay as little as they can to the passenger broker, whose business they thus assume—often as little as £3, or £3 5s. In addition to these large and knavish profits, they demand a commission of seven and a half per cent. from the passenger broker, and they have been often known to obtain and enforce this commission, although their whole concern in the matter may have been to watch the number of emigrants going into or coming out of the brokery office, and to put in a claim for having brought or "caught" them.

To form an idea of the sums paid in any one year as commission to the man-catchers, in the item of passage money, we have but to take the total steerage emigration of that year and multiply it by £3 10s., or seventeen dollars—the average amount of passage money—and calculate what a per-centage of seven and a half per cent. would amount to. The total steerage emigration of 1859 was one hundred and forty-six thousand one hundred and sixty-two souls, which, at seventeen dollars a head, would amount to no less than two million four hundred and eighty-four thousand seven hundred and fifty-four dollars, on which, taking the commission at the low rate of six per cent., they draw one hundred and forty-nine thousand and forty dollars, which is generally stated to be about the sum actually paid to this particular class of people, on the average of the last three years, by the passenger-brokers of Liverpool. But these are not the only class of the man-catching fraternity, nor do they confine their operations to an exorbitant profit upon passage money. The man-catchers keep lodging-houses for emigrants—wretched cellars and rooms, destitute of comfort and convenience, in which they cram them as thickly as the place can hold. The extra profits they draw from this source cannot be inferior in amount to their previously mentioned gains, and the cherished hoards of the poor pay a large per-centage to their unscrupulous rapacity.

In addition to this trade, some of them deal in the various articles composing the outfit of emigrants, such as bedding, clothes, food, cooking utensils, and the nick-nacks of all kinds which they can persuade them to purchase. Some of the store-keepers in this line of business pay their "runners" or "man-catchers" as much as ten per cent. commission on the purchases effected by the emigrants, from which the reader may form some estimate of the enormous plunder that must be drained from the poor ignorant people. As every emigrant must provide his own bedding, the sale of mattresses, blankets, and counterpanes, enters largely into this trade. After the bedding is provided, the man-catchers, who are principally Irishmen themselves, and know both the strength and weakness of the Irish character, fasten upon their countrymen—many of whom, poor and miserable as they look, have sovereigns securely stitched amid the patches of their tattered garments—and persuade them into the purchase of various articles, both useful and useless. Among these may be mentioned clothes of all kinds—shirts, trowsers, waistcoats, shawls, petticoats, south-westers, caps, boots and shoes, slippers, cooking utensils, cans for the daily allowance of water, and tins to hold their meal, rice, and sugar. Provisions, such as bacon, herrings, salt beef, and other articles not found them on board, and luxuries, in which whiskey and tobacco are generally included, come next on the list, after reiterated assurances from the man-catchers that no emigrant will be taken on board without them. These being provided, and an Irishman being easily squeezeable when a friend and a countryman is the man-catcher who has him in hand, and when he fears that his passage-money will be lost for non-compliance with the regulations, his attention is next directed to such articles as pocket-mirrors, razors, bowie-knives, pistols, telescopes, etc.

The stranger in Liverpool, who takes a walk in the immediate vicinity of the Waterloo Dock, whence the greater number of emigrant vessels take their departure, will see a profuse display of the various articles upon which the man-catcher makes his gains—articles generally of the most inferior quality, and sold at the most extravagant and ridiculous prices. The man-catching business, in all its various departments, has been reduced to a regular system, and no London sharper can be more sharp than the Liverpool runners. Perhaps the most complicated and ingenious trick is the following: When a steam-vessel laden with emigrants leaves an Irish port for Liverpool, one of the Liverpool fraternity, dressed up as a raw Irishman, with the usual long-tailed, ragged, and patched gray frieze coat, the battered and napless hat, the dirty unbuttoned knee-breeches, the black stockings, the shillelah, and the short pipe, takes his place among them, and pretends to be an emigrant. Before the vessel arrives at Liverpool he manages to make acquaintance with the greater portion of them, learns the parish they came from and the names of the relatives whom they have left behind, not forgetting those of the parish priest and the principal people of the neighborhood. He also ascertains the names of the friends in America whom they are going to join. He tells them of the roguery of Liverpool, and warns them against thieves and man-catchers, bidding them take especial care of their money. On arriving at the quay, in Liverpool, he jumps ashore among the first, where a gang of his co-partners are waiting to receive him. He speedily communicates to them all the information he has gained, and the poor people on stepping ashore are beset by affectionate inquiries about their friends in Ireland, and that good old man the parish priest. They imagine that they have fortunately dropped among old acquaintances, and their friend of the steamboat takes care to inform them that he is not going to be "done" by the man-catchers, but will lodge while at Liverpool at such and such a place, which he recommends. They cannot imagine that men who know all about the priest and their friends and relatives can mean them any harm, and numbers of them are usually led off in triumph to the most wretched but most expensive lodging-houses. Once in the power of the man-catchers, a regular siege of their pockets is made, and the poor emigrant is victimized in a thousand ways for his passage money, for his clothes and utensils, and for his food. Even after they have drained him as dry as they can, they are loth to part with him entirely, and they write out per next steamer a full, true, and particular account of him—his parish, his relations, his priest, and his estimated stock of money—to a similar gang in New York. Paddy—simple fellow—arrives in New York in due time, and is greeted on landing by the same affectionate inquiries. If his eyes have not been opened by woeful experience, he thinks once more that he has fallen among friends, and is led off by the "smart" man-catchers of the New York gang, to be robbed of the last farthing that he can be persuaded to part with; and he is possibly induced to spend the savings of years in the purchase of land, supposed to be in the far west, but having no other existence but such as paper and lies can give it.

It must not be supposed, from the statements in reference to the rogueries practised by runners and man-catchers upon the simple, emigrants themselves do not occasionally endeavor to commit frauds, both upon each other and upon the owners and captains of ships. The Irish emigrant, with the passion for hoarding which is so common among his countrymen, often hides money in his rags, and tells a piteous tale of utter destitution, in order to get a passage at a cheaper rate. The shameless beggary, which is perhaps the greatest vice of the lower classes of Irish, does not always forsake them, even when they have determined to bid farewell to the old country; and I have several times been accosted by men and women, on board emigrant ships in dock, and asked for contributions to help them when they got to New York. "Sure, yer honor, and may the Lord spare you to a long life; I've paid my last farden for my passage," said a sturdy Irish woman, with a child in her arms, when accosted on the quarter-deck of a fine ship, in the Waterloo Dock, "and when I get to New York I shall have to beg in the strates, unless yer honor will take pity on me." On being asked to show me her ticket, she said her husband had it; and her husband—a wretched-looking old man—making his appearance and repeating the same story, was pressed to show the document. He did so at last, when it was apparent that he had paid upwards of seventeen pounds—eighty-two dollars and twenty-five cents—for the passage of himself and wife and his family of five children. "And do you mean to say that you have no money left?" was inquired of him. "Not one blessed penny," said the man. "No, nor a fardin," said the woman, "and God knows what'll become of us." "Do you know nobody in New York?" "Not a living sowle, yer honor." "Have you no luggage?" "Not a stick or a stitch, but the clothes we wear." As the good ship was detained two days beyond her advertised time of sailing, all the emigrants, as usual, had liberty to pass to and from the ship to the streets, as caprice or convenience dictated. On the following day, this sturdy woman and her husband were seen entering the Waterloo Dock gates with a donkey-cart, tolerably well piled with boxes, bedding, and cooking utensils. When they were down in the steerage, and she was asked whether that was her luggage, she replied it was. "You said yesterday, however, when you were begging, that you had no luggage." "Sure, it's a hard world, yer honor, and we're poor people—God help us."

An incident of a kind not very dissimilar occurred on board of another American liner. When the passenger roll was called over, it was found that one man, from the county of Tipperary, had only paid an instalment upon his passage money, and that the sum of $6 each for three persons, or $18, was still due from him. On being called upon to pay the difference, he asserted vehemently that he had been told in the broker's office that there was no more to pay, and that to ask him for more was to attempt a robbery. The clerk insisted upon the money, and showed him the tickets of other passengers to prove the correctness of the charge. The man then changed his tone, and declared that he had not a single farthing left in the world, and that it was quite impossible he could pay any more. "Then you and your family will be put on shore," said the clerk, "and lose the money you have already paid." The intending emigrant swore lustily at the injustice, and declared that if put on shore he would "get an act of Parliament" to put an end to such a system of robbery. The clerk, however, was obdurate, and the man disappeared, muttering as he went that he would have his "act of Parliament to punish the broker, the clerk, and the captain." He returned in a few minutes from below, and, without saying a word of what had happened, and looking as unconcerned as a stranger, coolly presented a £5 note, or $24 25, and asked for his change. Such is a specimen of the rogueries attempted by those who have money. Those who really have none at all, or who possibly have not sufficient to pay their passage, resort to other schemes for crossing the Atlantic at a reduced rate, or free of charge altogether, and "stow away." This is a practice which is carried on to a great and increasing extent.

After encountering these perils of poverty and cheating, the crowd becomes finally located on board of ship, and assigned their quarters for the voyage. It is a strange place for the new-comers, and their admiration of the new life they have entered upon begins with the first day's issue of regulation food. The experience of most of them in the edible way, has hitherto been confined to "murphys" or, at most, Indian meal, which they heartily detest as "starvation porridge." They now come to the allowances, as above, handed them by law. The meal, the tea, the rice, the sugar, and molasses prove frequently a puzzler—tea in particular—and it is not unfrequently the case that a brawny Pat, who could do a good turn at Donnybrook fair, but whose knowledge of drinkables is confined to whisky, will, after gravely surveying the tea for a while, deliberately fill his pipe with a portion, and smoke it with much satisfaction. Others, with more expansive ideas, will at times mix the whole in a mass, and boil it into a thick soup or pudding, well specked with the expanded tea leaves. Information comes with experience, however, and the first serious experience is sea-sickness, which utterly prostrates them, mind and body, aggravating every dirty habit they may have formed. Then is exerted the utmost power of the captain to enforce cleanliness; he usually selects a dozen or two of the more intelligent, and investing them with authority, a general turn-out, and a thorough cleaning every morning, and in all weathers, is compelled.

By the rigid observance of this rule, much of the former sickness and mortality has been avoided. A voyage of some thirty days usually brings the human freight within sight of New York harbor. It almost invariably occurs that in the first delight of arrival every utensil and article of bedding is pitched overboard. No matter how poor are the people, or how hardly the things may have been come by, over they go; and cleaning for the landing takes place. How full of anxieties is that landing!

CHAPTER III.

LANDING IN NEW-YORK—FUTURE HOMES.

The Castle Garden, at New York, is allotted for the reception of the passengers under the Commission of Emigration, which was organized by law in 1847, and which charges a tax of two dollars per head on each immigrant, applying the proceeds to the support of the needy and destitute among them. The operations of this commission have become very extensive. It has charge of the Quarantine. Since its organization it has raised large hospitals on Ward's Island, where the sick are cared for. They are also sent to the Marine Hospital and the New York Hospital, and they reimburse the towns and counties of the state for the charges they incur for support of poor aliens, and advance money to immigrants on pledge of baggage, without interest. In the year 1859 $2,180 was so advanced to 162 families, and $2,031 was paid back. The operations of the commission in 1859 were:—

Receipts for commutation		$159,112
Other receipts		23,454
Total receipts		182,566
Balance in hand, January, 1859		5,656
		$188,222
Office	$16,486	
Hospitals	6,380	
Counties for support	23,555	
Castle Garden	34,727	
Agent at Rochester	1,087	
" Albany	2,160	
" Buffalo	2,601	
Ward's Island	54,890	
Marine Hospital	18,360	
Floating "	4,647	
Forwarding Immigrants, &c., &c.	32,130	
Incidental	721	
		$197,744

This account gives a general idea of the operations of the commission. The whole amount disbursed by the commission, May 5, 1847, to Jan. 1, 1860, was $834,786. The proportion who go into hospital appears to be about six per cent. of the arrivals.

A large majority of those who here land have their friends awaiting them to guide them to their future homes. Numbers have to seek their way amid numberless perils. But nearly all these have come provided with instructions more or less minute, derived from the numerous agents in Europe of the American land companies, who hold out inducements to settlers. The Germans are mostly inclined to agriculture, and they soon find their way, by the emigrant trains of the great trunk lines of railroads. Those lines have all exerted themselves to profit by the movement.

The following table, from official sources, gives the number of Germans and British under each head, and also the aggregate of all the aliens arrived since the returns have been regularly kept. Some of the passengers report themselves from Great Britain, without stating which portion. These are under the head "Great Britain." Thus, the total from Great Britain to 1859, is 2,670,059, of which, 1,415,399 are reported from Great Britain, 289,654 from England, 918,729 from Ireland, 46,277 from Scotland.

NUMBER OF PASSENGERS THAT ARRIVED IN EACH YEAR IN THE UNITED STATES FROM ENGLAND, IRELAND, SCOTLAND, GREAT BRITAIN, AND GERMANY, WITH THE TOTAL FROM ALL COUNTRIES.

	England.	Ireland.	Scotland.	Gt. Britain.	Germany.	Switzerland.	Prussia.	Total.
1820,	1,782	1,725	268	2,249	948	31	20	8,385
1821,	1,036	1,518	293	1,881	365	93	18	9,127
1822,	856	1,346	198	1,088	139	110	9	6,911
1823,	851	1,051	180	926	179	47	4	6,354
1824,	713	1,575	257	1,064	224	253	6	7,912
1825,	1,002	4,157	113	1,711	448	166	2	10,199
1826,	1,459	3,333	230	2,705	495	245	16	10,837
1827,	2,521	3,282	460	7,689	435	297	7	18,875
1828,	2,735	5,266	1,041	8,798	1,806	1,592	45	27,382
1829,	2,149	3,106	111	5,228	582	314	15	22,520
1830,	733	747	29	2,365	1,972	109	4	23,322
1831,	251	1,647	226	6,123	2,395	63	18	22,633
1832,	944	5,120	158	11,545	10,168	129	26	53,179
1833,	2,966	4,511	1,921	4,166	6,823	634	155	58,640
1834,	1,129	6,772	110	26,953	17,654	1,389	32	65,365
1835,	468	5,148	63	24,218	8,245	548	66	45,374
1836,	420	2,152	106	41,006	20,139	445	568	76,242
1837,	896	737	14	39,079	23,036	383	704	79,340
1838,	157	1,225	48	16,635	11,369	123	314	38,714
1839,	62	1,199	..	32,973	19,794	607	1,234	68,069
1840,	318	677	21	41,027	88,581	500	1,123	84,066
1841,	147	3,291	35	50,487	13,727	751	1,564	80,289

	England.	Ireland.	Scotland.	Gt. Britain.	Germany.	Switzerland.	Prussia.	Total.
1842,	1,743	4,844	24	66,736	18,287	483	2,083	104,565
1843,	3,517	1,173	41	23,369	11,432	553	3,009	52,496
1844,	1,357	5,491	23	40,972	19,226	839	1,505	78,615
1845,	1,710	8,641	368	53,312	33,138	471	1,217	114,371
1846,	2,854	12,949	305	57,824	57,010	698	551	154,416
1847,	3,476	29,640	337	95,385	73,444	192	837	234,968
1848,	4,445	24,802	659	118,277	58,014	319	451	226,527
1849,	6,036	31,321	1,060	175,841	60,062	13	173	297,024
1850,	6,797	40,180	860	167,242	78,137	375	759	369,980
1851,	5,306	55,874	966	210,594	71,322	427	1,160	379,466
1852,	30,007	159,548	8,148	2,544	143,575	2,788	2,343	371,603
1853,	28,867	162,649	6,006	2,703	140,653	2,748	1,293	368,645
1854,	48,901	101,606	4,605	5,141	206,054	2,953	8,955	427,883
1855,	38,871	49,627	5,275	1,176	66,219	4,433	5,699	200,877
1856,	25,904	54,349	3,297	15,457	63,807	1,780	7,221	200,436
1857,	27,804	54,361	4,182	26,493	83,798	2,080	7,983	251,306
1858,	14,638	26,873	1,946	12,372	42,291	1,056	3,019	123,126
1859,	13,826	35,216	2,293	10,045	39,315	833	2,469	121,282
	289,654	918,729	46,277	1,415,399	1,495,308	31,870	56,677	4,901,321

The returns give 1,495,308 Germans, mostly from the valley of the Rhine, a large portion of whom have arrived since the taking of the census of 1850. If we take the numbers of persons who had arrived from each country up to 1850, and compare them with the numbers reported by that census as living in the Union, we may be satisfied in how far two distinct official accounts correct each other.

STATEMENT OF THE NUMBER OF ALIENS ARRIVED IN THE UNITED STATES UP TO 1850, AND THE NUMBER OF EACH NATION RESIDENT IN THE UNION PER CENSUS OF 1850.

	Arrived 1820 to 1850.	Resident in 1850.	Excess of arrivals.
England........	55,530	278,675	
Ireland..........	218,626	961,719	
Scotland........	9,559	70,550	
Wales..........	1,616	29,868	
Great Britain.....	1,127,440		
Total Gt. Britain..	1,412,771	1,340,812	71,959
Germany........	577,264	573,225	4,039
France..........	131,714	54,069	77,645
Spain...........	6,950	3,113	3,837
Portugal........	1,550	1,274	276
Belgium.........	5,724	1,313	4,411
Holland.........	10,790	9,848	942
Turkey....	87	106	
Italy...........	4,675	3,645	1,030
Austria.........		946	
Switzerland......	12,772	13,358	
Russia....	917	1,414	
Norway & Sweden.	15,198	{ 12,678 3,559	
Denmark.........	1,791	1,838	
Prussia....	16,525	10,549	5,976
Sardinia.........	360	34	326
Greece..........	85	86	
China...........	386	758	
Asia............	145	377	
Africa..........	1,049	551	
British America...	57,833	147,711	
Mexico........ ...	14,689	13,317	1,372
Central America..	519	141	378
South America...	4,977	1,543	3,434
West Indies......	29,827	5,772	24,055
Sandwich Isles...	36	588	
Other...........	1,171	8,214	
Total.....	2,309,805	2,210,839	

These figures indicate the true currents of migration, as distinct from visitors. In thirty years there came from the British Islands 71,949 persons more than remained here. These represent those who returned home and those who died. Although a large number were reported as from Great Britain, their nativities, as reported by the census, inform us more than two-thirds were Irish. The French who arrived, it appears, did not remain in a proportion larger than forty per cent. The Belgians and Dutch returned to some extent. It is the case with these nations mentioned that the proportion of females is small, showing the character of the passengers to be more that of visitors than settlers. With some other nationalities more are reported resident than arrived. This may arise from the desire on the part of many, on arrival, to conceal their origin, because of some claims of the government upon them for military duty, such as we have seen exemplified in the correspondence of General Cass upon that point. In the case of British America, great numbers came over the lines not reported as emigrants in ships. With the West Indies, there are numbers come north in the summer season who return to their own homes in the winter. The aggregate results of arrivals and residences correspond pretty well.

Having traced these people from their various homes in Europe, and appreciated the motives that led them to migrate, and the difficulties that they encountered in so doing, we may now follow them to their final homes on this continent, as far as official returns permit. The French and English seem to cling to the sea coast, while the Germans push west into agricultural states, Ohio getting a large share of the whole. The "total" column includes all others, as well as English and German:—

LOCATION OF LEADING EMIGRANTS IN THE UNITED STATES.

	England.	Ireland.	Germany.	Switzerl'nd.	Prussia.	Total foreign.
Maine	1,949	13,871	290	11	21	31,456
New Hampshire	1,469	8,811	147	9	2	13,571
Vermont	1,546	15,377	218	2	6	32,831
Massachusetts	16,685	115,917	4,319	72	98	160,909
Rhode Island	4,490	15,944	230	8	5	23,111
Connecticut	5,091	26,689	1,671	55	42	37,473
New York	84,820	343,111	118,398	1,850	2,211	651,801
New Jersey	11,377	31,092	10,686	204	57	58,364
Pennsylvania	38,048	151,723	78,592	914	413	294,871
Delaware	952	3,513	343	22	28	5,211
Maryland	3,467	19,557	26,936	68	188	53,288
District of Columbia	682	2,373	1,404	36	11	4,967
Virginia	2,998	11,643	5,511	83	36	22,394
North Carolina	394	567	344	3	19	2,524
South Carolina	921	4,051	2,180	18	44	8,662
Georgia	679	3,202	947	38	25	5,907
Florida	300	878	307	7	17	2,757
Alabama	941	3,639	1,068	113	45	7,638
Mississippi	593	1,928	1,064	41	71	4,958
Louisiana	3,550	24,266	17,507	723	380	66,413
Texas	1,002	1,403	8,191	134	75	16,774
Arkansas	196	514	516	12	24	1,628
Tennessee	706	2,640	1,168	266	32	5,740
Kentucky	2 805	9,466	13,607	279	198	29,189
Ohio	25,660	51,562	111,257	3,291	765	218,512
Michigan	10,620	13,430	10,070	118	190	54,852
Indiana	5,550	12,787	28,584	724	740	54,426
Illinois	18,628	27,786	38,160	1,635	286	110,593
Missouri	5,379	14,734	44,352	984	697	72,474
Iowa	3,785	4,885	7,152	175	88	21,232
Wisconsin	18,952	21,043	34,519	1,244	3,545	106,695
California	3,050	2,452	2,926	177	158	22,358
TERRITORIES.						
Minnesota	84	271	141	22	5	2,048
Oregon	207	196	155	8	1	1,159
Utah	1,056	106	50	1	6	1,990
New Mexico	43	292	215	11	14	2,063
Total	278,675	961,719	573,225	13,358	10,549	2,210,839

In this manner were distributed in 1850 among the several states those of our citizens who were born abroad. In the aggregate, Wisconsin had the largest proportion of foreign citizens. Out of a population of 305,391, there were 106,691, or more than one out of three, born abroad. Of that number, nearly 40,000 were Germans. Next to Wisconsin, New York had the largest share of foreigners, these forming more than 1 out of 5 of the whole number. The New York state census of 1855 also reported the nativities, and these compare with 1850 as follows:

	English.	Irish.	Germans.	Total For'gn.	Native.
1850,	84,820	343,111	122,459	651,801	2,445,593
1855,	102,286	469,753	218,997	922,019	2,528,444
Increase	17,466	126,642	96,538	270,218	82,851

The foreign element, it appears, increased in these five years 270,218, while the native born only increased 82,851, showing how greatly the enterprise of those years sent people to the west. The natural increase of the white population in the United States is three per cent. per annum. Thus, on the 2,445,593 native whites in New York in 1850, the excess of births over deaths in one year would be 73,367; and for five years, to 1855, it would be 226,835 persons. But the census showed an increase of only 82,851, consequently 143,984 of the native population must have emigrated from the state during that period. Their places were more than supplied by the emigrants. The same movement is apparent in all the northern states. The number of persons born in the northern states and living at the time of the census, was 8,370,089. Of these, only 6,941,510 were living where they were born; the remainder, 1,428,579, were living in other states, south and west. But there were also living in the northern states, at the date of the census, 1,292,241 persons who were born abroad. These foreigners were mostly Irish—factory operatives, domestics, and artisans. It appears, then, that business enterprise had drawn 1,428,579 northern born men into other states, and their places had been supplied by 1,292,241 emigrants from abroad. This was up to 1850, and since then, as we have seen in the case of New York, the movement has been much more rapid; to how great an extent, the forthcoming census will show.

The amount of money or capital drawn from Europe by the emigrants is a question of much importance. The cost of preparation for the voyage in Europe, the cost of the passage, and the expenses incurred after arriving until the new home is finally reached, cannot, together, fall short of one hundred dollars each; and many have a small capital, in addition, with which to begin the world. The sums transported are often much larger. In 1854 the migration from the Palatinate, as stated in a Bremen report, was 8,908, and they carried $1,024,000. The reports of the New York commissioners of emigration, as the result of their investigation, show that the average of money brought is very near one hundred dollars per head—an amount which becomes formidable when taken in connection with the aggregate numbers arriving. This is exhibited in the following summary of arrivals:—

	Whole No. of Arrivals.	Number of Aliens.	Sums at $100 per head.
Ten years to Sept. 30, 1829.	151,636	128,502	12,850,200
" " 1839,	572,716	538,381	53,838,100
" " 1849,	1,479,478	1,427.337	142,733,700
" Dec. 31, 1859,	3,075,900	2,814,554	281,455,400
Total arrived......	5,279,730	4,908,774	$490,877,400

This is an immense sum, and poured forth even in small streams, has had an important effect upon the prosperity of the country at large, independent of the larger sums invested in land, stock, and utensils. On the other hand, very considerable sums are sent out of the country in aid of the emigrants, by their friends here, who have earned the money at service and otherwise. On this point, information has from time to time been gathered, of the houses through which remittances are made. These remittances are mostly small drafts, purchased in New York, for sums varying from five to one hundred dollars. The latter sum is seldom reached, however. The remittances of five of these houses, in one year, were as follows:—

			Average amount.
House A, number of drafts...	1,934	$32.125	$16¾
" B, " "	6,198	123,290	.19⅞
" C, " "	13,425	266,395	19½
" D, " "	18,175	363,140	$19\frac{9}{10}$
" E, " "	40,542	810,835	20
Total 5 houses 1 year..	80,274	$1,595,785	

These do not include the large banking-houses, of which there are no returns, but it is stated the Baring Brothers alone send $2,500,000. The British emigrant commissioners reported $2,160,000 so sent in 1848; $2,589,000 in 1849; $4,871,204 in 1850; $5,172,010 in 1851; $6,960,107 in 1852, and with the prosperous years during the great rail expenditures, up to 1857, large sums were remitted. It is to be remembered, however, that the sums so remitted come back mostly to American ship owners for passage money, so that, in fact, it does not all leave the country. In the same manner a good deal of the United States gold coin exported to Havre, Bremen, etc., is purchased there by emigrants in exchange for their native coin, and disbursed here on the arrival of the passengers. It results, then, that Europe sustained in the last ten years a drain of 2,814,554 souls, and at least $281,000,000 of money, which went to enrich the United States. This, without taking into account the productive value of the people after they arrived.

The legal rights of the emigrants, after they become naturalized, are the same in all respects as those of the native born citizens, with the single exception that they are not eligible to the office of president or vice-president of the United States. No law can be passed to abridge the freedom of their speech, or the free exercise of their religion, whatever that may be—even the enjoyment of Mormonism has been an attraction to some. Their right to hold real estate is perfect, as is the security afforded to persons, property, and papers, and they may be elected, or may elect to any office except those named.

Another very interesting feature of the passenger movement, although not strictly embraced within the emigration, is the number of United States citizens who annually arrive from abroad. There is no record of the number who go abroad each year, nor of the sums they expend in so doing; nevertheless, these are very considerable, and form an important element in the exchanges of the country. As a guide to the numbers who go, the returns of those who arrive each year become very interesting. These, distinguishing males and females, have been as follows:—

NUMBER OF NATIVE CITIZENS ARRIVED EACH YEAR FROM ABROAD.

	Males.	Females.	Not stated.	Total.
1820,	1,576	287	63	1,926
1821,	2,215	302	..	2,517
1822,	1,502	136	..	1,638
1823,	1,715	196	..	1,911
1824,	1,547	168	..	1,715
1825,	2,289	370	..	2,659
1826,	2,516	555	..	3,071
1827,	2,362	540	..	2,902
1828,	2,185	617	..	2,802
1829,	1,635	358	..	1,993
1830,	1,075	440	..	1,515
1831,	1,008	239	..	1,247
1832,	1,003	169	..	1,172
1833,	1,002	283	..	1,285
1834,	1,934	640	9	2,583
1835,	2,556	764	22	3,342
1836,	3,594	1,136	..	4,730
1837,	4,566	1,053	..	5,629
1838,	5,030	1,215	..	6,245
1839,	5,268	1,329	..	6,597
1840,	6,115	2,026	..	8,141
1841,	5,733	1,783	..	7,516
1842,	4,847	1,568	..	6,415
1843,	3,103	930	..	4,033
1844,	4,466	1,683	..	6,149
1845,	4,164	1,196	165	5,525
1846,	3,197	1,036	..	4,233
1847,	3,081	1,408	25	4,514
1848,	2,222	734	..	2,956
1849,	2,024	635	..	2,659
1850,	9,863	1,059	..	10,926
1851,	27,836	1,526	..	29,362
1852,	23,262	2,478	..	25,740
1853,	28,774	3,563	..	32,337
1854,	28,710	3,931	..	32,641
1855,	24,874	4,716	..	29,599
1856,	20,058	4,002	..	24,060
1857,	16,701	3,974	..	20,676
1858,	17,291	4,489	..	21,780
1859,	27,041	7,186	..	34,227
	309,940	60,710	284	370,968

At the era of the gold discoveries in 1849, a sudden movement in American travel took place, it appears. In the ten years ending with 1849, 51,951 persons arrived home; of these, one-fourth were females. In the ten years ending with 1859, 261,138 Americans arrived home. The amount of money spent by these persons abroad cannot be ascertained with precision, but it is known that the passage out and home, with a three months' expense, cannot be done inside of $600, at which rate the amount expended would be $156,682,800 for the ten years, or $15,000,000 per annum. The probability is that it is three times that amount; the passage-money alone would reach $52,227,000. This constitutes a very heavy drain upon the national resources, although the money paid for passages is mostly to American interests; as a whole it is doubtful whether the financial balance arising from migration is in favor of the country. The numbers of former emigrants who return home with accumulated means, added to the sums expended abroad by Americans, will probably at least cancel the amounts actually brought into the country by emigrants. But the vast amount of productive skill and labor that is brought into the country, and applied to the vast waste of land, develops more capital in a ratio which astonishes the observer. The number of persons who arrive in the United States in a single years equals the population of a whole state. Thus the numbers that arrived in 1857 were 427,883; the total white population of the state of Alabama was, in 1850, 428,779.

From 1859, the tide of immigration, which for two or three years previous had ebbed, began to flow again in something like its old abundance, and, though checked in 1861 and 1862 by the war and the presence of rebel privateers in the Atlantic, it soon increased again, and in 1863, '4, '5, and '6, has been very large. In 1860, the whole number of alien emigrants was 153,640. We have no returns from the whole country since that date, but the immigrants landed at New York since that time, which comprise about three-fourths of the whole number who enter the country, were, in 1861, 68,311; in 1862, 81,458; in 1863, 161,648; in 1864, 184,700; in 1865, 200,031; in ten months of 1866, 202,440. It is a noteworthy fact that the later immigrants, those of the last three or four years, are, socially and pecuniarily, of a much higher class than those of former years. A very large proportion of them are well, or at least tolerably educated, and many of them possessed sufficient means to enable them to go to the West and procure farms, or engage in other employments. Of the immigrants in 1865, 83,451 were from Germany, 70,462 from Ireland, 27,286 from England, and 15,153 from other countries.

SOCIAL AND DOMESTIC LIFE.

INTRODUCTORY.

Three quarters of a century ago, there were in the whole United States only about as many people as there are now in the state of New York; and now we have grown from less than four millions to thirty millions—having increased nearly eight-fold.

These large numbers will indistinctly represent the general progress of the nation; and the average social prosperity of each citizen has increased in a ratio materially larger. The actual amount of this increase in intelligence, wealth, and comfort, cannot be set down in figures, but will be understood as well as the case will permit, from an enumeration of details of improvements in social and domestic life.

There were sufficient reasons for a somewhat uncommonly low average of comfort at the end of the Revolution. The seven years' war had, of course, almost destroyed all industry, except farming and a few indispensable manufactures and trades. It had also drained all the specie out of the country, or frightened it into secret hoards; in consequence of which the currency was entirely disorganized. Government credit was at such a low ebb, that the bills of the United States (known as "continental money") would not purchase even such articles of comfort or luxury as existed, except at enormous nominal rates; nor was the paper money of the separate states in much better reputation. Thus, a hundred dollars in these depreciated bills was paid for a mug of cider; five hundred dollars for a bowl of punch; a thousand dollars for a pair of shoes; twenty-seven thousand dollars for an ordinary horse; and "part of an old shirt" was set in an inventory at fifteen dollars. The worthlessness of this money rendered it necessary to make payments, to a great extent, in barter—a mode of trading which always keeps the average of comfort and luxury down at a standard little above that of the better class of savages.

But even if this paper currency had been worth its face, or if specie had been plenty, it would have been possible to buy only a small share of comforts or luxuries compared with those now attainable, for the plain reason that they did not exist.

Beginning at this low period of average prosperity, we shall now rapidly sketch the progress of the country, up to the present time, under the general heads of

1. Domestic Architecture.
2. Furniture.
3. Food.
4. Dress.
5. Mental culture, intercourse, etc.

CHAPTER I.

DOMESTIC ARCHITECTURE.

Eighty years ago, houses were much more evenly distributed over the country than is now the case. There has ever since been a continual tendency to draw together into towns; and this tendency has been much assisted by the increased ease of travelling and transportation. At that time, therefore, there was much less difference between a country house and a city house than at present.

In the older parts of the northern states, the houses then built were often of the style called "lean-to," or "linter;" that is, with one side of the roof carried down so far as to cover an additional tier of rooms on the ground floor, or a wide shed. Another common style, rather later in use, was the "gambril roofed," where the roof rose at a very steep pitch from the eaves, about half the length of the rafters, and then fell in to the ridge-pole at a much flatter angle. This gave a very roomy garret. Dormer windows were very common, to light rooms finished off in the garrets.

Timber was plenty, and houses were built almost exclusively of wood, and often with beams and rafters of dimensions that would now seem truly enormous. Brick was comparatively little used, until lumber grew scarcer in the older parts of the country, and "brick machines," first invented by Kinsley a little before 1800, had rendered the production of brick more rapid and cheaper than could be afforded by hand labor. Stone was scarcely used at all, except by a very few wealthy persons. Sometimes the spaces between the timbers of a frame house were filled in with brick, so as to make a sort of brick body to the house, with wooden bones, and with the clapboards put on over these.

A beam was very often left running across the ceiling of a room, six or eight inches below the plaster, and was a convenient place for driving nails or pegs on which to hang dried apples, seed-corn, peppers, hams, baskets, rope, etc., etc. In like manner the uprights often projected into the corner of the room, giving it a kind of coarse cornice. The centre of the house was usually occupied by the chimney stack—an immense pile of brick or stone, sometimes occupying almost a quarter of the ground plan. In the different sides of this huge mass opened the great old-fashioned fire-places, in many of which one could sit in the corner while the fire burned, and see the sky through the chimney-top. Half a cord of wood might burn at once in some of these great fire-places, and yet, in the bitter cold of a northern winter, water would freeze at the other side of the room. This was by reason of the thinness of the walls, the imperfect fitting of doors and windows, and above all, the great proportion of heat that went off up chimney, and of cold that came down. Hinged to staples at the chimney-back was a crane, with its pot-hooks and hangers, or trammels, to accommodate the machinery of the cook. At one side of the fire-place was the oven—a cave in the masonry of the chimney-stack—and, usually, with an ash-hole underneath it. A great shovel, or "slice," with a handle five or six feet long, and a big pair of tongs to match, were for oven use; and to heat this affair thoroughly enough to bake bread, usually occupied an hour or an hour and a half, and consumed two or three good armfuls of dry wood.

Houses were commonly low "between joints," to economize heat. Roofs were shingled, with split shingles; the sawed shingles being little used until a little after 1800, from which time many patents for shingle sawing were taken out. A machine for getting out shingles was patented, however, as early as 1797. Slate roofs have never been much used, and tiles scarcely at all. Cypress wood is used for shingles at the south, instead of pine; exposure to the weather turns it to a quite distinct, but disagreeable black. Sheet tin has been quite extensively used for roofing during the last quarter of a century, being laid upon tongued and grooved boards; but most of such roofs leak vexatiously, from the alternate expansion or contraction of the tin from heat and cold. Since about 1840, quite a number of modes have been invented for covering roofs with oiled cloth, asphalt, mineral paints, etc., etc.; but no roof is better than a well made shingle roof.

A quite recent invention in domestic architecture is the plan of building what are called "gravel walls," by moulding gravel and loose stone with mortar into a kind of concrete wall on the spot, lifting up the moulding cases when the contents are firmly set, and moulding another section. This results in a house which may be said to be of one stone, for if the materials are good and well put together, they harden into an artificial breccia. This plan has not, however, been sufficiently proved; and a wrong choice of sand, or gravel, or lime might after a while cause the crumbling and ruin of the whole fabric.

Walls were usually finished inside with whitewash, paper, or paint; the use of stucco, or "hard finish," being quite rare until a late period. All house iron-work and trimmings of a better kind were imported from England, until within the present century. Wrought nails were used; cut nails having been invented, and their manufacture variously perfected by several Americans, from about 1791, when the earliest patent on the subject was issued, down to the present time. Jacob Perkins, of Newburyport, and Byington, of Connecticut, were two of the most prominent inventors in this line. Such latches, hinges, etc., as were then made in this country, were wrought iron, and clumsy and inconvenient. All such trimmings are, however, now manufactured to great perfection in our own workshops. Among the improvements of the last forty years in house trimmings, a very convenient one is the introduction of balance weights running over pullies, to facilitate opening and shutting windows. Before these were used, the practice was to use various kinds of catches, all of which made it necessary to lift the whole weight of the sash; and instead of which were often found merely a wooden button to turn under, and hold the sash open, or even nothing but a stick to hold it up.

The invention of the planing machine, first successfully introduced by William Woodworth in 1837, though many patents had preceded his, and of the circular saw, first patented by Cox, of Georgia, in 1795, were important improvements in dressing lumber, and cutting it; as the former could turn out boards smoothed, tongued and grooved, and fit for flooring, and the latter could cut thin work much more cheaply than a common saw movement. Another machine has been introduced within fifteen years, for boring auger holes, and others for cutting wooden mouldings, which save much time and labor in framing and in finishing respectively. During the last ten or twelve years, also, various new paints have been introduced, none of which, however, have entirely superseded the old-fashioned oil vehicle and ordinary mineral colors. Of these, the principal are preparations of zinc, to be used instead of lead, and also for a variety of browns and grays; and several "mineral paints," usually finely pulverized stone, which are recommended as good defences against fire.

The improvement of the last twenty years in architectural designs has been great. Up to that time, dwelling houses were built in the north most frequently on a plain parallelogram plan with the common ridge-pole roof. A style at that time quite frequently adopted for houses of a somewhat pretentious character was that of a Greek temple, usually with a row of pillars across one end. This absurd misapplication did not flourish long, and was succeeded by the Gothic cottage style; and this again, and with extensive and well-deserved success, by the very various and graceful modifications of the Italian villa style. In cities, where land is very expensive, a style called the "English basement house" is much used; with a front of brick, or stone, or both; a ground floor occupied by a library or dressing-room, and a dining-room; with the kitchen in the basement below, and the parlors and bedrooms on the floors above. This arrangement economizes land, but the great number of stories and stairs makes them very wearisome to the feeble frames of our American city housekeepers, unless they content themselves with sitting comfortably in the parlor, and letting Bridget govern, uncontrolled, in all the rest of the house. A modification of this house, known as the Boston style, has a front door sunk within a recess in the front, as a shelter from the weather.

A very common arrangement of old-fashioned houses was to set the house with the side toward the street, with the front door in the middle, opening into a little vestibule. From this the stairs passed up, often turning round three sides of the vestibule; and at each side a door led to two front rooms. These, often occupying all the ground floor of the two-story part, were parlors, or a parlor and a bed-room. Behind these, under the "lean-to" roof, was very probably one long room, used as kitchen, nursery, and sitting-room; for the parlor was used only for great occasions. The second floor was laid off as might be convenient.

The better houses of the southern states were built to suit the different demands of the climate—more airily, and usually with much piazza room, and not much provision for warmth. Early settlers in the south and west invariably put up log houses, whose chimneys were built outside against one end, of sticks laid in clay. A mode often used was to build two separate square rooms of logs, and then to throw one roof over both and the space between, thus securing an out-door shelter. These log houses were floored with "puncheons," that is, small logs split once and hewed even. A standing table of puncheons, some three-legged stools, a rude bedstead, with a bed of leaves or corn-husks covered with buffalo-hide or bear-skins instead of sheet, blanket, and coverlet; a shelf, and a variety of pegs driven into the wall, completed almost the entire outside and inside of these rugged, but comfortable homes, the nurseries of so many brave and great men. In such houses were born and brought up Andrew Jackson, Henry Clay, and the numberless heroic Indian fighters and mighty hunters of the west. And such houses are still the homes of thousands of the bold pioneers who are advancing westward, carrying forward the limits of civilized society toward the Pacific ocean. As the newer states increase in population and wealth, the domestic architecture of the older ones is copied, and dwelling houses of the same general character are now commonly used in city and country.

Among the chief improvements in domestic architecture are those which have been applied to modes of warming houses. The earliest improvement on the ancient fireplace was the Franklin stove, invented by the great philosopher whose name it bears, and which was in use before the revolutionary war. These were only shallow iron fireplaces, with a draft which could be modified by a sort of valve, and were used only for wood. Large box-stoves, also for wood, were the first means used for warming churches. Even these were not introduced until within the memory of many persons now living, and, as is well known, were violently resisted by the conservatives, who fought hard to retain the privilege of mortifying the flesh by freezing fingers and toes all day Sunday.

The introduction of anthracite coal was the next step in this department. This had been known for years to the hunters and trappers of the wild interior of Pennsylvania, as a black stone sometimes found on the mountains, but was not thought combustible, any more than granite.

Some successful attempts had, however, been made to burn anthracite; one by Dr. C. T. James, in 1804; and one by Judge Jesse Fell, of Wilkesbarre, who burned it in a grate, in 1808. This brought it gradually into use in that vicinity. In 1814, White & Hazard, iron-masters in Carbon county, bituminous coal becoming scarce, resolved to try anthracite in their rolling mill. They got a cart-load, at a dollar a bushel, and wasted it all in vain endeavors to kindle it. Procuring another load, they tried again; but after fruitless endeavors for a whole night, the hands shut the furnace door in despair and left the mill. Half an hour afterward, one of them came back after his jacket, and to his surprise found the furnace door red-hot, and the inside at a strong white heat. The discovery was made; and with the use of a similar let-alone policy in kindling, anthracite was afterward used in furnaces with entire success, an improvement in quality of product, and a large saving of expense.

Thus introduced, the use of the new fuel gradually spread, although so slowly that in 1820, three hundred and sixty-five tons completely stocked the Philadelphia market for a year. Many patents were now taken out for grates, blowers, cooking-stoves, parlor and hall stoves, ranges, and hot-air furnaces. R. Trexler, of Berks county, manufactured stoves for anthracite in 1815; and the earliest patent for furnaces seems to have been that of Thomas Gregg, of Connellsville, Pa., in 1814. Three or four years now brought the new fuel into extensive use, and from the three hundred and sixty-five tons, which was all that was mined in 1820, the amount had risen in 1849, in thirty years, to three millions and a quarter of tons, and has been continually increasing ever since.

Nott's stoves were early much used for warming houses with anthracite; Olmsted's stove and Bushnell's were in fashion next; the first invented by a college president, the second by a college professor, and the third by an eminent clergyman. It would be vain to enumerate the numberless patents and designs that have since been introduced. About 1836, Isaac Orr, a man of great inventive talent, patented the air-tight stove for wood, which was for a time so extensively used as to cause a sort of interregnum in the reign of anthracite, and which is yet frequently seen. Grates, long used in England to burn the bituminous coal there, were early adapted to anthracite, and their cheerful open appearance has kept them to some extent in vogue. Hot-air furnaces were also invented, as early, at least, as 1813; but various faults, from the too great fierceness and dryness of the heat, imperfect defence against fire, etc., rendered them on the whole quite unsatisfactory, until about 1840, when great improvements began to be made; and many of the furnaces now employed afford a bountiful supply of air, almost fresh from out-doors, and not too warm and dry for health.

Apparatuses have also been devised for heating buildings by systems of hot-water pipes, and by systems of steam pipes; of which the latter, especially in manufacturing establishments, offices, public rooms, etc., succeed very well, though the heat would sometimes be somewhat too slowly diffused for private residences.

Until within twenty years, scarcely any care had been given to the ventilation of any buildings, whether public or private. At earlier periods, an abundant circulation of air was secured by the open chimney, through which a strong current of warm air continually rushed up, taking, as has been computed, at least nine-tenths of all the heat with it. With the introduction of stoves and furnaces, this ventilator was closed, and the air of warm rooms became unhealthily dry and hot, or vitiated by use, especially in schools, ball-rooms, court-rooms, public assemblies, etc. Many disorders were aggravated or made more common by this state of things; such as headaches, nervous affections, and lung complaints. Various plans of ventilation have been adopted to remedy these evils, but the principles of the science of pneumatics are even yet so imperfectly understood that no entirely satisfactory system of ventilation has yet been devised. The modes commonly used are, for large public buildings, such as churches, an opening at the ceiling, with a device outside for forming an upward current by the help of the wind; in private houses, openings at the sides of rooms, communicating indirectly with the external air; and where hot-air furnaces are used, a pipe supplying air from without, which is warmed by the furnace and passed on into the apartments. Stove-heat is, however, still not usually applied in such a manner as to promote health.

City residences are at present frequently furnished with two kinds of improvements rarely found elsewhere—gas and water.

The use of gas for lighting streets and houses was first invented by an Englishman named Murdoch, and tried at Redruth, in Cornwall, in 1792. It was first introduced in the city of New York by the old New York Gas Company, chartered in 1823. It is now used in most of our cities, and its deprivation would be thought a very serious misfortune.

An equally, and indeed much more labor-saving and convenient improvement in our modern domestic architectural arrangements, is the introduction of water from water works. Water works were commenced in New York before the Revolution, in 1774; but none were erected there until 1797, when the Manhattan Company put up a reservoir on what is now Chambers street. These small works were superseded by the Croton aqueduct, opened in 1842. Philadelphia was first supplied by a steam engine in 1799; and this was replaced by the celebrated Fairmount works, commenced in 1811. A number of our larger or more enterprising cities are now provided with aqueducts.

The fountains thus set flowing in our houses save all water-carrying, for bathing or cleaning purposes, either up or down stairs; for a proper connection with a sewerage system will admit of a sink as well as a water pipe in every story. The burdensome daily details of housework are thus very greatly lightened, and health, and time, and exertion very much economized by the various appliances of the modern city bathing-room.

Within about ten years, there have been introduced into one or two very luxurious city houses, hoistways, somewhat like those used in stores, but upholstered, and, in fact, fitted up like little rooms; these are raised and lowered so as to save the exertion of using the stairs, and are exceedingly convenient for the old and feeble.

This brief enumeration of improvements in domestic architecture could not properly include what may, however, in conclusion, be merely mentioned; that is, those large and splendidly finished houses which are erected by the great millionaires of the present day. The costly frescoes, the statues, the extravagant splendor of their fitting, the picture-galleries, conservatories, libraries, etc., etc., though good and beautiful in themselves, are exceptions, and not yet numerous enough to be considered domesticated in this country.

CHAPTER II.

FURNITURE—FURNISHING GOODS, ETC.

The furniture of country dwellings during the latter part of the last century was scantier than now, and, on the whole, of much cheaper quality and poorer make, although that of the wealthy was often handsomely designed, well and massively made, and heavily and tastefully ornamented. Little machinery was used in manufacturing furniture, which had, therefore, to be made by hand labor. This made patterns more numerous, as one design often served for a single side-board, set of chairs, etc., and for those made by one workman only; while now, one pattern may serve for thousands of sets. There was, therefore, greater variety, and often remarkably fine workmanship, and even artistic skill. The greater cheapness of wood, and the little use made of veneering, occasioned much furniture to be made of solid wood. Many pieces of this ancient, solid furniture now bring extravagant prices at auction, or from a second-hand store, where chance supplies a buyer with taste and means. As much as ten, or even twenty dollars each have been given for old-fashioned, carved, mahogany chairs; from twenty-five to forty dollars for a tall clock, etc., etc.

The increase in the supply of money, the decrease of any distinction between classes of society, and the general diffusion of wealth and comfort, render the difference between the furniture of the rich, and that of the poor, much less at the present day than formerly. Comparatively few luxuries of any kind are now accessible to the rich, which are not so to the farmer and the mechanic. This is not, of course, to be understood of the very poor, nor the very rich; nor of the most expensive luxuries; for Gobelin carpets an inch thick, marble statues by Powers, pictures by Church, Johannisberg wine, Strasburg pies, and the like, can never be possessed except by very few.

The bedsteads of our grandparents and great-grandparents were very commonly "four-posters;" that is, they consisted of four tall posts, into which were framed the side and end pieces. These posts often supported a wooden frame covered with cloth, somewhat like a roof, and called a "tester," from whose four sides hung down the curtains. Feather beds were universally used. Sheets were of linen; and coverlets of patchwork, marseilles, chintz, etc.

Carpets were comparatively little used; most people contenting themselves with a floor, washed clean, sanded, or, at most, painted. The carpets used eighty years ago were mostly English or Scotch ingrain, though a good many home-made rag-carpets were also used; and the price per yard was, perhaps, $1.50 to $1.75; not varying very much from the present price of a fair article, though the same sum represented more value then. There is a well-known anecdote of an honest old farmer who was one day introduced, for the first time, to a carpeted room. The carpet, as was usual in those days, was a sort of patch in the middle of the room, surrounded with a wide margin of bare floor. The visitor skirted cautiously along the sides of the room, and when invited by the lady of the house to walk across, excused himself with rustic politeness, because, he said, "his boots were too dirty to walk on the "*kiverlid.*"

Chairs were of hard wood—maple, oak, cherry, or mahogany—with seats of wood, basket-work, or cushion, covered with cloth, haircloth, or leather. Much skill and taste was expended on many of the costly solid mahogany parlor chairs, and they are even now much more stately than most of their modern successors. The rocking-chair—a truly American invention—dates back to a point not ascertained, but certainly not less than seventy or eighty years ago. No rocking-chairs of so antique a pattern as common chairs can, however, be found. An early improvement upon the old-fashioned wooden or wicker chair-seat was the straw-seat, of straw or rushes, woven together in four compartments, which converged to the middle of the seat. The cane-seat, woven like fine basket-work of slender strips of ratan, came afterward, and is still much used; it is strong, neat, light, and convenient. Many business and study chairs are now made with the seat pivoted on a stout iron pin—a very convenient invention, rendering it very easy to turn round from writing-desk to customer or client.

Tables were made of oak, pine, cherry, black walnut, and mahogany. In old-fashioned houses may sometimes still be seen a small table hinged to the wall at one side, so as to turn up flat against it, secured, when not in use, by a button. A leg hinged on beneath hung flat to the table when thus raised, and swung to its right place when lowered. Some old tables were enormously heavy, framed almost as strongly as a house, and with curiously complicated swinging legs to hold up the leaves. Such tables were often heirlooms, as was much household furniture. The substantial strength and solid materials used rendered it much more fit to serve generation after generation than the lighter and cheaper articles now made. The present "extension tables," which are frequently used in dining-rooms, were first patented in 1843; they draw out within certain limits to any length, when additional boards supply the top. Thus the same table accommodates either a large party or a small one.

The sideboard was an indispensable article in dining-rooms where it could be afforded, being used instead of a closet, to hold plate, wine, table-linen, cake, etc.

Bureaus, or chests of drawers, were made on a larger scale than now, sometimes towering far toward the ceiling, containing a great number of drawers, large and small, and often ornamented in a peculiar and striking manner at the handles and keyholes, with brass escutcheons elaborately and fancifully pierced or carved.

The movable wash-stands, still commonly used, have been replaced in some cases, where aqueduct water in pipes is used, by fixed stands, sometimes luxuriously topped with marble, having fixed basins sunk in them, faucets for water, and a hole below to let it off. A "water-back," or boiler, attached to the kitchen range or stove, is sometimes made to supply hot water through pipes, from which another faucet supplies hot water as desired to each basin—a most comfortable provision in cold weather.

China and glass ware were much more costly than at present; pressed glass, now so extensively used, having been introduced only within the present century. Pewter platters and plates were frequently the only dishes on a country table. Table crockery was most commonly of white stoneware, with blue edges, or of the "willow pattern." There was very little silver ware, and what there was, was much more solidly manufactured than is now usually the case. Block tin was much used, until to a great extent superseded by Britannia metal, which came into use about twenty-five years since; "albata," a sort of white metal, introduced within about ten years, and German silver, an invention dating back, in this country, about twice as far. A still later substitute for the precious metals is "oreide," a sort of brass, very closely resembling gold; and another, discovered within the last three years by a French chemist, is aluminium, a light, strong metal, resembling silver in appearance, which can be extracted from common clay, and other aluminous earths. It is by no means improbable that this last metal will come into very extensive use, for household as well as other purposes.

Silver forks were first brought into general use about twenty-five or thirty years since. Those previously used were the common three-pronged steel forks, or two-pronged ones, either of them sufficiently inconvenient for carrying loose food to the mouth. Another improvement, about as old, in table furniture, is the invention of balanced knife-handles, the weight in the handle keeping the blade off the table cloth when laid down; a little thing, but very promotive of cleanliness.

Instead of the modern Yankee clock, the first patent for which was taken out by Eli Terry, of Plymouth, Conn., in 1797, were used either small Dutch clocks, stuck up on the wall, like a swallow's nest, or the old-fashioned tall clocks, in cases seven feet high, which were sometimes very handsomely ornamented with carving, brass decorations, and richly painted dials. On the broad faces of these old clocks were sometimes given, besides the hour and the minute, a whole almanac of indications: the time of high tide, moon's age, day of the week and month, name of month, year, etc., etc. Occasionally, a wooden bird came out and was supposed to sing, or a tune was played when the hour struck. Quite a large number of these old clocks, most of the best of which were made during the first quarter of this century, are still in use, and are frequently excellent time-keepers.

These observations do not include the Mississippi valley, which was just beginning to be settled by Anglo-American pioneers at the close of the revolutionary war. In all that extensive region, the rudest substitutes for all the supposed indispensable instruments of civilized life were used. Furniture, indeed, scarcely existed. A bedstead and a table, rudely hewn out by the sharp axe of the master of the house, some stools of the same manufacture, a shelf, a row of pegs in the log wall, an iron kettle, which often served in its own proper person the various purposes of wash-basin, cooking-kettle, soup-tureen, slop-dish, dish-pan, swill-pail, and hog-trough; a few tins, or a little crockery, a chest or two, a stump hollowed at the top for a mortar to pound corn, and a stick for a pestle — such was the scanty furnishing of that day in that region. As the population has increased, it has brought with it from the older states all their improvements, and now no distinction can be found between the two sections—at least, so far as concerns those of moderate or liberal means.

Lamps, for oil, or candles of tallow, sperm, or wax, were the only means of lighting either rooms or streets, eighty years ago. The amount of ingenuity which has been exercised in this department of housekeeping is astonishing; a hundred and thirty-seven patents for lamps alone having been issued from 1798 to 1847. The variety of these, and of the substances to the use of which they are adapted, is remarkable. There are yet some families which make their own mould or dip tallow candles; but only a few. Those who still use candles mostly, either indulge in the costly luxury of wax or sperm, or use some of the various lately invented substitutes, introduced within ten or fifteen years, such as the so-called "margarine," "stearine," etc., made from lard, or the still more recent "paraffine" candles, of a material extracted from bituminous coal. The first innovation upon the old-fashioned custom of using oil lamps—not, however, including in this term the argand and similar modifications of it—was the introduction of lamps for the use of burning-fluid and of camphene, which are preparations of oil of turpentine and alcohol, and though neat and convenient to use, and giving a pleasant light, have, in careless hands, been the occasion of a terrible number of deaths and maimings by burning. These fluids have been in use during somewhat more than twenty years. The use of gas has been already referred to for the lighting of cities and dwellings. Not long after the introduction of camphene, a large number of lamps were invented for burning lard oil, just beginning to be manufactured, and also lard, tallow, and other gross animal fats. About thirty patents were issued for lard lamps alone, during 1842 and 1843, including lamps of the common standard style, argand and solar patterns, etc. These lamps, in some cases, gave a very good light, but it proved troublesome to light them during cold weather, and they required much greasy work in cleaning, etc.

During the last five years, another class of illuminators has come into use, and is at present spreading extensively. These are the various oils known as coal oil, kerosene, helion oil, etc., etc. They are all, or nearly all, distilled or purified from the crude coal oil of the wells of western Pennsylvania, or from the products of the more bituminous varieties of coal. It has thus far been found necessary to use a chimney in burning them, and they smoke very easily while burning; but the light they give is clear and pleasant, they are much more cleanly than any of the animal oils, and of an aromatic odor.

Improvements in furniture are gradually introduced, and in a manner which renders it peculiarly difficult to fix precise dates. It may be said in general, that the uniform tendency has been toward lightness and convenience of form. The artistic beauty of the designs has not materially improved.

CHAPTER III.

FOOD—COOKING, ETC.

The general character of the food, drink, and cooking of three quarters of a century ago, was very similar to that of to-day. Meats were the same, but less fresh meat was eaten; salt beef, salt pork, and bacon being the ordinary meat, and the beef and pork barrel being almost as universal and necessary in the household as the flour barrel. The common vegetables were potatoes, turnips, cabbages, and onions, with a few beets and parsnips. Carrots were scarcely used at all. At the south, sweet potatoes were, as at present, used in place of Irish potatoes, and okra, tomatoes, etc., were also cultivated as at present. Tomatoes were scarcely known at the north, until about 1820 or 1825, when they were occasionally brought from the south, and gradually began to be cultivated, under the name of "love-apples." The egg-plant, spinach, cauliflower, broccoli, and other kitchen-garden plants, have also been introduced since the beginning of the century, from abroad.

Bread of rye, "rye-and-Indian," or Indian meal alone, and Indian puddings, johnny-cake, and the like, were more used than at present; for most grinding was done at the small country mills; transportation was slow, difficult, and costly; neither the great wheat fields of the east, nor the greater ones of the west, were yielding their increase; and the great flouring mills that are supported by them had not grown up. Every farmer's family, therefore, commonly used breadstuff of its own raising; and but a very small share of that used in the towns was brought from any other than the immediate neighborhood.

All the labor of preparing the raw material for food was performed in the family. All the coffee had to be burnt and ground, spices pulverized, salt powdered, yeast made, soap manufactured, meat pickled, etc., etc., by each housekeeper for herself, or under her immediate supervision.

Throughout the extensive western forest frontier, a large proportion of the inhabitants lived in great part upon game; but this was, from the difficulty of transportation, even less accessible in the older settlements than now, when it must be brought from the distant lakes, and streams, and woods of Canada or Maine.

The use of spirituous and malt liquors was universal. It was thought no impropriety for distinguished clergymen to own a share in a distillery; and the meetings of ministers on religious business were made occasions of jollity, often even to such an extent that the reverend companions went home quite tipsy. Cider was drank in the country, and cider, rum, brandy, or wine in town, at every meal. Spirits were expected to be offered to every visitor, and if not, the host was thought mean and stingy.

Cooking was performed over an open wood fire; a mode in many respects more laborious and less convenient than the present use of stoves and ranges; but which, if skilfully conducted, gives the food a flavor more perfect and delicate than can be attained in any other manner.

As has been implied, the changes in food have thus been more in the treatment than in the materials of it. The chief of these changes, like those in warming houses, have arisen from the introduction of anthracite coal into use, which has caused the employment of cooking-stoves and ranges, instead of the open fire. Nearly four hundred patents for cooking-stoves and ranges were issued from 1812 to 1847, and great numbers of others have been granted since; the total number of such patents may safely be estimated at not less than six hundred.

An early style of cooking-stove, and quite a favorite one in its day, was the rotary, whose top could be swivelled round by a crank and cog-wheel geared to a ratchet underneath its edge, so as to bring any sauce pan or kettle forward to the cook. This variety is, however, now nearly obsolete, and innumerable later inventions have succeeded, each enjoying a brief reputation, usually conferred rather by diligent advertisement than by any real peculiar merits in the stove itself.

The cooking range may be described as a modified stove bricked into a fireplace, instead of standing out in the room. Its oven, instead of being back of the fireplace, as in a stove, is above it; and in most patterns, so far back as to render it very hot and inconvenient for use. Some late patterns, however, have brought the oven sufficiently far forward to remedy this objection.

The use of stoves and ranges has rendered cooking much more convenient, but has, in a great measure, substituted the baking of meats in the oven for the better old fashion of roasting. Their advantages, however, are greater than their disadvantages; they are far cheaper and easier in management than an open fire; and in all the older portions of the country are necessary, because wood could not be furnished to supply the kitchens.

CHAPTER IV.

DRESS.

In discussing the changes of costume since the revolutionary war, it will be more convenient to divide it with reference to female than to male costume. On this principle, the period from 1783 or thereabouts may be divided into five, thus:—

1. 1783 to French Revolution.
2. French Revolution to 1815.
3. 1815 to 1830.
4. 1830 to 1845.
5. 1845 to present time.

Speaking generally, the changes thus succeeding each other have been improvements; although almost all of them have been sufficiently absurd in themselves. These fashions have always come from England or France; since about 1815, almost entirely from France.

1. *Period first*, 1783 to French Revolution. At the close of the Revolution in 1783, the costume of gentlemen was in the English style of the day, viz.: a single-breasted low-collared coat of broadcloth, commonly of some gay color, often scarlet, bright blue, claret color, peach-blossom, with full skirts, and ample pocket-flaps, sleeves, and cuffs; a waistcoat, with long flaps; knee-breeches, often also of gay colors, fastened at the outer side of the knee with a buckle; long stockings, black, white, or colored; shoes with the well-known showy buckles, or boots with a broad piece of white or unstained leather turned down around the tops, and therefore called top-boots; a ruffled shirt, a lace cravat, powdered hair, a queue, not unfrequently a wig, and a three-cornered cocked hat. A very few aged men still wear or have worn this costume within the last ten years, even to the queue and the shirt-frill. The cocked

hat did not maintain its place so long, though quite often to be seen during the first quarter of the present century.

The formal stateliness of this old costume suited well the more careful manners and stiff politeness of the day; for even in our republican country, the distinctions of social rank and station prevailed to an extent which few people now realize. Old persons now living can remember when "Mr." was a title considered exclusively proper for the "gentry;" when a "gentleman's" son would have been reproved by his father for calling a farmer "Mr.". A farmer or mechanic was called "goodman," and his wife not "Mrs." or "mistress," but "goody."

Female costume was on the whole, perhaps, less strikingly different from that now in vogue, except in head-dress. Its other most distinguishing characteristics were high-heeled shoes, often of bright red or other strong colors; sleeves to the elbows, with heavy lace ruffles; a tight, close, long waist, and a skirt stiffened out by hoops very nearly as much as by the "skeleton skirts" now used.

The head-dresses then fashionable were, however, most monstrous, and furnished an endless theme for satire and jest. The hair was greased, and powdered, and "craped," as it was called—that is, combed up over artificial hair, a mass of tow, or a cushion; artificial flowers were worked into it, broad ribbons hung around it, feathers three feet high stuck into it, all sorts of vegetable-looking leaves and even fruit and vegetables themselves (imitated) were piled on, and a mass constructed which it seemed totally impossible for a lady's neck to uphold or endure; which was often, literally and truly, quite as large as a bushel basket. A caricature of those days represents a lady sitting in a chair during her head-dressing, while one barber, mounted on a tall pair of steps, is frizzling a curl, and another stands off at one side, taking the altitude of the edifice he has helped to build, with a quadrant. Calashes, whose gig-top appearance almost every one may remember to have seen, were invented long before this time, as early as 1765, as the only contrivance in the nature of a bonnet which would cover these vast machines. Such head-dresses required great skill in preparation and adjustment, and could, of course, not be made up by the owner herself. It was the business of the barber, and often occupied two or three tedious hours. The idea of going through such an operation daily was out of the question, and these "heads," as they were called, were made to last sometimes for weeks together. Indeed, they were continually corrupting, even so that worms bred in them, among the flour used for hair-powder and the pomatum; and numerous recipes were in use for poisons to prevent vermin from breeding in them. Sleeping in the natural posture was, of course, impossible; ladies slept sitting up or with a carefully arranged support for the neck and head, adapted to the precious mass of absurdities that crowned it.

Period second, French Revolution to 1815. The French Revolution may be called the conclusion of the era of those strange fashions. The freedom of that period, so licentious in politics, was equally so in dress, and in this department, as in the other, caused many and great changes both at home and abroad. In this country, which had before that time followed the English fashions almost exclusively, those of France now began to take the lead, and the ancient caprices of dress to be replaced by others more modern, but not less absurd.

From about 1780, down to about 1800, women's skirts grew more and more scanty in circumference, until they were "gored," and cut so close as to almost impede walking. The waist was also carried up sometimes to one inch below the arm-pit, and the neck at the same time cut indecently low. The skirt was fitted closely to the figure, no wrinkles being admissible, and the fewest possible underclothes were worn; a fashion both abominably ugly and very unhealthy. These ungainly waists excited much deserved ridicule. A well-known song beginning—

> "Shepherds, I have lost my love—
> Have you seen my Anna?"

was parodied so as to apply to them, commencing with—

> "Shepherds, I have lost my waist—
> Have you seen my body?"

The variations in bonnets and head-dresses during this same period were many and wonderful. In 1786, women wore their hair frizzed and powdered; and for riding costume, a man's jacket with broad lapels, and a broad-brimmed hat. In 1789, the hair was frizzled out into an enormous bush, sometimes with a quantity of dangling curls besides; and bonnets, to hold this affair,

1776.

EVENING DRESS. 1780.

1780.

1785.

EVENING DRESS. 1795.

EVENING DRESS. 1797.

1800.

1805.

1805.

1812.

1812.

1812.

1815.

1818.

1820.

1825.

1828.

WINTER DRESS. 1833.

1833.

1833.

1833.

1840.

1844.

1850.

were made like an upright bag stiffened out. In 1794 a fashion came in of finishing up the head-dress with feathers half a yard high. About 1795 these styles of expansive head-dress disappeared, and small bonnets came into use all at once, like a helmet or a straw cap, with a vizor such as is now worn on a boy's cap.

From 1805 to 1810, bare arms were much in fashion with women, and a singular mode of wearing gloves prevailed. The glove was worn with a long armlet attached, which was drawn on smoothly up to the elbow, and then pushed down again so as to lie in irregular wrinkles on the arm, which was reckoned remarkably pretty. These were termed "rucked gloves." About 1808 was introduced the "gunboat" style of bonnet, which consisted of a moderate-sized crown, and a wide expanse of brim, spreading out around the face, in a form fancied to resemble the peculiar shape of a gunboat, which is very wide toward the bows.

About 1810 appeared the plaid cloaks, used both by men and women, which may still sometimes be found hung up in an old closet; very wide and long, and for women having a great clumsy hood hanging at the back of the neck. In 1814 the bonnets all at once spread out into an immense crown, leaving very little brim.

Men's costume varied during this time no less. The reign of powder and pigtails may be said to have ended about 1793, immediately after the French Revolution; and about the same time the round hat took the place of the three-cornered cocked hat. A little later, perhaps about 1800, people began to leave off wearing wigs when they had hair of their own. It is hard to comprehend how people could submit so long to a custom so disfiguring, inconvenient, and cumbrous—for every wig-wearer had to have his whole head shaved every few days, and lived in constant peril of making a fantastic appearance if his clumsy and unsafe head-gear should be knocked off. Yet the mode prevailed for two hundred years; nearly from 1600 to 1800.

One of the early costumes which replaced the ante-revolutionary fashions for men, and which was the height of the *ton* in 1786, consisted of a very broad-brimmed hat; a powdered wig with a pig-tail; a coat with a very short waist, broad lapels, and tremendous swallow-tails; buckskin breeches, and top-boots.

During this period, and, indeed, down to about 1830, gentlemen's necks were often swathed with an enormous thickness of cravat; a fashion said to have been introduced by George IV., while a leader of fashion, to hide the scrofulous swelling of his neck. Two or three handkerchiefs, each a full yard square, were thus worn; giving the neck an appearance which now seems excessively dowdy and uncomfortable.

During the closing years of the last century, knee-breeches began to yield to the pantaloon, which came from France; and shoe-buckles disappeared to give place to a mere string or ribbon. The prince-regent of England, afterward George IV., first led this fashion, although he resumed buckles at the petition of the buckle-makers, who represented that the ruin of their trade would starve them. It was ruined, however, in spite of them and him, and notwithstanding that he was the inventor of a shoe-buckle.

This introduction of the pantaloon and the shoe-string, and the disuse of wigs, marks the era of the modern costume. The dress-coat, however, or a garment much like it, was worn at intervals, as early as 1750; although it did not definitely occupy the place of the old-fashioned broad skirts until about 1800. It should be observed that "pantaloon" means, in its first strict sense, a garment fitting quite tightly to the shape of the leg, and buttoning close around the ankles, as if a prolongation of the knee-breeches. The present pantaloons are in strictness "trowsers," having been introduced as such, and by that name, under the auspices of the Duke of Wellington, after the battle of Waterloo.

High-heeled shoes, for women, went out of use about 1789, and were replaced by something very like the present graceful, low-quartered shoe. Round toes, for men's shoes and boots, came in about the same time, and prevailed until about 1804 or 1806, when the first beginnings appeared of square toes.

Period third, 1815 to 1830. The last period may be characterized as that of tight, scant dresses. The present one may be described as that of big bonnets, puffed hair, and leg-of-mutton sleeves, which last, however, appeared only toward its end.

Knee breeches, which had continued to be "full dress," were now quite out of date. Frock-coats had been introduced by the Duke of Wellington and his officers after the peninsular war, together with the boot called after him. In 1815 trowsers began to be worn, being also introduced under his auspices; although the original pantaloon, with its tight, close fit and ankle-buttons, maintained itself for ten years or more before quite disappearing. In 1815, also, bonnets underwent a great revolution, shrinking to small dimensions in the crown, and spreading into a portentous brim.

Not far from 1820 began what may be called the modern era of tight lacing, which was adopted as the short waists began to be replaced by longer ones, and the modern type of female dress, viz., a long waist, bulging with a sudden angle into a voluminous skirt, became established. About 1825 was adopted a method of wearing the hair in great puffs at the sides and on the top of the head, dressed, also, with large bows of ribbon. To hold this array, an enormous bonnet was required, and was used. Skirts now began to be a very little fuller; two or three plaits at the waist being all that were at first admitted, and more being introduced from time to time. About 1828 began the "leg-of-mutton sleeves," which grew at once to enormous proportions. These ridiculous and most inconvenient appendages were stuffed out with down, or held out with reed, millinet, or whalebone; but they were continually becoming crushed, and were very troublesome. They had a certain absurd harmony with the big bonnets and puffed hair of the day, as well as with the broad-shouldered, stiffly-cut capes that were worn with them.

Period fourth, 1830 to 1845. The beginning of this period is marked by the introduction of the costume of the days of Jackson—the bell-crowned hat, long, swallow-tailed coat, with high collar and "bishop" sleeves, and loose trowsers. The bishop sleeves were distinguished by rising into a ridge where they were set in at the shoulder, as do the sleeves of the episcopal vestments; this ridge being in 1830-35, stuffed with cotton to hold them up. The big bonnets and puffed hair, wide capes and leg-of-muttons still prevailed. Boots and shoes were worn with very broad, square toes until about 1840, when narrow toes took their place; and the calash, invented almost a hundred years before, was still employed to cover the elaborate head-dress. The decrease in the size of women's sleeves is the chief feature of this period; the minor details of the successive changes of style were innumerable, as usual.

Period fifth, 1845 to 1860. This period, also, may be dismissed with brief consideration. Its first years were marked by the introduction of the sack coat, or, as it is called in France, the *paletot*. This easy, commodious, and cheap garment is infinitely more becoming than a dress-coat, and very much more convenient than either that or a frock coat. This garment, though introduced in the present century later than either the dress or frock coat, may be traced to a far greater antiquity; a very similar garment having been worn at the courts of France and England about the year 1450—nearly half a century before the discovery of America. At about the same time was introduced that most preposterous of all feminine fashions, the *bustle*, which was a sort of pad tied on behind to make the skirts stand out with the desirable degree of fulness. This was made of various materials: cloth stuffed with bran, hair, cotton, rags, old newspapers, etc., and sometimes of India-rubber, inflated with air. The bustle marked the beginning of the present period of expanded skirts. As this machine did not sufficiently spread out these garments, various other means were resorted to; the use of an enormous number of skirts—a habit most pernicious to health—and skirts fewer in number, of stiffly-starched cloth with cords sown on, or of grass cloth, or hair-cloth, or stiffened out with many cords of new manilla rope or common clothes-line, or with whalebone or coils of brass wire. All these having been tried and failed, the present fashion came up, of "skeleton-skirts," made of strips of iron somewhat similar to a watch-spring. These seem at present to be quite adequate to their purpose; although what the real reason of that purpose is, it would be impossible to say. Why women's skirts should constitute a great stiff, hollow cone about their lower limbs, within which they must wear an entire second suit of clothes for warmth and protection, is as unanswerable a riddle, as would be the inquiry why, during the first years of this century, they should be so scanty in dimensions, so thin, and clinging so closely to the figure.

Another fashion introduced during this period is that of wearing soft felt hats instead of the round hats, which last are now often described as "hard-shells," or "stove-pipe" hats; nick-names well applied, and which may aid in driving out this very uncomfortable and unreasonable fashion. The felt hat was not often seen among us until the enthusiasm which attended Kossuth's visit to the United States, in 1851 and 1852; after which it was brought out, at first with a feather, in close imitation of the national hat of the Hungarian hero, and called a "Kossuth hat." The feather was soon left off, being not much more suitable to our national characteristics than a nose-ring would be; but the hat itself, being found both comfortable and graceful, was retained, though many different patterns have since been used.

The size of bonnets, so large about 1830, gradually decreased until a minimum was reached in the very small ones worn during the last few years. These scarcely covered the back half of the head, and were, therefore, kept in place by a sort of skewer thrust through two holes in the back lining and the knotted back hair. The bonnets worn now are a very little larger, and we may, perhaps, be on the verge of a return to large ones. Among the latest styles of ladies' head-dress are two quite remarkable ones. One is a very homely hat, singularly like an inverted tin wash-basin in form; the other is as graceful as this is awkward; namely, the "Spanish hat," a small, low-crowned hat of black felt, velvet, etc., with a brim turned up at the sides, usually worn with a feather, and with a net for the hair.

Perhaps the very latest invention of the tailors is one for men, similar in purpose to the artificial means often used by women to remedy natural defects of form. This is a sort of pad, or frame of wire covered with cloth, to be worn under the shirt-bosom, to give the chest an appearance of manly fulness. No criticism is necessary upon such a trick; for no dandy so silly as to use it could be reached by any argument whatever.

In reviewing the whole series of fashions as thus briefly presented, it will appear that, on the whole, there has been a decided improvement. There are, doubtless, a sufficient number of not very wise fashions in dress now prevailing; but the preposterous, filthy head-dress of 1783, the indecent, scanty costume of 1800, the pudding-like cravat of the same period, the broad shadow of the gunboat bonnet, the balloon-like appendage of the leg-of-mutton sleeve, have each, in turn, been superseded by something, on the whole, less foolish; and it may be claimed with safety, that at this present writing, the fashions, both for men and women, are based upon something more like common-sense principles, and admit more freedom in adaptation, and, therefore, greater convenience and grace, than has ever before been the case. It is matter of congratulation, however, that an American taste is being developed, and our ladies becoming less dependent on fashions from abroad; and every year is yielding a larger liberty to our female population, in adopting such forms and colors as suit the peculiarities of each individual, without regard to any absolute or universal decree, and this is still more the case with men. Thus we seem to be approaching that condition of eclectic philosophy which, if it becomes actually a received law, will afford the utmost possible variety, comfort, and elegance.

CHAPTER V.

SOCIAL AND MENTAL CULTURE—INTERCOURSE—HEALTH—ART, ETC.

Nearly all the increase in comfort and happiness which is the pride of modern civilization is traceable to scientific discovery and to mechanical invention. These causes have supplied the means of the labor-saving machines and processes of the last three-quarters of a century. The use of these machines and processes has brought it to pass that men can earn their living by the labor of a less proportion of their time than formerly. And this power enables them to devote a correspondingly larger share of effort to the task of gaining knowledge, and of pressing forward in the path of moral and mental improvement. The amount of mental activity which has been devoted to these material processes is astonishing, and is only feebly indicated by the statistical fact that from 1801 to 1848, inclusive, the number of patents issued in the United States reached the large total of 15,844.

The readiest way to sketch the general progress of society at present sought to be described, will be to set forth briefly, in chronological succession, the periods or occurrences which have marked the commencement or maturity of any important influence upon the prosperity of the community, without attempting to classify them particularly.

In 1796 was taken out the first American patent for a pianoforte, by J. S. McLean, of New Jersey. The manufacture of these instruments has become very extensive; the larger manufactories sometimes turning out thousands a year. Many improvements have been made in their construction; and they are now so good and so numerous, as to be an important means in the increasing diffusion of musical knowledge.

In 1799 Dr. Waterhouse, of Harvard University, first introduced Jenner's discovery of vaccine inoculation; a measure which has substantially freed our community from the fear, the pain, and the disfigurement of the small-pox. This single discovery has had no inconsiderable influence in lengthening life, and increasing its happiness by dispelling the apprehensions, always felt before, of suffering and death.

The importance of regular, rapid, and cheap modes of travel and transportation, to the general improvement of society in wealth and intelligence, is exceedingly great. Distance of residence, difficulty of travelling, difficulty of carrying, has, through all the history of the world, been a chief means of keeping nations poor, because thus they could not exchange what they had for what they had not; and thus, however much they possessed of one thing, they were poor. For wealth does not consist in mass of possessions. Not mountains, even of gold, if unexchangeable, are wealth. Wealth is *mass and variety* of possessions together, and must therefore necessarily arise by exchange, that is, travel and transportation. The seacoast nations, commanding water-carriage, have thus always been the rich ones; it was not until steam destroyed the obstacles of river currents, and of wide plains and rugged mountains, that inland nations could be rich in any sufficient sense.

In the same way, speed and certainty of intercourse promotes exchange of mental wealth, by correspondence, visiting, etc.; maintains a sense of nationality, and keeps up acquaintance and good feeling. Were it not for ease of travel, there would be but slight hopes of keeping Maine and Georgia in the same republic with California and Oregon. As it is, they will remain.

In 1811 commenced a movement of a very different character from that of the inventor Fulton, but which has exerted an influence upon the health and morals of our nation, even more important than the benefits of cheap and rapid locomotion. This was the temperance reform.

The laxity of manners and morals which must attend war, had greatly increased the use of intoxicating liquor during the Revolution, and it continued to spread after the peace. Dr. Rush had published his "Inquiry into the Effects of Ardent Spirits," in 1804; but no decided movement against their use was made until 1811, when the Presbyterian General Assembly appointed a committee on the subject. That and other ecclesiastical bodies, at various times, passed different resolutions and recommendations intended to limit the use of liquor, but with no very great success. The first total abstinence society was formed in Boston in 1826, and during the following ten years, others multiplied with great rapidity, liquor-selling became disreputable, and the common use of ardent spirits was to a very great extent broken up. For the last quarter of a century it has been a generally received belief that the use of any intoxicating liquors as a beverage is hurtful, demoralizing, and an unmitigated evil in every respect; and the consequence has been perceptible improvement in health, diminution of crime, and saving of money both public and private. It must, however, be admitted that the temperance cause has stood still, if it has not actually retrograded, during the last few years; and that the so-called "Maine law," which its advocates hoped would prove a final bar to the folly and wretchedness of intemperance, has, in some cases at least, produced rather a reaction than a progress. Still, the practice of total abstinence, and the very great diminution in the quantity of liquors drank by those not total abstinents, has accomplished an inestimable amount of good, and immensely promoted the prosperity of the nation, both in material and in moral respects.

In 1832 the study of phrenology was introduced into this country by Spurzheim. This system, whatever the correctness of its doctrines as to indications by the shape and size of the head, which are certainly believed by many intelligent persons, is at any rate entitled to the merit of having furnished a new and very clear classification of the mental faculties, which has become the means of a great improvement in mental philosophy.

Two years later, viz., in 1834, the homœopathic system of medicine was introduced, which has since become very extensively believed. As in regard to phrenology, it may be said of this system, that whether all its peculiar doctrines are true or false, it has at least done good indirectly, by operating to reduce the quantity of medicines given by the old-fashioned practitioners, and to direct their attention more than before to the very important points of regimen, ventilation, and the other collateral departments of general hygiene.

About 1840 was introduced into this country the greatest improvement in pictorial art since the discovery of painting in oils by John Van Eyck in the fifteenth century; the greatest discovery ever made in that department of human knowledge; viz., the art of taking pictures by the chemical action of light, named, from its discoverer, daguerreotyping; and various modifications of which are known as the talbotype, photograph, ambrotype, crystalotype, etc. These methods render it both easy and cheap to procure an absolutely and necessarily perfect representation of a person or a thing. Besides the pleasure of thus being enabled, at a trifling cost, to possess a whole gallery of perfect portraits of friends—a privilege heretofore scarcely attainable, even at an immense price, by the great men of the earth —this new art has already been made exceedingly useful in securing diagrams of lunar and other astronomical phenomena, and in taking pictures of buildings, landscapes, statues, etc.; and promises in many ways to promote the progress of many other arts, by means of its wonderful power of perfect representation.

Not far from the same time, another system of medical treatment was introduced—the "water-cure," or "hydropathic" system, which has proved very useful in certain classes of diseases, and has, like homœopathy, done its part in relaxing the dogmatic and extreme severity of much of the old, or regular practice. This treatment, besides a very simple mode of life, consists only in the application of water, at various temperatures and in various ways; and it is successfully practised in many establishments devoted to it, which have been put in operation at places where water of the requisite purity could be had.

In 1845 the principle of cheap postage was established in this country by a law of Congress, and another step thus taken toward the entire release from tax or encumbrance of the intercourse of one mind with another. Cheap postage is one of the latest signs of a high civilization; it is one of the most promising indications of our own future.

Still one year later was discovered the medical process, since termed "anæsthesia," which consists in rendering persons insensible by the inhalation of certain gases (usually an ether, or chloroform), thus affording an opportunity of performing surgical operations quite without the knowledge of the patient. The agonies suffered in the dentist's chair, or under the hands of the surgeon, and the not less tormenting pain of many nervous diseases, may thus be much alleviated, and even entirely relieved.

In the same year was issued the first patent for sewing machines, to Elias Howe, jr. It is only necessary to allude to the very great saving of time, and strength, and health which these machines have effected; their effects are before the eyes of all. They are performing in a day the work of weeks, and doing very much to relieve women of a species of labor which was principally confined to them, but which consumed, in the merest petty drudgery, a wretchedly great proportion of their time, and often ruined health and destroyed life.

An important outgrowth of one of the departments of improvement which have been described, is the modern hotel. The American first-class hotel is an institution quite peculiar to this country, and includes within itself many of the various inventions which have just been catalogued: splendid furniture, elaborate food, economical and yet liberal housekeeping, labor-saving machinery; in short, an unrivalled combination of the applications of human ingenuity to the improvement of domestic life.

To recapitulate: It has thus been shown, though briefly and with many imperfections, that the course of our nation during the seventy-seven years since the Revolution has been one of steadfast, and essential, and solid improvement in things material and immaterial, physical and mental, practical and ornamental; in business, travel, dress, homes and home comforts, wealth, morals, intellect—in short, in every department of human activity.

BOOKS.

CHAPTER I.

BOOK TRADE—PUBLISHING—JOBBING—RETAILING.

"YANKEE curiosity" is frequently a subject of remark with the flippant writers and travellers of the old world, and if not always urged as a reproach, it is not seldom referred to in a deprecating sense by those who do not appreciate the immense activity of intellect of which it is one manifestation. There is no doubt either of the existence of the alleged curiosity, or that it sometimes exhibits itself in a ludicrous light; but it also manifests itself in the indefatigable investigations to which nature and art are continually subjected by the ever inquiring American mind. There result from those investigations, not the dreary metaphysical theories that are evolved from German contemplation, but those countless inventions, improvements, and applications of mechanical principles that are every year recorded in the patent office, and the effects of which are seen in every department of industry. The religious and political assemblies; the amusing, instructive, and scientific addresses of the lecture-room; and the marvellous circulation of the public press, all reflect that thirst for knowledge which is a part of Yankee curiosity. This, however, gives a still stronger evidence of its vigor in the book trade, which, in the United States, shows an extent of sales that no other country can hope to approach. It is based on the universal ability of the people to read, and on that "curiosity," or thirst for knowledge, which induces them to do so, accompanied by means to purchase books. The word "means" comprehends not only greater wealth on the part of the purchaser, but reduced prices for the books. The existence of 20,000,000 of people who can all read, composes an immense market for books, that must be supplied; and happily, busy intellects have written, while the mechanical processes of publishing have been developed in a manner to supply the demand. In order to compare the book market of the United States with that of Europe, we may refer to the census returns of 1850. That informs us that in that year there were 19,553,068 white persons in the country. Of these, 9,421,557 were over 20 years of age, and of these, 962,898 could neither read nor write, of whom 195,114 were aliens. We now turn to France, and we find that there were 17,000,000 persons over 20 years of age; and of these, 3,400,000 only could read and write, and the remainder, 13,600,000, could not. In other words, there were, in the United States, 8,458,000 readers of books, against 3,400,000 in France. But there were, also, in the United States, 4,530,845 persons between 10 and 20. Of these, 4,063,046 attended school, and, as a consequence, bought and read school-books. The ratio of these scholars to the whole number who can read and write must be the same in France. Hence there are, in fact, three times as many readers in the United States as in France.

The making of books has kept pace with the increasing demand for them. If we look back to the library of King Alfred, we find that he gave 8 hydes of land for a book on cosmography, brought from Italy by Bishop Biscop. At such rates, none but a king could afford to buy a book; but, on the other hand, there were few, even among nobles, who could read if they had them! There was no market, and no manufacture. As the art of reading became so far progressive that the old barons could sign their names, instead of punching the seals of instruments with their sword pummels, some little demand for books sprung up, but at enormous rates. The state of the book market, when literature began to dawn in those iron ages, Scott makes old Douglas describe in terse phrase:—

> "Thanks be to God! no son of mine,
> Save Gawain, e'er could pen a line."

A modern canvasser would not have gotten his name in advance for numbers to be left. Louis XI., of France, in 1471, was obliged to give security and a responsible endorser to the Paris faculty of medicine, in order to obtain the loan of the works of an Arabian physician. The art of printing, which was introduced into England in 1474, had an important influence upon the production of books, and this, probably, was the cause of a greater spread of learning, that reacted upon the demand. The Bible was the most commonly used, and these, in noble houses, with heavy covers and clasps, were chained to shelves and reading-desks. In the sixteenth and seventeenth centuries, books were mostly folio and quarto. But the dimensions of books decreased as they became popularized, and this was in proportion to the spread of learning among the people. This went on gradually, until both the market and supply were considerable, up to the eighteenth century. With the colonies of America—among whom both religious and political views were based upon general education—schools became an institution, and in New England the use of them an obligation. From that time the market for books increased with the numbers of the people. The first bookseller mentioned is Hezekiah Usher, of Boston, in 1652; and his son, John Usher, is mentioned by a writer in 1686, as very rich, and as having "got his estate by bookselling." That books, in the early part of the century, were by no means abundant, or easy to be got at, is evident from what Franklin tells us of the difficulties he encountered, and the great advantage he enjoyed, in having access to the library of a merchant. The most of them were imported at, no doubt, such expense as confined their general use to the better classes. Some years after, viz., in 1732, at the time Franklin commenced the publication of "Poor Richard's Almanac," in Philadelphia, a Boston bookseller advertised as follows:—

"Whereas it has been the common method of the most curious merchants of Boston to procure their books from London, this is to acquaint those gentlemen that I, the said Fry, will sell all sorts of account books, done after the most acute manner, for 20 per cent. cheaper than they can have them from London.

"For the pleasing entertainment of the polite parts of mankind, I have printed the most beautiful poems of Mr. Stephen Duck, the famous Wiltshire poet. It is a full demonstration to me that the people of New England have a fine taste for good sense and polite learning, having already sold 1,200 of those poems."

This was pretty well for Richard Fry, and we hope he had not then introduced the art of magnifying his sales on paper. That there were a number of booksellers then doing well, is evident from the fact that Mr. John Usher had made his fortune at it 50 years before; and in 1724 there was held a convention of Boston booksellers, to regulate the trade, and raise the price of some descriptions of books. The publication and sale of books increased slowly, until the events of the war began to excite the minds of the public, and works on those subjects were eagerly taken up. The practice was, to some extent, to sell books in sheets, to be bound as the purchaser might fancy—perhaps to be uniform with his library. This is now done only where the work is sold in numbers by subscription. There was then less capital in the trade, and few were disposed to risk the amount required to get out large works of a standard character. The cost was then more than it now is, and the time required much longer to complete and dispose of it. There was then formed, in 1801, the American company of booksellers, and these generally subscribed together in the publication of a work, to guarantee the outlay. There was a sort of union, that regulated the principles of publication, and those who did not conform to these regulations were repudiated. School-books were, as a matter of course, as having the largest and steadiest market, the first that were extensively published. A type of this class of books is Webster's Spelling-Book, which has grown with the country in a remarkable manner. In 1783, with the advent of the peace, Mr. Noah Webster published his elementary spelling-book. The work became a manual for all schools, and its influence has been immense, in giving uniformity to the language throughout the whole country. The "Yankee schoolmaster," who was raised upon that book, has gone forth into every section of the Union, spreading the fruits of that seed of knowledge, as writes Fitz-Greene Halleck:—

> "Wandering through the southern countries, teaching
> The A, B, C, from Webster's spelling-book."

When it was first published, there were 3,000,000 people in the United States; there are now 30,000,000, and there have been sold 32,000,000 copies of the work, or one for every soul in the Union. The spelling-book was enlarged into a dictionary in 1806, and immediately Dr. Webster went on with preparations for a still larger work. This occupied him 20 years of unremitting research, during which the sales of his spelling-book supported his family; and in 1828 the work was published in two quarto volumes. Twelve years after, viz., in 1840, a new edition made its appearance, greatly improved; and the last edition contains a vocabulary of more than 80,000 words. These works have exerted a wonderful influence in giving uniformity to the use and pronunciation of the language. There have been sold more than 200,000 copies of the large dictionary; and the sales of the spelling-book are 1,500,000 per annum by D. Appleton & Co., New York. During 70 years the spelling-book grew into a dictionary superior to what any other nation could boast of in its language, and with its growth, its sales spread in proportion. It is a type of the country itself, and its future is still before it.

The publication of religious works was greatly promoted by the societies formed, particularly the American Bible Society, which was formed in 1816; the Bible Society of Philadelphia in 1808; one in Connecticut in 1809; and also one in Massachusetts. The American Society in New York published, in its first year, 6,410 volumes, mostly Bibles and Testaments. In 1854, the issues were 815,399, and the whole number during 42 years, was 12,804,083 volumes of the Bible. A good copy of the Bible is sold for 45 cents, and a cheaper edition at 25 cents; Testaments as low as 6¼ cents. Contrast this with the Bible copied in 22 years by Alcuin for Charlemagne about 800, and which was sold in modern times to the British Museum for $3,750, and the distance we have gone appears great.

The American Bible Union was organized in 1850, and it has since issued 59,748,804 pages of matter, including Bibles. The publications by other societies have been considerable.

These societies were not a portion of the regular book trade, which continued to be mostly under the association, until the appearance of the Waverley Novels in 1820 to 1830. The competition to which the large demand for these works gave rise, broke down old arrangements of the trade. The publishers thenceforth acted independently. At the same time, the supply of desirable books from abroad, upon which there was no charge for copyright, was much increased; and as all the publishers were upon the same footing in respect to those books, the competition extended only to the mechanical process, reducing its cost to the lowest rates. The capitals of the publishing houses gradually increased, but there was still great difficulty in getting an American book printed. Cooper tells us, in the preface to his Pilot, that so great was the difficulty he encountered in getting a printer to undertake it, that he was obliged to write the last page of the story first, and have it set up and paged, to insure the extent to which the matter would run.

About the period of the establishment of the American Bible House, a number of firms commenced business, some of which have reached great eminence in the trade, such as Harper Bros., and Appleton & Co.

In the publication of books, the expenses are of various kinds, and may be classed under general heads as follows: First, as in the case of Mrs. Glass's recipe for cooking, catch your fish. This is done in various ways. Among the American publishers, until lately, the works to be printed were supplied from abroad, without cost, and the publisher only selected and printed according to his judgment. To decide upon these, readers are employed to read manuscripts, as well as books; but the difficulty of deciding what will "take" with the public is very great. At other times the written matter is purchased for a sum of money of the author, who offers it for sale. Again, an author may have the publishing done at his own risk and expense. Sometimes this is done only to the extent of a few copies to present to his friends. At another time the work is printed at the expense of the publisher, who allows the author a certain sum for every copy sold—the author retaining the copyright. At other times a work may be gotten up by the publisher, employing a number of writers, and paying them by the page for their labor. After any or all these plans have been adopted, and the "matter" is in hand, the expenses are, first, "composition," or setting up the types, from which proofs are taken to be read by the author. When all corrections are made, the type is sent to the stereotyper, who casts therefrom plates, each one containing a page of the book. These plates are sent to the press-room, where they are "worked off," generally on an "Adams press." The paper is purchased according to the size of the proposed book; sent to the press-room; and "wet down," by being opened and sprinkled with clean water. Standing in piles for a number of hours, the dampness diffuses itself through the paper, and it is ready for the press, whence it goes to the binder, leaving his hands ready for sale. Thus the composition and stereotyping, the press-work, the paper, and the binding, are the chief expenditures, requiring large capital. If the work is illustrated, the expense of designs, of engraving and printing, swells the amount considerably. When in the hands of the publisher, there are a number—perhaps from 100 to 200—appropriated to the press, a copy to each editor. Two copies are deposited with the copyright clerk, with his fee. The expense of advertising is then added, and this is according to circumstances. Sometimes large sums are so spent, particularly when the author is himself interested, and has not the means of spreading the book possessed by the large publishers. There are two distinct prices to all books. These are the trade price, charged to those who sell again, and the retail price, charged to the public. This, however, sometimes depends upon circumstances. The city publishers have correspondence with all the booksellers throughout the Union, and to them they send numbers of the books published to sell, and with them show-bills, and means of making the work known. In such cases, the works, if not sold, are returned in a certain time at the expense of the publisher; but, if sold, the trade price is charged.

The number of book publishers in the United States is about 400. There were 385 in 1857, mostly in New York, Boston, and Philadelphia. About thirty years since, a practice sprung up of holding semi-annual sales by auction, called trade sales, which are now regularly held in the cities of New York, Philadelphia, and Cincinnati. These sales are made up by contribution from all the leading publishers, and are attended by retailers as well as wholesale buyers. That opened in New York, September 4, for the fall sales this year (1860), was very full. The catalogue comprised 522 pages, and probably cost $1,500 to get out. The sales reached over $500,000. It did not comprise, however, the books of Harper & Brothers, that firm holding a sale on their own account. This mode of selling diffuses the publications through all branches of the regular trade. This is divided into publishers, jobbers, and retailers. The number of regular booksellers who distribute the productions of the publishers is about 6,500; but the number of those who keep books as one item of a general assortment of goods is very large, and cannot be ascertained exactly. The jobbers buy in quantities of the publishers, and consequently obtain them at rates which allow them to supply retailers at the publisher's, or trade price, and still realize a profit. The retailers are to be found in every town and hamlet of the country; almost every country store has some books among its wares. Through these regular channels the books descend, from the great reservoir of the publishers to the little lots that are brought to the view of the reader. Although the large publishing houses issue any description of work that will pay, yet the increasing extent of the trade has led to subdivision in bookselling; such as those who keep foreign books only, and import any work in any language to order. These are, again, divided into French, German, and English. There are also sellers of medical books, of law books, of religious books, of scientific works, and miscellaneous productions.

It is obvious that this "regular trade" depends upon the demand from the public; that the readers shall come to the book. To do this, it is necessary that the public shall know, first, that the book exists, and second, that it is one in which they have an interest. To spread this information is the most difficult problem; and it is done by the regular trade through advertising in the papers, by means of the editorial notices in exchange for the presentation copy, and by means of placards spread plentifully in public places, particularly in all the stores where the books are for sale. These are means which are applicable only to the first appearance of the book, since the notices and placards are promptly succeeded by others, and the announcement forgotten by the public. If the work takes, and creates a sensation, the sale continues large. This sensation is sometimes artfully brought about by means of political or other organization, according to the nature of the work. Sometimes an immense number of copies of most worthless matter is thus put upon the public.

The enormous difficulty of making any work known to the public, can be appreciated only by those who have tried it; and this difficulty increases in proportion to the number of people and the extent of the country. The fame of a really good work spreads among those only who are interested in the matter of which it treats, and not at all among those who are either not interested or opposed to its teaching. Hence religious, scientific, and political publications form, as it were, parishes within which the work may circulate. From these circumstances arise the thousand and one modes adopted by publishers to arouse public curiosity, and sometimes with very great success. The publication of school books has at times assumed an extraordinary character. The object of the publishers is, of course, to create for them a popularity with the schools, and to have them introduced by any means. This desire has induced many to send agents to various schools, and substitute new books for the old, without charging for the difference in value. A system so ruinous cannot, of course, last long. The competition in school books by many ways, direct and indirect, greatly enhances the cost of education, by causing children, who cannot always afford it, to buy new sets frequently.

Another mode of selling, recently introduced with some success, is the "gift-book" system. By this plan, the books are sold at the regular retail price; but with each and every book sold, some article of jewelry is presented to the buyer. Every book in the store being numbered when the buyer selects, he receives the jewelry which bears a corresponding number. This numbering, of course, takes place preparatory to the sales, and is so arranged that the jewelry is apparently of greater or less value, according to the work. The actual value of the jewelry is really very small, not so much as if a small sum were deducted from the price of the book, as a commission on its sale. There seems to be nothing objectionable in the mode of selling beyond the sort of chance which the buyer is led to suppose he plays for jewelry in making a purchase. The book is generally worth the money. It has in a few cases been very successful, so much so as to have broken down the old-fashioned barriers of legitimacy, and taken rank with the elder magnates of the trade; Prof. Ingraham's "Pillar of Fire," "Throne of David," etc., which were thus introduced to the world, being among the largest selling books of the day.

The sale of old or second-hand books is also a very extensive branch of business in the great cities. It is obvious, that where book-buying and book-reading are so prevalent, as is the case among all classes of the people here in the United States, there must exist a large number both of public and private libraries, and that these, through death, and the continual vicissitudes that attend families, are being constantly broken up. If every family has a library of greater or less magnitude, sooner or later there is a sale, and it generally comes to the hammer in one or more of the large book auctions that are held almost nightly. These auctions are attended by the public, but mostly by the second-hand booksellers. Of these there are numbers in those parts of the city frequented most by strangers. They are the same as the "book-stalls," so familiar a feature in the literature of England and the countries of western Europe, as they are in fact a necessity everywhere. In New York, the stall-keeper generally procures, for a rent of $50 to $150 per annum, according to circumstances, the privilege of putting up a set of shelves against the outside of some store corner. These shelves shut up at night, like a large window, and the shutters are fastened by iron bars that have padlocks. These shelves contain a small stock, from $300 to $400 value, of the most saleable books that can be picked up cheap at the auctions of books, or of household furniture of families breaking up, or purchased of needy persons who offer them. It follows that the stalls, or stands, become the receptacles of all old books, and sometimes very rare and valuable ones that have gone out of print, and can be found nowhere else. A great many valuable foreign books are found here, having been disposed of by immigrants who become necessitous. A large number of books are sold from these stalls, which also keep much of the current new literature. The keepers—some of them—soon become possessed of sufficient capital to open whole stores; and there are now in New York, and most cities, some quite large stores that have rare collections of old books. This business has also extended across the water, so that persons of more scholarly tastes have, through these agencies, access to the reservoirs of old books to be found in the cities of Europe.

A distinct class of publishers are those who issue books by subscription, or send the books to the reader, instead of waiting for him to come to the book. These are of two classes—those who issue books in numbers, and those who issue complete works. We have spoken of the great difficulty in bringing the existence of a work to the knowledge of the individual reader. The regular trade seek to do this by general appeals through the public press. The publishers by subscription take the more direct and energetic method of appealing personally to each individual, showing him the work, stating its merits, and enlisting his judgment. Harper's "Illustrated Bible" was published in this way, the number of issues being known in advance, and the edition reached 25,000 copies, at $20 each, or $500,000. The mode of publishing by numbers, involves the employment of a great number of agents, and the success of the enterprise depends in a great measure upon these. Much dissatisfaction has grown out of this plan of sales, arising from the nature of it. The numbers will sometimes far exceed what the agent promised to complete the work; and many other contingencies arise, not anticipated by the buyer. The contracts made with the agents are various, according to the expense of the publisher. The numbers are delivered at uncertain times; and, when completed, the expense is generally much more than was looked for by the subscriber. The numbers, if then all preserved, are to be bound at greater outlay of trouble and expense. It not unfrequently happens in this class of publications, that the subscribers drop off so fast, from disappointment and dissatisfaction, that the work is abandoned, unfinished, by the publisher.

The plan of combining the two systems is now coming into favor. It is to publish a complete work of a high character, and sell it by agents. This is found to be far the most satisfactory. The agent accosts the individual reader with the complete work in his hand; the buyer inspects it, and pays the price, at once completing the transaction on the spot. A well-organized system of canvassers will thus gradually bring a deserving work to the notice of the whole people by personal appeal. The work does not fall stillborn because the first notices have failed to attract readers; but its sale grows steadily with its increasing reputation, since the publisher, looking to a continued sale, takes care that it shall be of such a character that its reputation will grow as the work spreads. This plan is so obviously useful and proper, that many important works, published originally on the trade plan, are now being withdrawn and placed in the hands of agents, who, being responsible and intelligent men, bring the book to the notice of the reader directly. This system, which had met with considerbale success, previous to the war, has, since that time, been pushed with great energy, and the amount of sales of popular works has been enormous. Of histories of the war, sold by subscription, the sales of three considerably exceeded one hundred thousand copies each, and three others approached that figure, while several others sold 30,000, 40,000, or 50,000 copies. Of other books, "The Nurse and Spy" sold over 160,000 copies; "Life and Death in Rebel Prisons" about 75,000; "Raymond's Life of Lincoln" 70,000; Richardson's "Field, Dungeon, and Escape," over 100,000; and Junius Browne's "Four Years in Secessia," above 60,000. Many other books, having a more or less direct connection with the war, sold very largely.

In the period from 1848 to 1857, works of fiction, both from known and unknown authors, had an immense sale. Mrs. H. B. Stowe led the way in this matter, her "Uncle Tom's Cabin" selling to the extent of 310,000 copies here, and nearly a million and a half copies in England; of "The Lamplighter," by Miss Cummins, 90,000 copies were sold; of "Fern Leaves," 70,000; "Alone," by "Marion Harland," over 50,000; "Fashion and Famine," by Mrs. Ann S. Stephens, 30,000; "Wide, Wide World," and "Queechy," by Miss Warner, nearly 100,000 each, &c., &c.

The circulation attained at times by sterling and standard works is very large, as follows :—

Irving's Works	1,100,000	copies.
Irving's Sketch Book	98,000	"
Longfellow's Hiawatha	43,000	"
Hugh Miller's Works	50,000	"
Grace Aguilar's Works	157,000	"
Amer. Cyclopædia, Appleton's, 16 vols., 8vo.	33,000	sets.
Benton's Thirty Years' View, 2 vols., 8vo.	98,500	copies.
Kane's Arctic Voyages, 2 vols., 8vo.	65,00	"
Harper's Pictorial Bible, $20	25,000	"
Goodrich's History of all Nations, $7	30,000	"
Dana's Household Book of Poetry	100,000	"

Kane's Voyages paid $65,000 copyright. The sale of Prescott's Histories was very large, giving, it is said, 50 cts. copyright. The sales of school books surpass in quantity those of all other books.

We have referred to the very large sales of Webster's Spelling-books and Dictionaries. The aggregate of these to the close of 1865 exceeds fifty millions of volumes. For several years before Messrs. Cooledge & Brother relinquished the business (in 1857), their sales of Webster's Speller were very nearly one million copies per annum. Messrs. Appleton became the publishers in 1857, and though for several reasons their sales have, a portion of the time, been smaller than Cooledge's, yet their aggregate sales, to the close of 1865, were 6,390,000 copies, and their present rate of issue is about 1,300,000 per annum. This house have also sold about one and a half millions of Cornell's Geographies, and nearly 700,000 copies of Quackenbos' Series of Text-books.

Messrs. E. H. Butler & Co., of Philadelphia, the present publishers of Mitchell's Geographies, sell about half a million copies annually, and the aggregate sale in the twenty-five years since their first publication has been about 7,500,000 copies. Smith's Grammar, also published by this house, sells at the rate of 100,000 copies a year. Two and a half millions of copies of it have been sold.

Messrs. Ivison, Phinney, Blakeman & Co., one of the largest houses in the school-book trade, sell annually of their Sanders' Readers and Spellers over one million copies, and of their other text-books about 1,300,000 more. The Sanders' Spellers and Readers had been sold up to the close of 1865 to the extent of more than twenty millions of copies; Robinson's Mathematics, two millions of copies; Colton's Geographies, over one million; Fasquelle's French, and Woodbury's German Series, half a million copies.

Messrs. A. S. Barnes & Co., also largely engaged in the school-book trade, have sold over five millions of volumes of Davies' Mathematical works, one work (the old "School Arithmetic") having sold to the extent of 1,250,000 copies. They have sold of Mrs. Willard's Histories 350,000 volumes, and over 400,000 of Clark's Grammars, a still larger number of Parker and Watson's Readers and Spellers, and of Monteith and McNally's Series of Geographies; and the entire annual sales of text-books by this house reach nearly two millions of volumes.

Messrs. Sargent, Wilson & Hinkle, of Cincinnati, the publishers of McGuffey's Readers and the Eclectic Educational Series, sell annually about 2,000,000 volumes of these books.

The sales of Comstock's text-books of Philosophy, Chemistry, &c., Olney's Geographies, and Bullions' Latin and Greek text books, now published by Messrs. Sheldon & Co., has been very large. Of Comstock's Philosophy over 1,100,000 copies have been sold, and about 2,200,000 of Olney's Geographies.

Messrs. Harper & Brothers have combined with the largest list of miscellaneous publications in the country a very extensive issue of school text-books of all kinds, to which they are constantly making additions. They also publish two of the most widely-circulating periodicals in the United States. They employ an active capital of about one million dollars in stock and machinery, expending more than $600,000 per annum for paper alone. They run forty-one power presses, thirty-five of them Adams presses, and many of them night and day. They have published 2,200 works, in over three thousand volumes, about equally divided between original works and reprints. Their issues of bound books amount to more than three millions of volumes per annum.

Messrs. Lippincott & Co., of Philadelphia, publish a large list of books, but their most important business is the jobbing of books to booksellers throughout the country. Their business in favorable years amounts to from five to seven millions of dollars. It is estimated that, on an average, ten tons of books are sent out of their establishment daily.

The sale of music books is very large. Some of the smaller music books for schools and Sunday-schools have sold to the extent of more than a million of copies, and the "Carmina Sacra," a popular collection of church music, has had a sale of over 500,000 copies. A single house, Messrs. Mason Brothers, with whom the sale of music books is but one department of their business, sell over 300,000 volumes per annum.

The publication of agricultural books has been made a specialty by one or two houses, and one of these, Messrs. Orange Judd & Co., who are also the publishers of the agricultural paper of largest circulation, sell very large quantities.

The following table gives the number of works of the different classes specified, published in each year or period mentioned.

	1855. Works.	Jan., 1856, to Mar., 1858. Works.	1864. Works.	1865. Works.
Educational	139	748	47	67
Natural History, Agriculture, and Science	65	160	241	189
Biography	124	218	104	150
Essays, Poetry, and Fiction	776	1,667	407	465
Theology and Religion	531	842	165	129
History	76	231	143	191
Juveniles	92	117	428	312
Music	42	154	65	87
Voyages and Travels	29	157	30	25
Medicine	29	138	54	55
Drama	29	28	..	..
Classics	13	61	10	10
Mechanical Sciences	23	80	36	42
Miscellaneous	94	290	112	116
	2,162	4,886	2,028	1,802
Of which were Reprints	649	1,492	301	276

Mr. S. G. Goodrich (Peter Parley), in his "Recollections of a Life-time," gave a table of the value of books manufactured and sold at different periods in the United States. We add to that table an estimate of the values of each class of books sold in 1860, based upon the census returns for that year:—

	1820.	1830.	1840.	1850.	1856.	1860.
School Books	$750,000	1,100,000	2,000,000	5,500,000	7,500,000	10,100,000
Classical Text-Books	250,000	350,000	550,000	1,000,000	1,600,000	2,000,000
Theological and Religious	150,000	250,000	300,000	500,000	650,000	1,000,000
Law	200,000	300,000	400,000	700,000	800,000	900,000
Medical	150,000	200,000	250,000	400,000	550,000	700,000
All others	1,000,000	1,300,000	2,000,000	4,400,000	4,900,000	6,500,000
	2,500,000	3,500,000	5,500,000	12,500,000	16,000,000	21,200,000

The aggregate of 1865 was probably four or five millions of dollars beyond this, not because there had been any very considerable increase in the number of books manufactured and sold, but that, owing to the expansion of the currency and the consequent advance in the cost of labor and material, the cost of production and the market price of books was from 33 to 50 per cent. higher than in 1860.

The reading portion of the population of the country is increasing at present in a ratio somewhat more rapid than the general growth of numbers in the nation. According to the census of 1860, there were 1,126,575 whites and 91,736 free colored persons over twenty years of age who could not read or write. There were also probably not less than 3,500,000 slaves who could not read or write. Since the emancipation proclamation of January, 1863, large numbers of the freedmen have been earnestly engaged in acquiring a rudimentary education, and before 1870 it may safely be calculated that nearly two millions of this class will be able to read. Great efforts are making all over the country to bring into the schools the very large class of children who have hitherto not received instruction; and the census of 1870 will doubtless show full thirty millions of people in the United States capable of reading intelligently. All this creates a larger demand for books, and makes a market for instructive reading probably unequalled in any country on the globe.

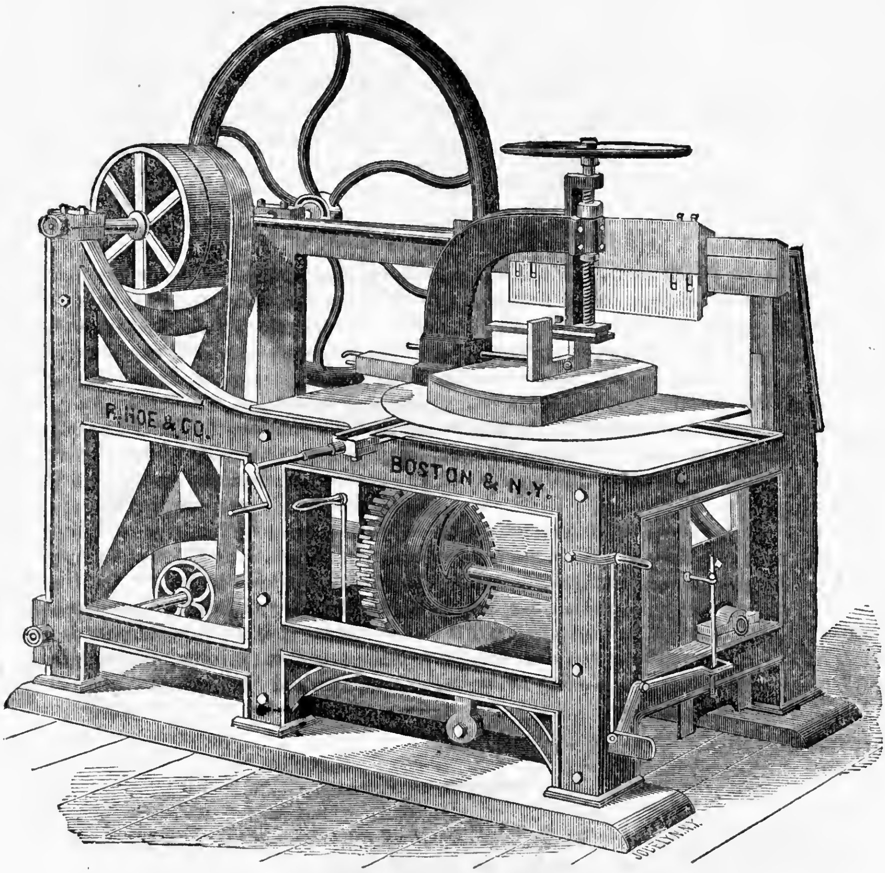
BOOK-BINDING.

CHAPTER I.

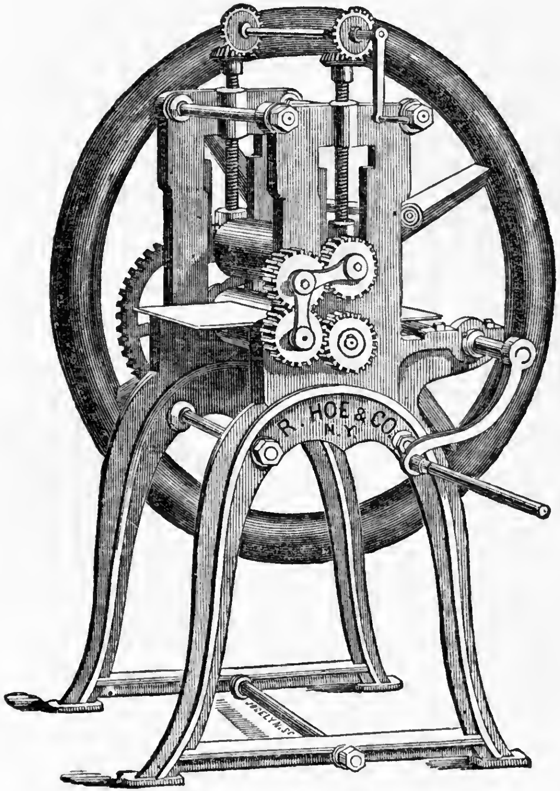
BOOK-BINDING.

The binding of books is an art probably older than the art of book printing itself, since there existed a necessity for confining the manuscripts and scrolls that were the medium of preserving thought in ancient days. Even that was a progress, however; since the slabs of stone that bore the divine commandments could not have needed binding, nor could the rocks and bricks, on which the Babylonians traced their ideas, have well been bound. The different modes of conveying and preserving ideas, that were adopted in different ages and nations, caused recourse to be had to almost all materials according to exigencies, and these were preserved according to the exigency.

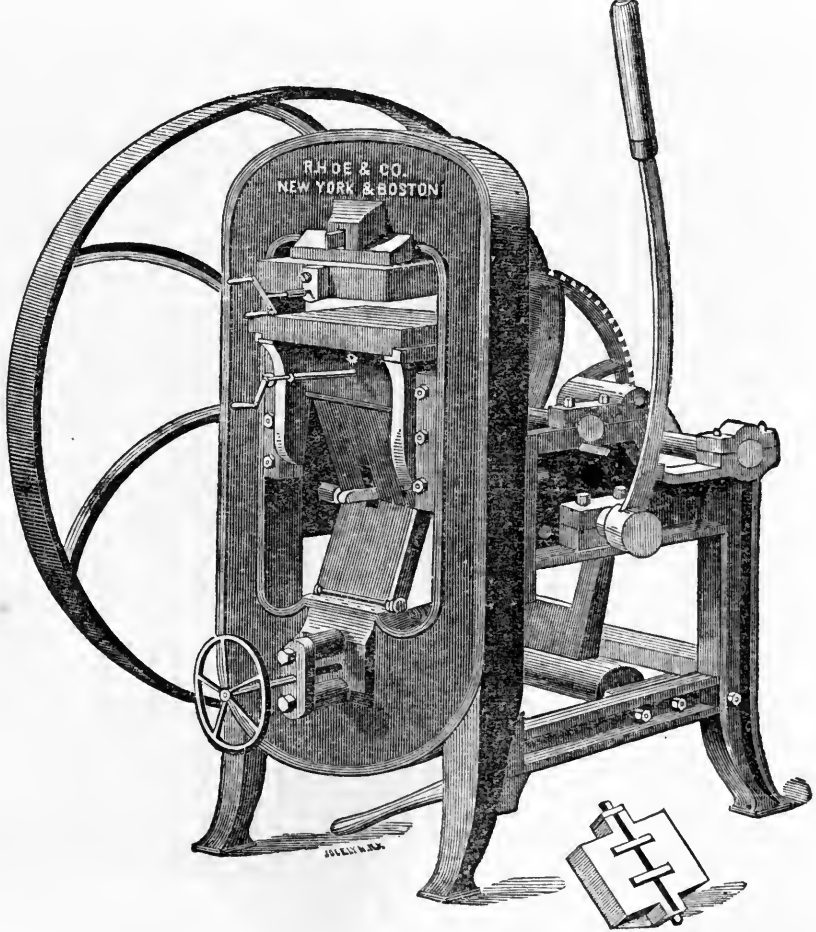
The books of wood, or metal, were bound



PATENT BOOK AND PAPER TRIMMING MACHINE.



BOOK ROLLING MACHINE.



EMBOSSING MACHINE.

by fastening the sheets of which they were composed at the backs by hinges. When parchment and paper succeeded, the backs of the sheets were sewed together, and the covering varied as the arts progressed and materials were adopted. The art itself has made material progress only of recent years. It came to be a separate art only when the discovery of printing, by multiplying books, made the binding of them too laborious for those who did it when years were spent in copying one book. In 778, Alcuin, a monk, native of England, commenced to copy the Bible, and finished it 800, for the Emperor Charlemagne. When twenty-two years was required to make one copy, there was not much business for the binder, whose labors commenced with those of the printing press. While books were still comparatively dear, the binding bore a small proportion to the cost. Of late years, the tendency has been toward neatness and durability. The requisites of a well-bound book are solidity, elasticity, and elegance. Among the nations of Europe, the French take the lead in artistic taste, but the English excel in the expensive finish of the more costly editions. In the United States, machinery is employed, more than elsewhere, to attain the desirable result at less cost.

Books are printed upon paper of various sizes, which formerly were three, called royal, demy, and crown. The book took the size indicated by the paper used. The demy size was mostly used, and the sheets were folded a greater or less number of times. Thus, folded once in the middle, gives two leaves, or four pages, and is called folio. When the sheet is again folded, it gives four leaves, or eight pages, and is called quarto; folded again, the result is eight leaves, or sixteen pages, and is octavo. By folding into twelve leaves, or twenty-four pages, we make a duodecimo; and if into eighteen leaves, or thirty-six pages, it forms octodecimo. Of a size less than this, the books are pocket editions. The sizes of books thus formed are generally designated as 4to, 8vo, 12mo, 18mo, 24mo, 32mo, 48mo, etc. The size of the printed page corresponds with the size of this fold. Thus, the size of this volume is royal octavo, being printed on paper a size larger than demy, or ordinary octavo. Each sheet of paper contains eight leaves, or sixteen pages; and there are fifty of these sheets in the book. Thus, the type is composed of sixteen pages in one "form," and one side of a double sheet receives the impression of those sixteen pages by one movement of the press, and then, being reversed, receives an impression on the other side from the same type. As the sheets leave the press they are hung up to dry, when they are placed under a hydraulic press of great power. They are then counted out into quires of twenty-four sheets each, and sent to the binders. There, in the folding room, the sheets are folded by girls. The object is to fold down the pages, so as to fall one upon the other with perfect accuracy, since upon this the proper binding of the book depends. The whole edition of sheets is folded with great rapidity by one girl. Some of these will fold 400 in an hour, but the average may be 300. A folding machine has lately been introduced, by which, it is said, two girls will do as much as eighteen by hand. Each sheet folded is a signature, and generally these are designated by some figure at the bottom of the first page of each sheet. The folded sheets are laid in piles, in the order of these signatures. The "gatherer" then, with the right hand, takes them, one by one, and places them in the left, until a complete set, or full book, is collected. This is performed so rapidly, that it is said an active girl will gather 25,000 in a day. After this, the sheets are "knocked up" evenly, and pressed in a hydraulic press; but recently, a machine has been introduced, by which time is economized. The engraving, on another page, shows the figure of that by Hoe & Company, which is the favorite for embossing, as well as compressing. The machine runs slower for smashing. The size, 15 by 17, weighs half a ton, and is sold at $400. The book is now examined by the collector, in order to detect any error of arrangement in the signatures. The books then go to the sawing machine, where, being properly arranged, fine circular saws cut fine indentations in the books, to admit as many pieces of twine, to each of which each sheet is sewed. This is performed by girls, at a table appropriated for that purpose. When the sewing is complete, the "end papers" are pasted on the book.

The books next are trimmed by having the edges cut by a machine. To effect this they are piled upon a platform, under a large knife, which, being worked by a crank, descends, like a guillotine, cutting a large number at once. The figure of the trimming machine is given on another page. The knife used in this machine is 21 inches long, and has a short, vibratory movement; thus combining the advantages of the long stationary knife with those of the ordinary plough. The work to be trimmed is placed against the adjustable guide on the bed of the press, in front of the knife, and is compressed by the wheel and screw. The table, on which the press stands, is adjustable in all directions, and is also self-acting, so that, when thrown into gear, it rises to the required height and disengages itself—thus preventing injury to the knife—and then drops down to its original position. Three sides of the work can be successively presented to the action of the knife, by simply turning the press to the quarter and half-turn stops. The machine can be worked either by hand or steam power, and can be easily adjusted to cut any size from 3 to 18 inches long, and from 1 to 15 inches wide. This machine has been in operation some twenty-five years. The backs now receive a coat of glue, to impart firmness. They are then, by the "backing machine"—which is an improvement of some ten years' standing—rounded on the back, and receive a groove for the boards. They are then cut on the ends. A piece of muslin, nearly as long as the book, and extending an inch over the sides, is then pasted on, and the book is ready to receive the boards, or cases. These consist of mill-boards cut a little larger than the book, and cloth cut large enough to turn over all. The cloth is glued, and one board is placed upon it. The corners of the cloth are then cut, and the edges turned down and rolled smooth. It is then dressed, when it goes into the hands of the stamper. The stamping, or embossing, is done in a press, from dies previously prepared. When the sides are lettered, the letters are engraved in metal, and impressed upon the cloth. Gold leaf is placed upon the cloth, and the heat of the stamp causes it to adhere in the desired places. The book is then pasted on the sides, placed in the covers, and pressed, when it is a book bound in cloth. The stamping, or, as it is sometimes called, the arming press, will perform, almost instantaneously, what formerly would have required a week. This has been brought about by a combination of the arts—designing, die-sinking, and application of machinery. When a particular design is required upon a book, the artist draws it upon paper; it is then cut in brass, or steel, and this block in the press embosses a great many covers at a blow.

With books bound in leather, the process is not so expeditious. In order to insure solidity, the books were formerly beaten upon a stone with a broad-faced hammer. They are now squeezed between steel rollers, to effect the same object. The engraving of the rolling machine, in another column, will give a good idea of the one that is now used by bookbinders, in place of screw and hydraulic presses, for pressing folded sheets. The work is placed on an iron table in front of the rollers, between plates of iron, pasteboard, or leather, and passed through the machine as often as necessary. The adjusting screws are geared together, so that the rollers are always parallel to each other. It is strongly geared, and may be run by either hand or steam power. The sewing is done in a more substantial manner. The volume, placed in the laying press, has its back hammered very carefully, so as to spread the sheets on each side of the boards without wrinkling the inside, and the work proceeds until it leaves the hands of the finisher a perfect model. It opens easily, and lies flat out without any strain, and its hinges are without crease.

In gilding the edges of a book, they are scraped smooth and covered with a preparation of red chalk, as a groundwork for the size, which is formed of one egg to half a pint of water. The gold is laid on the size, and then burnished with a bloodstone.

The embellishment of book covers is called "tooling," and, when plain, blind tooling. By this latter, sometimes glossy black indentations are made to contrast tastefully with the rich color of the morocco. This is performed by wetting the morocco, and applying the tool in a heated state.

There has been a method invented by which the leaves of a book are fixed together with India-rubber instead of sewing. The sheets being cut evenly, receive a solution of the material; as each leaf is held only by the rubber, the book is made to lie very flat. This does not appear to have come into much favor. The fashion of imitating antique styles of binding has led to the use of wood instead of pasteboard, in some fancy styles of costly books. It is only a passing caprice, since wood cannot supplant the pasteboard.

WRITERS OF AMERICA.

CHAPTER I.

THEOLOGIANS—STATESMEN—NOVELISTS—HISTORIANS.

With the settlement of the colonies, there were necessarily but few attempts at literary productions. The Pilgrim Fathers brought with them many books from their native land, but these were mostly bibles and theological works. They were persons whose minds bore the strongest religious impressions. In them the sentiment of piety approached austerity; and they were not unfrequently charged with fanaticism. The time they had to devote to literature was wholly absorbed in the perusal of those devotional works that sustained and illustrated that faith which they had made their rule of action under all circumstances, and which they lived up to with all the sternness of their bold and decided characters. They had encountered the perils of the wilderness to rear free homes; and they were determined, also, to make them temples to the Lord. It is not to be inferred that literature and the finer arts of life were, even at that remote period, foreign to the people of the country. The founders of all the colonies were among the most elegant writers and accomplished scholars of the time. Such men as Raleigh, Baltimore, Penn, Oglethorpe, Smith, Winthrop, and a crowd of others, would have been ornaments to the most brilliant circles of any country: with them and their successors, education and religion were the foremost objects of attention. But among men so busy with the work in hand, as to declare "that the laws of God should govern until they had time to make others," much general literature could not find cultivation. Theological works were the staple, and these were produced with an independence of thought and a vigor of argument which enchained their adherents and astonished the opponents they had left at home. As the laws of God were the models of government, so were the inspired writers the only guides for the faith of that steadfast people. Those original and strong thinkers were also powerful and prolific writers; and some of them won the first place, in the estimation of the learned, as theologians. Cotton Mather, who had no equal as a scholar, wrote 382 works, of one of which, "Essays to do Good," Dr. Franklin remarks: "It perhaps gave me a tone of thinking that had an influence upon some of the principal future events of my life." Thus was one of the most powerful minds of the eighteenth, or, indeed, any century, impressed with the vigorous style of a colonial author. The simple missionary, Jonathan Edwards, a large portion of whose useful life was spent on the confines of civilization, produced works which, according to Dr. Chalmers, a century afterward, stamped him as "the greatest of theologians," and called from Sir James Mackintosh the remark that, "in power of subtle reasoning he was, perhaps, unmatched among men." Mr. Edwards succeeded to the presidency of the New Jersey College, and died in 1758. He was the type of the theological age of the country. His work became the standard of orthodoxy for enlightened Protestant Europe. That voice, which was indeed "one crying in the wilderness," became the textbook of the most learned divines of the old world.

As the colonies advanced in wealth and numbers, more diversified views naturally sprung up, but the books of amusement and instruction were mostly imported from England. There was little in the rude struggle with the wilderness to foster an independent school of literature, which flourished much better in England, where existed all the resources of libraries and information. That bold and strong natural intellects, like that of Dr. Franklin, should grow up, was almost a necessity of the vigorous race that produced him; and his works were at once appreciated, because they reflected the genius of the people. The clear, strong sense of "Poor Richard"struck a responsive chord in every heart, and there was little reason to be surprised that the almanac reached a circulation of 10,000 in 1735. The school system that had been early established by the colonists, laid a broad foundation for future literature. To make all classes of persons readers, was to create a demand for books that must sooner or later be gratified; and writers and speakers were sure to find the avenue to the public mind when the occasion offered. This presented itself when the disputes with the mother country began to take a serious form. Those events stirred the depths of feeling in all ranks and classes, and an army of orators rose into public view at once, to fan the flames of discontent into a conflagration that ultimately consumed the loyalty of the colonists, and left their original sturdy independence of character to assert itself in political separation. The eloquence of Otis, of John Adams, Patrick Henry, Samuel Adams, of Pinckney, of Rutledge, and others, live for us only in the effects they produced, and of which our institutions are the manifestation. Unhappily there were then no means of reporting by which those soul-stirring speeches could be preserved, and we have but a few sketches of Fisher Ames and Patrick Henry. While those illustrious men roused the nation with their voices, numbers aided with their pens; among these, Thomas Paine's pamphlet, "Common Sense," and his series of tracts entitled "The Crisis," produced a marvellous effect. The papers in themselves, at the present day, give no evidence of great ability, but they were fitted to the epoch with extraordinary aptness; and tradition assures us that each, on its appearance, produced a *furore* difficult to conceive. The epoch was one of intense excitement; and those papers held up clearly the dark side of kingcraft to a people in whose minds republicanism was making rapid growth. The pamphlets and papers that circulated at that period were, some of them, marked with great learning and power. The correspondence then carried on among public men, and which has since been collected and given to the public, surpasses in learning, political sagacity, grace of diction, vigor of thought, and power of expression, any thing of the kind that ever before appeared in any country. We, that read those papers by the light of seventy years of subsequent history, are better able to appreciate the extraordinary ability they evince. The letters of Franklin, Jefferson, Jay, Adams, Washington, Morris, and others, will, while the nation lasts, be preserved as models of literary excellence. The publication of the "Federalist" was an era in political writing; the work was the joint production of Alexander Hamilton, James Madison, and John Jay. The papers were signed "Publius," and their object was to urge the importance of union in the adoption of the constitution. The statesmen of Europe regarded the work with admiration; and the *Edinburgh Review* remarked: "It exhibits an extent and precision of information, a profundity of research, and an acuteness of understanding which would have done honor to the most illustrious statesmen of ancient or modern times." In his work on "Democracy in America," De Tocqueville remarks that "it ought to be familiar to the statesmen of every nation." If the reader of the present day is struck with the clear-sighted sagacity that the papers evince, how much greater is our admiration when we reflect that those statesmen were reared in our colonial state, without any of that experience which has shed its light upon us. The wisdom they displayed was the result of their own profound deliberation. The writings were an interchange of views between a race of intellectual giants who were giving birth to a nation. The works of James Madison comprise fifteen octavo volumes of 600 pages each, and are distinguished for soundness of reasoning, and great sagacity. The report of Hamilton, as secretary of the treasury, on banks and manufactures, was of great celebrity; and, as far as it described the existing state of affairs, was valuable. It is to be borne in mind that he was one of a race of Titans who were organizing a nation of a kind that never before existed; and if the views he advocated have not been justified by the experience that the nation has wrought out in the last seventy years, it is not surprising; nor can his great wisdom be taxed on that account any more than the vast ability of Patrick Henry be questioned because he opposed the new constitution. The writings of Jefferson, the statesman and patriot, were of a nature more durable and statesmanlike than the effusions of Hamilton, which were more the products of a subordinate executive officer than a directing head. The pen which wrote the Declaration of Independence and the state papers, wrote, also, the "Notes on Virginia," the autobiography, correspondence, and Anas, included in the four volumes of his works published after his death by Mr. Randolph. Of the same age as these eminent statesmen, was John Marshall, the celebrated chief justice of the United States. Judge Marshall appeared as an author in 1805, when he published his "Life of Washington." The introductory volume, being a "History of the Colonies planted by the English on the Continent of North America," was published separately in 1824. In 1832 an abridgment of his "Life of Washington" appeared. Mr. Marshall occupied the posts of minister to France and secretary of state, and his state papers commanded admiration as of the very highest order. His appointment and career as chief justice seems to have been one of those special providences that have so often manifested themselves on behalf of the United States as a nation. The powers of the Supreme Court are such as were never before, by any people, confided to a judicial tribunal. It determines, without appeal, its own jurisdiction, and that of the legislature and the executive. It is not merely the highest court in the whole country, but the constitution of the country is in its hands. This tribunal was to decide upon every question that should arise under the new constitution, in relation to all the rights and powers of each department of government, and also those of all the states. A want of ability or of integrity upon the part of the court, possessed of such power, might, by vicious interpretation, have destroyed the whole fair fabric that had been raised with so much care and wisdom. This immense responsibility devolved upon John Marshall, and nobly did his great capacity and sterling integrity meet the occasion. During thirty-four years, that great man decided every question that arose; and, so to speak, fairly launched the constitution and government upon the stream of time.

Cotemporary with Judge Marshall, upon the supreme bench, was Joseph Story, who, born in Massachusetts in 1779, was appointed in 1811, and held the office until his death in 1845, a period of thirty-four years, during twenty-four of which he was associated with Judge Marshall, and displayed talents worthy of such a colleague. His literary writings were published in 1835, comprising sketches of eminent men, and other papers.

The eminent statesmen who have adorned the literature of their country, have been many. Henry Wheaton, Esq., who was born in 1785, served the country in many capacities. He published the most complete work on international law, in 1835. John Quincy Adams, one of the most remarkable men of the country, was born in Braintree, July, 1767, while his great-grandfather, who was born in the reign of Charles II, yet lived. Mr. Adams graduated at Harvard College in 1787, just 100 years after the birth of his great-grandfather. He chose the law as a profession, and began to write for publication over the signature of "Publicola." He replied to some portions of Paine's "Rights of Man." Washington appointed him minister to the Netherlands from 1794 to 1801. He had, also, appointed him to Portugal, but while on his way, his destination was changed to Berlin by the accession of his father to the presidential chair. While in Berlin, Mr. Adams became acquainted with German literature. A series of letters at this period to his brother in Philadelphia, was afterward published. They were of high interest. Subsequently, he was a member of the Massachusetts legislature, and professor of oratory at Harvard University. He was appointed minister to Russia by President Madison. From thence he was transferred to Ghent, to negotiate peace in company with Messrs. Bayard, Clay, and Gallatin. Afterward, he was appointed minister to St. James. He was eight years in the cabinet, and four years president. In 1831, he was sent to the House of Representatives, where he remained until his death, in 1848. He filled more of the high offices of government, than any other man in the country. The largest portion of his published writings consists of orations and miscellaneous discourses of a high character. He gave to the world some essays upon Shakspeare; also, translations from the German of Wieland. In 1832 he published "Dermot Mac Morrogh; A Tale of the Twelfth Century," with some shorter poems, chiefly lyrical. All the writings of Mr. Adams display the most mature scholarship, but the statesman seems to have overshadowed the man, since it is probable that from a less eminent person they would have been more highly considered.

William Wirt was born in 1772, at Bladensburg, Maryland, and became a lawyer in 1792, in which profession he was eminently successful. In 1802, he wrote the

"British Spy," which had a great success. In 1807, he earned a great reputation by his famous speech in favor of Blennerhasset. He produced many works before he gave to the world his extraordinary "Life of Patrick Henry" in 1817. That work has an enduring reputation.

Daniel Webster, that type of New England intellect, was born in 1782, in the same year with Audubon, the great American naturalist. He was a New England farmer's son, of Salisbury, N. H., and pursued learning with the indomitable energy of his race—teaching school as he himself acquired learning—forcing his way to notice, until he acquired a world-wide reputation. His earliest literary performance was in 1806, when 24 years of age, being a Fourth of July oration. He was a contributor to the *North American Review*, and his orations on different occasions were eagerly read in every section of the country. No speeches were more fraught with wisdom and eloquence, or had greater influence upon the public mind, since, being models of their kind, many are daily read in the public schools. He is so thoroughly American, and so in earnest in his expositions of the constitution, that his name, to use his own expression, must ever have an "odor of nationality." He speaks always to the understanding, and always with effect.

In the same year in which Webster was born, South Carolina gave birth to her great statesman, John C. Calhoun. He was born in Abbeville district, in March, 1782. He graduated at Yale College in 1804, and began the study of law, in which he attained great success. In 1809, he was elected to the state legislature. In 1811, he was elected to the House of Representatives, immediately taking a foremost post, until 1817, when he became secretary of war under Mr. Madison, and so continued eight years. Subsequently, he was twice elected vice-president, the last time in 1828. He soon resigned for the Senate, where he continued until his death, in 1850. Mr. Calhoun was one of the most extraordinary men of the country, and one of those whose works will live far into posterity. His eloquence was of a most refined cast, and distinguished for its compact reasoning. He was possessed of that quickness of perception and subtleness of argument, which made Jonathan Edwards the first of theologians. His works have been collected since his death, in six volumes.

Cotemporary with Webster and Calhoun, were the great orators, Clay, Mangum, and others, whose speeches belong to the standard literature of the country, but who have not contributed to it directly by writing. Thomas H. Benton, the great Missouri senator, was born in North Carolina in 1782, and pursued the study of law. In his "Thirty Years' View" of the American government, he has contributed a work of great value to the historical literature of the country. That great work is not only a faithful record of the political history of the country for the thirty years, but the clear Saxon style in which it is composed, gives it a charm seldom found in similar productions. When this work was completed, he commenced the task of condensing, reviewing, and abridging the debates of Congress, from the foundation of the government, which he lived to bring down to the compromise measures of 1850. With a strong intellect and bold character, Col. Benton was well calculated to dominate in the western states. In Missouri, at one time, his power was boundless.

The brothers Everett have deservedly occupied a high place among the literary men of the country. The elder, Alexander, was born in 1790, in Boston. He graduated at Harvard in 1806, and pursued the profession of law, but filled many offices of public trust, being minister to China at the time of his death, in 1847. During his life, his attention was never long diverted from literature, and his writings were numerous in the *North American Review*, of which his brother, Edward, was editor, and elsewhere. Edward Everett was born in 1794, and graduated at Harvard in 1811. He began the study of law, but adopted theology, and at 19 years was called to the Brattle street church, Boston, to fill the vacancy caused by the death of Mr. Buckminster, one of the most remarkable orators of modern times. He soon after was elected Greek professor at Harvard. While filling that office, he published some school books. In 1820, he became the editor of the *North American Review*, to which he largely contributed. He became member of Congress, and afterward governor of Massachusetts. He was minister to England, president of Harvard College, and United States senator. Like his brother of opposite politics, he has enjoyed a succession of offices, and was, in 1860, the candidate of a large party for the vice-presidency. When Lord

Macaulay, from over occupation, declined to add a memoir of Washington to the many brilliant biographical papers he prepared for the new edition of the "Encyclopædia Britannica," he suggested to the publishers of that work, that his friend Edward Everett would be the very man to execute the task; the counsel was adopted, and Sheldon & Co., of New York, obtained permission to bring out this memoir in a separate volume, which has just been accomplished. It may be said of Mr. Everett, that he has been perfectly successful in every thing he has undertaken, and his reputation is world wide.

John P. Kennedy, of Baltimore, was born in 1795. He pursued the law as a profession, until he entered Congress. He is one of the most genial and popular of writers. He is, perhaps, best known as the author of "Horse Shoe Robinson," in 1835, and "Rob of the Bowl," published in 1838, followed by "Annals of Quodlibet," in 1840. His delineations of nature are truthful, and his character drawing marked with great delicacy and freedom.

Hugh S. Legaré was born in South Carolina, in 1797, and graduated at the South Carolina College, following the law as a profession. In 1820, he was sent to the state legislature, and subsequently was appointed attorney-general of the state, was made chargé d'affaires at Brussels, and chosen to Congress in 1836. His contributions to the *New York Review* gave him a high literary reputation. In 1846, a collection of his writings was published in Charleston, establishing his high reputation as of the first class of intellects.

There are a number of others of our statesmen and political men, who have contributed by their writings to the literary capital of the country, but we have here selected only the most prominent of them.

Of those who have made literature a profession, Charles B. Brown seems to have been the first. He was born in 1771, in Philadelphia, and was of very early promise. In New York, in 1793, he was introduced to a literary society, which numbered among its members James Kent, afterward chancellor, Dr. Mitchill, Dunlap, Bleecker, and others. In 1797, he published a work on the rights of women, which then found less favor than some writers on the same subject have more recently experienced. He published, subsequently, a number of works that met with no very great success.

A year younger than Daniel Webster was Washington Irving, he having been born in 1783. Mr. Irving, "the prince of story tellers," is the admitted leader of American literature. His first publications were in 1802, over the signature of Jonathan Oldstyle, Gent., in the *Morning Chronicle*, of which his brother was editor. In 1806, in connection with James K. Paulding, he began writing "Salmagundi." This created a great sensation. It attacked, with amusing ridicule, the ignorance, presumption, and vulgarity of the British tourists, and satirized pretenders at home and abroad in a most effective manner. He soon after commenced the "History of New York, by Diedrich Knickerbocker," which must ever remain the finest monument of his genius. He was connected in business with his brothers, and upon the failure of the firm, he was, happily for the public, forced to depend upon literature for support. His next production was the "Sketch Book," published in New York and in London, in 1819-20. Its success was great at home and abroad, fully establishing the fame of the author. From that date, his works appeared at pretty regular intervals, although he was absent from the country seventeen years, up to 1832. Soon after, he purchased the old mansion of the Van Tassels, on the Hudson, near "Sleepy Hollow." He then resumed his literary labors until his appointment as minister to Spain, in 1841. He returned, in 1846, to his residence, and remained there until his death, still continuing, at times, to add to the list of his productions, the last of which was the "Life of Washington," which has had a sale probably as extensive as all the rest of his works, and the aggregate of which will exceed half a million volumes. It may be said that he has been one of the most successful of authors.

James K. Paulding, the colleague of Irving in "Salmagundi," was four years his senior, having been born in 1779, in the town of Pawling, on the Hudson. Notwithstanding the great success of "Salmagundi," the publisher refused to remunerate the writers, and it was brought suddenly to a close. In 1813, Mr. Paulding published a satirical poem, called "The Lay of a Scotch Fiddle," and in 1816 the most humorous of his satires, "The Diverting History of John Bull and Brother Jonathan," was published. His works were numerous up to 1831, when the "Dutchman's Fireside" appeared, meeting with great success. It is called the best of his novels. This was followed by "Westward, Ho!" in which his characters are drawn with great truth and vigor. His sketch of the Kentucky hunter in his comedy of "Nimrod Wildfire," has met with great popularity. In 1837, Mr. Paulding became secretary of the navy under Mr. Van Buren. On his retirement he resumed his pen, and some of his later productions were contributions to the *Democratic Review*. All the works of Mr. Paulding would probably reach some thirty volumes. His works evince great descriptive power, skill in character drawing, with much humor and a strong natural feeling running through them all.

James Fenimore Cooper, the most widely known of American novelists, as well as the most distinguished, was born in 1789, at Burlington, New Jersey. He became a student in Yale College in 1802, in the same year with John C. Calhoun. On quitting college, in 1805, he entered the navy as a midshipman, for which position his daring and open-hearted nature seemed to fit him. He was very popular in the service, and a most promising officer, when, after six years of sea service—more than many old officers see in a whole life-time—he resigned, married, and finally retired to Cooperstown, N.Y. His first work was "Precaution," which had success, but not that eminent success that attended his subsequent works. His next work was the "Spy." This was decidedly the best historical romance ever written by an American, and its success was immense. Notwithstanding many attempts of the press to speak slightly of it, it created a *furore* in the public mind, and imparted an immense impulse to literature. The work was immediately republished in all parts of Europe, and it demonstrated the fact that everybody read "an American book," since even in England it rivalled the Waverley Novels in popularity. A few years before his death, Mr. Cooper received information that it had been translated into the Persian, Arabic, and some other oriental languages. When it is remembered that this story was a life picture of the struggle for independence, the effect of such a wide-spread circulation among readers under every form of government, may be estimated.

In 1823, the "Pioneers" made its appearance, commencing that series of Leather-stocking tales that will last while the country stands. The next work of Mr. Cooper's opened the series of his sea tales, in which he stands confessedly without a rival. Those two lines of romance, the American forest and the domain of Neptune, Mr. Cooper made peculiarly his own, and they both illustrate scenes peculiarly American. The "Pilot," it is said, originated in the fact that the "Pirate" of Sir Walter Scott having recently appeared, the conversation turned upon the faultiness of the sea delineation, and Cooper undertook to write a sea story in which the seamanship could not be criticised, and the "Pilot" resulted. Its success was unbounded. The next work was "Lionel Lincoln," a story of the war during the British occupation of Boston, and although it was quite equal to the "Spy," yet for some reason did not take with the public in so great a degree. In 1826, the "Last of the Mohicans" was produced, and it had a success from the first, greater than any novel had ever before had. It was purely original, introducing for the first time upon the field of literature, that race of men of whom but a few years will leave only the tradition. In the "Pilot," a real seaman for the first time came upon the stage, in the person of Paul Jones; and in the "Mohicans," the red man made his *début* in the person of Uncas. Mr. Cooper immediately took rank in England as one of the first romance writers of this, or any other age. Like the "Spy," it was reproduced in every language of Europe. The "Prairie" appeared next, while Mr. Cooper was in Europe, and it carried the reputation of the writer to a still higher point. That work was succeeded by the "Red Rover," which was followed by the "Water Witch." The labors of Mr. Cooper continued up to 1839, when his "History of the American Navy" appeared. It had a great and deserved success. It is a noble monument to the gallant service which, springing from the bosom of a newly formed country, successfully grappled with the tyrant of the seas, and demonstrated to the world that a new power had arisen to redress the balance of the old upon the ocean. There followed this work a continuation of the Leather-stocking tales, in the "Pathfinder" and the "Deerslayer," both of which sustained the high reputation of the series. The complete works of Mr. Cooper embrace a great number of volumes. Not all of them are of the high grade of those which have given him a world-wide character. There is not a language in Europe into which they were not all translated as soon as they appeared in London. The readers of books in South America, in India, throughout England, and in Russia, are familiar with the name of Cooper, even where America is only known as his home. The world has no author whose fame, while living, was so universal as Cooper's. This fact is the conclusive answer to the sneering English critic, who asked, "Who reads an American book?"

James Hall, born in Philadelphia in 1793, has made many contributions to the national literature. He is the author of "Legends of the West," "A History of the Indian Tribes of North America," "The Wilderness and the War Path." The works are creditable.

The years 1804 to 1810 were prolific in the production of authors. No less than ten distinguished writers were born in those years: Theodore S. Fay, Geo. B. Cheever, Chas. F. Hoffman, C. M. Kirkland, Nathaniel Hawthorne, N. P. Willis, H. W. Longfellow, W. G. Simms, Joseph C. Neal, S. M. Fuller. Mr. Fay was educated for the New York bar, and published first, in 1832, "Dreams and Reveries of a Quiet Man," and essays written for the *New York Mirror*, in which he was associated with Willis, Gen. Morris, Rufus Dawes, etc. His novel of "Norman Leslie" is better known. In 1837 he produced the "Countess Ida;" subsequently, "Hoboken; a Tale of New York." He has spent most of his life abroad, under government appointments.

Rev. Dr. Cheever was born in Maine, and now presides over a Congregational church in New York. He has twice visited Europe, and on each occasion has published some works, and made other contributions to literature.

Charles F. Hoffman was born in New York, where he graduated at Columbia College, and commenced the study of the law. He began his literary career as editor of the *New York American*, associated with Charles King, Esq., since president of Columbia College; and in 1835 he published "A Winter in the West," which met great success, as well in London, where it was published, as in New York. This was followed by "Wild Scenes in the Forest and the Prairie," and subsequently by "Greyslaer."

Mr. Hoffman was the first editor of the *Knickerbocker*. In 1843 he published "The Vigil of Faith;" and many songs and essays appeared afterward.

Nathaniel Hawthorne was born in Salem, and graduated at Bowdoin College, in Maine, in the class with Longfellow, in 1825. Franklin Pierce graduated a year before him. In 1837 he published "Twice Told Tales," that had previously appeared in periodicals, in book form. In 1846 a new collection of his magazine papers was published, under the name of "Mosses from an Old Manse." He had a custom-house appointment in Boston, under Collector Bancroft; and subsequently joined the Fourierite community at "Brook Farm," Roxbury. Afterward appeared "The Scarlet Letter," and "The House of Seven Gables," which confirmed his rank as one of the great masters of romance. He is one of the most distinguished of American writers; and was appointed consul to Liverpool by President Pierce. In 1851 he published "True Stories from History and Biography;" in 1852, "The Snow Image;" in 1853, "The Wonder Book;" and in 1859 "The Marble Faun."

N. P. Willis is a native of Portland, but went early to Boston; whence he went to Yale College, where he graduated in 1827. He was then engaged by S. G. Goodrich, since known as "Peter Parley," to edit "The Token." About the year 1830 he was appointed *attaché* of the American legation at Paris; in which capacity he collected the materials for "Pencillings by the Way," which was first published in the *New York Mirror*. In 1839 he was one of the editors of the *Corsair*, which was short-lived. In 1840 an illustrated edition of his poems was published, and his "Letters from under a Bridge." In 1843, he, in connection with Geo. P. Morris, revived the *Mirror*, which lived but a few months. In 1846, he, with Mr. Morris, commenced the *Home Journal*, which continues to flourish. Mr. Willis has a wide reputation at home and abroad. While he wins the admiration of the most refined taste, he enjoys the widest popularity. He commands more of the public sympathy than, perhaps, any other writer.

Henry W. Longfellow is also a native of Portland. He graduated at Bowdoin College, and commenced the study of the law; but abandoned it for a professorship of modern languages in Bowdoin College, which office he assumed in 1829. He speedily won the reputation of a most graceful poet, as well as of an accomplished scholar. In 1836 he was called to the professorship of modern languages at Harvard

College, which he has since retained. In 1833 he published his translation from the Spanish of the *Coplas* of Don Jorge Manrique. In 1835 he published "Outre-Mer," and in 1838 "Hyperion; a Romance," followed by other poems. The merits of Mr. Longfellow as a poet are of the highest order. Some of his poems have had an unusual success. "Hiawatha" circulated to the extent of 45,000 copies, and the "Courtship of Miles Standish" acquired great popularity.

William G. Simms is a native of Charleston, South Carolina, and became a lawyer in that city. When only eighteen years of age, he published his first poems, lyrical and others. These were followed, successively, by "Early Lays," "The Vision of Cortes," and, in 1830, by the "Tri-color." In 1832, while travelling at the north, he wrote, at Hingham, Massachusetts, his chief poem—"Atalantis; a Story of the Sea." This was followed by the stories of "Martin Faber;" "Guy Rivers; A Tale of Georgia;" "The Yemassee; A Tale of South Carolina;" and these by a great number of poems, historical romances, revolutionary stories, histories and biographies, essays, and reviews—making in all fifty volumes in twenty years.

John Greenleaf Whittier was born in Haverhill, Mass., in 1807. His parents were members of the Society of Friends. Receiving a very thorough English education, at the age of twenty-two he became editor of the *American Manufacturer* at Boston, and in 1830 succeeded George D. Prentice in the *New England Weekly Review* at Hartford. In 1831 he published "Legends of New England," and in 1833 returned to his early home, where he published an essay entitled "Justice and Expediency; or, Slavery Considered with a View to its Abolition." In 1836, he became secretary of the American Anti-Slavery Society, and soon after removed to Philadelphia, where he edited for some years the *Pennsylvania Freeman*. Meantime he had been writing some stirring poems, afterward collected under the title of "Voices of Freedom." In 1840 he settled at Amesbury, Mass., and since that time he has been a prolific writer of both prose and poetry. His poems have been collected in several forms, and entitle him to rank among the best of American poets.

Joseph C. Neal, born in Greenland, N. H., in 1807, became editor of the Philadelphia *Pennsylvanian* in 1831, and, after ten years' connection with it, started the *Saturday Gazette*. He is best known by a humorous volume—"Charcoal Sketches." He died in 1848.

Fitz-Greene Halleck (born 1795) belongs rather to the period of Cooper and Irving than to the more recent class of poetical writers. He has written but little, but his "Marco Bozzaris" and "Alnwick Castle" will live.

Edgar A. Poe (born 1811—died 1849) was, both as a poet and prose writer, a man of extraordinary genius.

James Russell Lowell (born 1819), editor of *Atlantic Monthly*, and later of *North American Review*, is, perhaps, the ablest of our younger poets, possessing both humor and pathos. He is also a vigorous prose writer.

Oliver Wendell Holmes (born 1809) has distinguished himself both in prose and poetry. His humor is both delicate and pungent, and his pathetic pieces full of feeling. J. G. Saxe (born 1816) has a high reputation as a humorous poet. Alfred B. Street (born 1811) is a poet of great descriptive power. Of the younger literary men, Bayard Taylor, as traveller, poet, and novelist, occupies the foremost rank. T. B. Aldrich, J. R. Thompson, G. H. Boker, T. B. Read, R. H. Stoddard, W. Allen Butler, and E. C. Stedman, have all won a high reputation.

Among the clerical contributors to general literature, Rev. Timothy Dwight, D. D. (born 1753—died 1817), deserves the first place. In 1774 he published an epic poem, "The Conquest of Canaan," which was followed by numerous lyric pieces. After his accession to the presidency of Yale College in 1795, he published "Travels in New England and New York" in four volumes, the best picture of the life and manners of those times now extant.

Timothy Flint was born in Reading, Mass., in 1780, and graduated at Harvard College, after which he was settled as a minister, but soon departed for the west, where he collected the materials for his "Recollections of Ten Years in the Valley of the Mississippi," which were published in 1826. The success of this work was so great as to induce him to make literature his profession. His next work was "Francis Berrian; or, The Mexican Patriot," followed by the "Geography and History of the Mississippi," in 1827. These works were followed by many others, and, in 1833, Mr. Flint had charge of the *Knickerbocker Magazine* for some time, after which he removed to Cincinnati, and continued there until his death.

William E. Channing was born at Newport in 1780. He graduated at Harvard in 1798, Judge Story being his classmate. On leaving college, he became a tutor in a family of Virginia. He was ordained pastor of the Federal street church in Boston in 1803, and he continued there until his death in 1842. His earliest publications were theological, particularly one on the "Unitarian Belief," in 1819, which excited great attention. In 1823, he published an essay upon "National Literature." This was followed by "Remarks on the Life and Character of Napoleon Bonaparte." The address delivered in Boston, on "Self-Culture," in 1838, was regarded as one of his best efforts. These were followed by many others.

Joseph S. Buckminster was born at Portsmouth in 1784. He graduated at Harvard in 1800, and became the pastor of Brattle street church in 1805, and, after much illness, died in 1812, with a great reputation for eloquence and literary genius.

Andrews Norton was born in Hingham in 1786, graduated at Harvard in 1804, and became a tutor in Bowdoin College. He published many able works, with some poems.

Horace Bushnell was born in Connecticut in 1802, and graduated at Yale College in 1824. At one time, he was literary editor of the *New York Journal of Commerce;* from 1833 to 1856 he was pastor of a Congregational church in Hartford. The first of his theological works was published in 1847, and he has since written many others, which have attracted great attention.

Orville Dewey was born in 1794, in Sheffield, Mass. He graduated at Williams College in 1814. He supplied the pulpit of Dr. Channing when that gentleman went to England. After being settled ten years in New Bedford, he became pastor of the Church of the Messiah in New York, but has for some years past resided in Boston. He has published many volumes at different times on various subjects; among others, in 1836, "The Old World and the New;" in 1838, "Moral Views of Commerce, Society, and Politics." He is one of the most popular pulpit orators that the country has produced.

Among the other clergymen who have attained a high reputation for scholarship and literary ability, we should name George Bush, a critical Hebrew scholar, Moses Stuart, Thomas J. Conant, Horatio B. Hackett, all eminent Hebraists; Bennet Tyler, Nathaniel W. Taylor, Lyman Beecher, Edward Beecher, Mark Hopkins, Leonard Woods, George P. Fisher, theological writers; T. C. Upham, J. Torrey, W. G. T. Shedd, Leonard Bacon, Henry B. Smith, Bishop C. P. McIlvaine, W. B. Sprague, J. W. and J. A. Alexander, G. W. Bethune, S. H. Tyng, Francis Wayland and Bishop Brownell, as religious and ecclesiastical writers; and Nehemiah and Wm. Adams, Richard S. Storrs, Jr., George B. Cheever, Joseph P. Thompson, R. D. Hitchcock, H. W. Beecher, A. L. Stone, Bishops Potter, Burgess, Coxe, Doane, and Kip, Richard Fuller, William R. Williams, William Hague, Robert Turnbull, Abel Stevens, J. P. Durbin, W. P. Strickland, Daniel Curry, Stephen Olin, and James Floy, as eloquent preachers and writers. The two Roman Catholic Archbishops Kenrick, Archbishop Hughes, Archbishop McCloskey, and Bishops Fitzpatrick and Rosecrans, have all acquired distinction as preachers and authors, mostly on controversial topics.

Francis Wayland was born in the city of New York in 1796, and graduated at Union College. He was first settled over a Baptist church in Boston, but ultimately succeeded to the presidency of Brown University, in 1827. His publications have been numerous on moral and scientific subjects, and he has contributed largely to the periodical press. The editions of some of his works have been very large: 12,000 were sold of his "Political Economy," and nearly 30,000 of his "Moral Science."

William Ware was born in 1797, at Hingham, Mass., and graduated at Harvard in 1816. He was soon after settled in a Unitarian church in New York. He commenced, in the *Knickerbocker Magazine,* in 1836, a series of papers, which were subsequently published together, as "Zenobia; or, The Fall of Palmyra: an historical romance." Then followed "Probus; or, Rome in the Third Century;" "Julian; or, Scenes in Judea," appeared in 1841. The writings of Mr. Ware are graceful, pure, and brilliant in style.

Herman Hooker was born in Poultney, Vt., in 1807. Graduating at Middlebury College, he took orders in the Episcopal church, but, abandoning the pulpit, he removed to Philadelphia. He has given several works to the public, which have met with great success.

Orestes A. Brownson was born in Vermont in 1802. The early life of Mr. Brownson was obscure. He seems, however, to have been very erratic, but published several works, until, in 1838, he began the *Boston Quarterly*, and in 1840 he published a metaphysical novel called "Charles Ellwood." He continued to write for many reviews, until, in 1844, he began *Brownson's Quarterly Review*, after having united with the Roman Catholic church. Since then he has met with success.

John James Audubon, the great ornithologist, was born in Louisiana in 1782. He was educated in Paris. On his return he immediately commenced the series of drawings, which, with the lapse of time, grew into "The Birds of America"—of which work Baron Cuvier remarked: "If ever it be completed it will have to be confessed that, in magnificence of execution, the old world is surpassed by the new." After encountering many vexations and disappointments, he succeeded in publishing, in 1830, his first volume, containing one hundred plates, representing ninety-nine species of birds; every figure of the size and color of life. The kings of France and England headed the subscription list; he was made a member of the Royal Societies of London, Edinburgh, and Paris, and the scientific world were enthusiastic in his praise. The second volume was published in 1834; in 1840 the fourth and last volume was completed. The whole comprises 435 plates, containing 1065 figures, from the bird of Washington to the humming-bird, of the size of life, and a great variety of land and marine views, carefully drawn and colored from nature. He had spent half a century in completing this marvellous work, and well might he say: "I look up with gratitude to the Supreme Being, and feel that I am happy."

After the completion of this work, he began the "Quadrupeds of America," which was also a marvellous production. His drawings exhibit a perfection never before attempted, and his pen is scarcely inferior to his pencil. When Buffon had completed the ornithological portion of his history, he supposed that he had described all the birds in the world, and remarked that the list "would admit of no material augmentation!" Yet his list comprised but one-sixteenth of those now known to exist. Mr. Audubon died in 1851.

Gulian C. Verplanck was born in 1785, in New York—a true representative of the Knickerbocker race. He graduated at Columbia College, and soon after obtained admission to the bar. In 1818 he came before the public in a literary character, in an address before the New York Historical Society. He became professor of the evidences of Christianity in the theological seminary of the Episcopal church, in 1820. Subsequently Mr. Verplanck, in connection with Mr. Bryant and others, formed a literary confederacy, contributing to the literary magazines and daily journals. At this time was published "The Talisman," mostly by Mr. Verplanck. He was for some years a member of Congress. In 1844–46, he edited a pictorial edition of Shakspeare, in which he fully sustained his high reputation.

Henry R. Schoolcraft was born in 1793, near Albany, and was early distinguished for his literary and scientific acquirements. He has contributed largely to the preservation of the history of the fast disappearing red races of the continent, and is a high authority on all that concerns their customs.

In the range of history, American writers have won the foremost position among historians of the present century; and Europeans admit the high reputation of American histories.

Jared Sparks was born in 1797, and graduated at Harvard College in 1815. He became then a tutor, and was subsequently ordained in the Unitarian church in Baltimore. His first historical work was the "Life of John Ledyard, the American Traveller." This met with some success, and in 1831, he published, under an order of Congress, the "Diplomatic Correspondence of the American Revolution," in twelve volumes. In 1832, he published the "Life of Gouverneur Morris," who was the American minister to France during the reign of terror. Between the years 1833 and 1840, he published in twelve octavo volumes the "Life and Writings of Washington." The memoir, by Mr. Sparks, contained in the first volume, was translated into French by Guizot, the minister of Louis Philippe. The whole work was translated into German, and published at Leipsic. In 1835, he published the complete works of Franklin. In this the autobiography of Franklin is continued to his death. Mr. Sparks also published two series in 10 and 12 volumes of the "Library of American Biography." In the preparation of these he was aided by the brothers Everett, Prescott, Wheaton, and others. He also published a history of the American Revolution. In 1849, he succeeded Mr. Everett as president of Harvard College, but resigned in 1853.

William H. Prescott was born in 1796, at Salem. He was grandson of that Prescott who commanded at Bunker Hill. In 1814, he graduated at Harvard College, and entered upon the study of the law. At college, by an accident, one of his eyes was destroyed, and the sight of the other much injured. He was possessed of a handsome income, $12,000 per annum, and he devoted himself to the study of the languages and literature of Europe, and contributed largely to the *North American Review*. Ten years thus passed in a kind of preparation for historical studies; ten years more were occupied with investigation, and then his "Ferdinand and Isabella" was published. The materials for this had been sent him by Alexander Everett, when minister to Spain. The work of acquiring the contents of books and writing without the use of eyes was a severe labor, but was overcome by ingenuity and patience. The work was everywhere hailed with enthusiasm. Mr. Prescott was made a member of the Royal Academy of Madrid, and its rich collections, with those of the archives of Seville, placed at his disposal, and every reservoir of Spanish history laid open to him. The "History of the Conquest of Mexico" followed, and was succeeded by the "Conquest of Peru," and the "History of Philip the Second," which appeared successively, added to the high fame of Mr. Prescott. He died in the midst of his honors and usefulness.

George Bancroft was born in Worcester in 1800, and graduated at Harvard in 1817. He commenced the study of divinity, but adopted literature as a profession. In 1834, he published the first volume of the "History of Colonization in the United States." He was subsequently appointed collector of Boston, and in 1844 secretary of the navy, which post he resigned to represent this country at the Court of St. James. During more than thirty years his great "History of the United States" has been in progress, and the tenth volume has appeared the present year (1867).

William C. Bryant was born in Massachusetts in 1794. He contributed lines to the county gazette when ten years old, and four years later he published two poems; when nineteen years old, he wrote his "Thanatopsis." He graduated at Williams College, and studied law. In 1825 he edited the *New York Review*, and in 1826 he became editor of the *Evening Post*, with which he is still connected. His works have been many, in both poetry and prose. His prose is remarkable for the purity and elegance of its style.

John Lothrop Motley, who at once took rank with Prescott and Bancroft as a historian, was born in Dorchester, Mass., in 1814, educated at Harvard University, and subsequently at Gottingen and Berlin, studied law, and was admitted to the bar in 1836, but did not practice. He wrote two historical novels, published in 1839 and 1849, was secretary of legation to Russia in 1840, became interested in the history of Holland in 1845, and after collecting material for a history here, went to Europe in 1851, and spent five years at Berlin, Dresden, and the Hague in investigations, and the composition of his "Rise of the Dutch Republic," published in 1856. This was followed, in 1860, by three volumes of a history of "The United Netherlands," and in 1866 he published two more volumes of this history. In 1861 he was appointed U. S. minister to Austria.

Richard Hildreth (born at Deerfield, Mass., 1807—died 1865) was an able political writer, novelist, and historian. He will be longest remembered for his valuable "History of the United States," in six volumes. He was also author of a work on Japan. He was, at the time of his death, U. S. Consul at Trieste.

Benson J. Lossing (born in Beekman, N. Y., in 1813) has attained a high reputation as a historian and historical biographer. His "Pictorial Field Book of the Revolution," his works on Washington and Mount Vernon, his life of "Philip Schuyler," his "History of the United States," his "War of 1812," and his "Pictorial History of the Rebellion," are all works of interest and value, and their illustrations are from his own skilful pencil.

James T. Headley, Jacob and John S. C. Abbott, John Foster Kirk, Francis Parkman, John G. Palfrey, J. Romeyn Brodhead, E. B. O'Callaghan, Parke Godwin, Charles Gayarre, Francis L. Hawks, have all published historical works of some reputation.

The female writers of America have been numerous, and many of them have achieved great distinction. Mrs. Emma Willard has written extensively on history and educational topics, and her sister, Mrs. Almira H. Phelps, has not only contributed several text-books to physical science, but has a fair reputation as a novelist. Hannah Adams, the pioneer of female writers in America, born 1756, wrote a "History of New England," "Vienna," &c. Mrs. Eliza Leslie (1787–1857) wrote several excellent novels, and some works of great value, in the domain of the culinary art. Mrs. Lydia H. Sigourney (1791–1865) was alike remarkable for her poetical and her prose works; many of the latter were prepared for the young. Miss Catharine M. Sedgwick, one of our oldest living female writers, is the author of "The Linwoods," "Redwood," "Hope Leslie," &c., novels of great merit. Mrs. Harriet Beecher Stowe (born in 1812) has been the most successful of novelists. Her "Uncle Tom's Cabin" sold to the extent of about 320,000 copies in the United States, and over a million and a half in Great Britain, and her subsequent novels, "Dred," "The Minister's Wooing," "Agnes of Sorrento," and "The Pearl of Orr's Island," have had a very large sale. She has also written several prose works of the essay class, a volume of "Travels in Europe," and some occasional poems of great merit. Her sister, Miss Catharine E. Beecher, has written numerous works, educational and controversial, which have been very popular. Miss Emily Warner achieved a high reputation (under her *nom de plume* of Elizabeth Wetherell) by her novels, "The Wide, Wide World," "Queechy," "The Hills of the Shatemuc," and "Say and Seal." Mrs. S. P. W. Parton (Fanny Fern) has been very successful, not only as a novelist, in her "Ruth Hall," but as a light essayist, in her "Fern Leaves," &c. Miss M. J. Mackintosh, the author of "Charms and Counter-Charms," and numerous other novels, has a high reputation. Mrs. E. D. E. N. Southworth (born in 1818) commenced her career as an author in 1843, and since that time has published over one hundred novels, all of them of considerable merit. Mrs. Ann S. Stephens (born in 1813) has attained distinction as a novelist, as a writer of historical and practical works, and as editor of a ladies' magazine. Mrs. E. Oakes Smith has written largely and well on the most diverse subjects—metaphysics, literature, household matters, criticism, the drama, poetry, and fiction have been alike the topics of her works.

Mrs. Lydia Maria Child (born 1802) has been a very popular writer. Her "Hobomok" and "The Rebels" were her earlier efforts, and brought her reputation, which was increased by her subsequent works. Mrs. Caroline M. Kirkland (1801–1864) was a graceful and elegant writer. Her "New Home—Who'll Follow?" first introduced her to the public, and her subsequent works enhanced her reputation. Mrs. Alice B. (Neal) Haven (1828–1863) edited the *Saturday Gazette* after the death of her husband (Joseph C. Neal) for some years, and subsequently published a volume of poems of great merit, and a number of admirable juvenile books.

Mrs. Mary J. Holmes, Mrs. Virginia Terhune (Marion Harland), Mrs. Anna C. (Mowatt) Ritchie, Miss A. J. Evans, Miss Alice Cary, Mrs. E. F. Ellet, Mrs. E. C. Embury, Miss Maria Cummins, Miss Caroline Chesebro, Miss H. E. Prescott, Mrs. E. Robinson (Talvi), Mrs. Catharine A. Warfield, Mrs. Harriet Stuart Phelps, and her daughter, Miss E. Stuart Phelps, Mrs. Elizabeth Stoddard, Mrs. Mary A. Denison, Mrs. M. A. Sadlier, Mrs. Margaret C. Lawrence, Mrs. Madeline Leslie, Miss Caroline Kelley, Mrs. M. E. Hewitt, Miss Virginia F. Townsend, Mrs. L. C. Tuthill, Mrs. Emily C. Judson (Fanny Forrester, 1817–1854), Mrs. Helen C. Knight, and Mrs. Hubbell (author of "Shady Side," &c.), have all written works of fiction, or light literature, which have had a very considerable and many of them a very large sale.

Miss S. Margaret Fuller, afterwards Countess D'Ossoli, one of the most vigorous and thoughtful writers of any age (1810–1850) was for some years in charge of the literary department of the *N. Y. Tribune*, and published, beside some translations and many essays, a work entitled "Woman in the Nineteenth Century."

Several of the ladies named above have distinguished themselves as poets, particularly Mrs. Sigourney, whose religious and elegiac poems have given her a high reputation; Mrs. Stowe, Mrs. E. Oakes Smith, Mrs. Alice B. Haven, Mrs. Emily C. Judson, Miss Alice Cary, and her sister, Miss Phœbe Cary. But there are other American female writers, whose poetry alone has won them high distinction. Among these we may name Mrs. Maria Brooks (Maria del Occident, 1795–1845), whose principal poem, "Zophiël," attracted attention in Europe from its remarkable creative power; the Davidson sisters, remarkable instances of precocious talent; Mrs. Frances Sargent Osgood (1812 – 1850), remarkable for her playfulness of fancy and felicity of expression; Miss Hannah F. Gould, a poet of rare ability and vigor; Mrs. Julia Ward Howe, perhaps the most gifted of our living female poets; Mrs. Frances Anne Kemble (born 1811); Mrs. Caroline Gilman; Mrs. Sarah J. Lippincott (Grace Greenwood), whose "Ariadne a Naxos" attracted great attention from its intensity of passion; Mrs. Amelia B. Welby, remarkable for the exquisite rhythm of of her poetry; Mrs. Sarah Helen Whitman, Mrs. Anne C. (Lynch) Botta, Mrs. Estelle Anna Lewis, Mrs. Sarah J. Hale, Miss Caroline May, Mrs. Maria Lowell, Mrs. Mary H. C. Booth, Miss Edna Dean Proctor, Mrs. Rosa V. Johnson, Miss Rose Terry, and Mrs. M. S. B. Dana. There are, very possibly, yet others who deserve a place in this record, but these have all gained a prominent position as poets.

PRINTING-PRESS.

CHAPTER I.

PRINTING PRESS—HANDPOWER—LIGHTNING.

If a middle-aged man now visits the press-room of a "crack" daily, and observes a huge machine, some twenty feet high, driven by a steam engine, delivering seven large newspapers, nicely printed, at every tick of a clock, and watches the piles of paper growing at the rate of 420 per minute, or at that of 20,500 per hour, weighing over one ton, and reflects that the utmost power of the best machines of his youth would require an active man and a boy two long hours to do what this whizzing monster does in a minute, he will form some idea of the progress made in paper printing, and also of what is required to meet a daily demand. In the days of Franklin, the press-work of a paper was a very laborious affair. The machines of that day were very imperfect, and, if reference is had to the illustration on another page, contrasting the actual machine which Franklin used, and which is still preserved in the patent office at Washington, with the fast press now in use, a good idea will be formed of the progress in press-building. In that press, it will be observed, the bed is a platform about three feet high, between two uprights. In the cross-piece at the top is a female screw in which works the screw attached to the wooden platen. This screw being turned by the pressman, causes the platen to ascend and descend. There is, in front, a table, which slides over the platform at the will of the operator, who, to effect this, turns a crank. On this table was laid the type. Over the type was a frame, which encircled the type, or form, and crossed it in those places where the white margin appears in a printed paper. On this frame the paper of proper size was laid, after being "wet down;" another fold of the frame confined the paper; the whole was then slid on to the platform. The screw being turned, caused the platen to descend, and the impression was made. The screw was then raised, the form slid back, the frame raised, and the paper lifted and examined by the pressman to see if his impression was "good." If it satisfied him, he proceeded to ink his types for a new impression. The ink employed in printing is very different from that employed for writing, and much skill is required in the manufacture. It must be soft, adhesive, and easily transferred; it must dry quickly, and be durable, and not liable to spread. The usual materials are linseed oil, rosin, and coloring matters, lamp-black being used for black ink. The peculiar mode of the best makers is somewhat of a secret. The old mode of applying it was by two ink balls, about the size of a man's hat, made of soft leather, and stuffed with cotton, the leather being nailed round a wooden handle. The pressman, taking one in each hand, daubed them with ink, and worked them together until he had spread the ink. He then applied them to the types as evenly as possible; then, laying them aside, he proceeded, as before, to lay his paper evenly upon the frames, slide it up, work the screw, etc. By this process, an active man could work fifty sheets in an hour; by ten hours steady industry, he could get off an edition of 500 copies for the carriers in the morning. There was little room for much expansion under such a state of printing. The first great advance in the direction of speed, was when the lever was substituted for the screw in making the impression. This was introduced by Mr. John Clymer, and called the Columbian, or Clymer press, in which there was no screw, but the head itself was a large and powerful lever, acted on by proportionate levers, thus bringing to perfection, for presses of a large size, certain principles of leverage which had previously been patented in England, and used in presses of a small size, such as foolscap. The platen was, in fact, a fulcrum for the head, or great lever. Thus the fulcrum and lever superseded the inclined plane, or screw. Mr. Clymer went to England in 1817, and, at that time, the famous "Cobbett's Register" was printed on an "American press," a circumstance that was regarded as a great joke at the time. By this invention, two levers, one affixed at the cross-piece above, and one to the platen, were brought together by a joint, like the bent knee of a man's leg. At this joint was applied a lever, by which the pressman, with one pull, brought the joint into a perpendicular line, by so doing giving an instantaneous and powerful impression. The platen being suspended by spiral springs, instantly rose when the lever was released. The saving in time was immense, one pull of the workman being sufficient for all the old screwing and unscrewing. Improvements in the Clymer press were made by Peter Smith and Samuel Rust, and these improvements are combined in Hoe's Washington press, of which a cut will be found on another page. Inventions of a similar character were made by Mr. John Wells, of Connecticut. The principle of the lever has been applied in various ways, and contains the chief feature in press power. The form of lever now generally used, will be seen in the engraving of Hoe and Smith's printing press, which is the favorite for all work where power presses are not required. Next to the introduction of the lever, was the substitution of the inking machine for the old ink balls. This was constructed of a cylinder which revolved, by hand, against an ink trough, and, by so doing, received evenly over its surface the ink. The smaller rollers were constructed on a light frame, to which a handle was attached. These, laid upon the ink roller, received from it the ink, and then being pushed forward over the type, imparted it to them with one movement of the hand. This, worked by a boy, is seen in the engraving. The pressman was now relieved of the inking, and, working with a lever, he could print, with active industry, 250 sheets in an hour. The next movement was to make this inking machine self-acting, by attaching it to the press in such a manner that lifting the paper frame would cause it to act. The boy was now dispensed with.

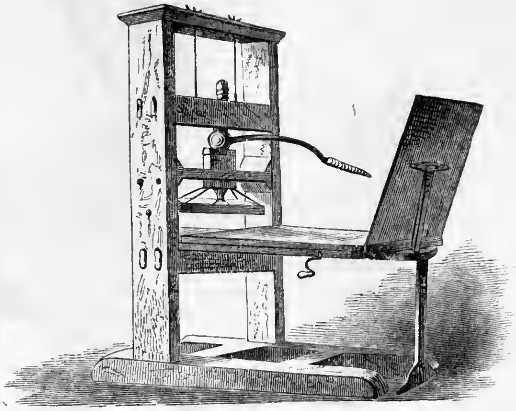
In 1839, the Ruggles Job press was introduced, and is now extensively manufactured in Boston, on the site of the house where Franklin was born. The Combination press was introduced in 1854, and is manufactured by the Power Press Co. on a very large scale.

The next important improvement in the machines, was the introduction of the cylinder, or Napier press. In this machine, of which an engraving is presented in another column, the form of type is locked upon a strong iron table, which moves forward and backward, passing in its course under a cylinder, which, made of iron, is covered with a soft blanket, and provided with a set of fingers to seize the sheet as it is presented. Against this is inclined the feeding bench, on which is laid the paper. On the bench is a small brass peg, or pointer, against which the feeder brings the paper accurately, in order that the sheets may "register"—that is, each receive the type at the same distance from the margin. When the cylinder revolves, it raises with its fingers the edge of the paper, draws it round itself, and presses it against the type, which, at the same instant, passes under it. The paper then released by the cylinder, is carried by ribbons to the rear, while the type vibrates back, to return as soon as the cylinder has again drawn forward a sheet of paper. At first, a boy was required to fly the papers, or catch them as they were thrown back from the cylinder, and pile them up. This, by the self-acting flyer, as seen in the engraving, is now dispensed with. This machine raised the number that might be printed to between 2,000 and 3,000 per hour. The bed is made of a size to take a paper from 25x33 inches, to one 40x60 inches. The cost of the former size is $1,390, and of the latter, $2,600. An obvious improvement suggested itself soon. The type, in moving forward and backward, made only one impression. It was easy to introduce another cylinder, in order to take an impression from the type on its return. This was the double cylinder, which delivers a paper at each end. The cost of these is, for the large size, $4,250, and it will give 3,500 to 6,400 impressions per hour. In this operation, the vibration of the type bed was the great difficulty. The type and bed will weigh over 1,000 lbs. This mass, moving backward and forward with great momentum, produced a great concussion, although it was met by strong springs which stopped its progress and aided its return. Many improvements were made in these springs. The noise and annoyance occasioned by the concussion of the bed against the springs, which are placed at each end of the machine to overcome the momentum of the bed, was removed by means of adjustable India-rubber buffers placed at the points of contact, which in no way interfere with the lively and certain action of the spiral springs. The same object is also effected by air springs, by which the head of the bed, plunging into a receiver, condenses the air, causing it to act as a spring.

It was obvious, however, that the weight and concussion of this bed were a bar to further progress in this direction, and it was felt that greater speed could be attained only by causing the type itself to revolve. This was no new idea. It had been patented in England in 1790, but the inventor could not succeed in holding the types, since the rapid revolution of such a weight gives a powerful centrifugal motion. What they could not do in England, Richard M. Hoe did in New York, in 1847, after many attempts had been made to accomplish the desired result. In this machine, as will be seen in the illustration, the form of type is placed on the surface of a horizontal revolving cylinder of about four and a half feet in diameter. The form occupies a segment of only about one-fourth of the surface of the cylinder, and the remainder is used as an ink-distributing surface. Around this main cylinder, and parallel with it, are placed smaller impression cylinders, varying in number from four to ten, according to the size of the machine. The engraving represents three. The large cylinder being put in motion, the form of types is carried successively to all the impression cylinders, at each of which a sheet is introduced, and receives the impression of the types as the form passes. Thus, as many sheets are printed at each revolution of the main cylinder, as there are impression cylinders around it. One person is required at each impression cylinder to supply the sheets of paper, which are taken at the proper moment by fingers or grippers, and, after being printed, are conveyed out by tapes and laid in heaps by means of self-acting flyers, thereby dispensing with the hands required in ordinary machines to receive and pile the sheets. The grippers hold the sheet securely, so that the thinnest newspaper may be printed without waste.

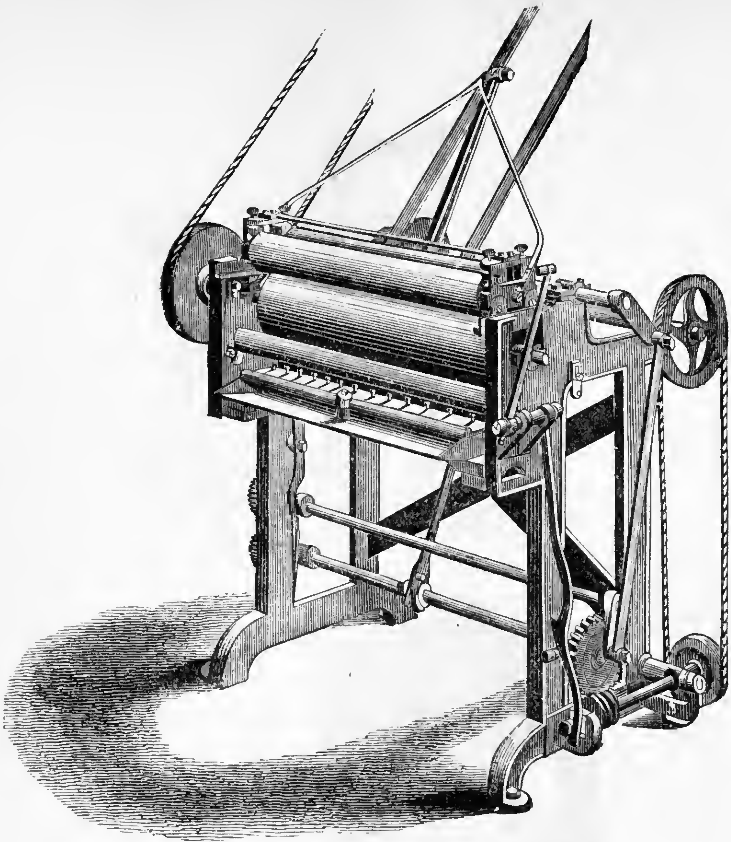
The ink is contained in a fountain placed beneath the main cylinder, and is conveyed by means of distributing rollers to the distributing surface on the main cylinder. This surface being lower, or less in diameter than the form of types, passes by the impression cylinder without touching. For each impression, there are two inking rollers, which receive their supply of ink from the distributing surface of the main cylinder, which rise and ink the form as it passes under them, after which, they again fall to the distributing surface.

Each page of the paper is locked up on a detached segment of the large cylinder which constitutes its bed and chase. The column rules run parallel with the shaft of the cylinder, and are, consequently, straight, while the head, advertising, and dash rules, are in the form of segments of a circle. The column rules are in the form of a wedge, with the thin part directed toward the axis of the cylinder, so as to bind the types securely. These wedge-shaped column rules are held down to the bed by tongues projecting at intervals along their length, which slide in rebated grooves cut crosswise in the face of the bed. The spaces in the grooves between the column rules are accurately fitted with sliding blocks of metal even with the surface of the bed, the ends of which blocks are cut away underneath to receive a projection on the sides of the tongues of the column rules. The form of type is locked up in the bed by means of screws at the foot and sides, by which the type is held as securely as in the ordinary manner upon a flat bed—if not even more so. The speed of these machines is limited

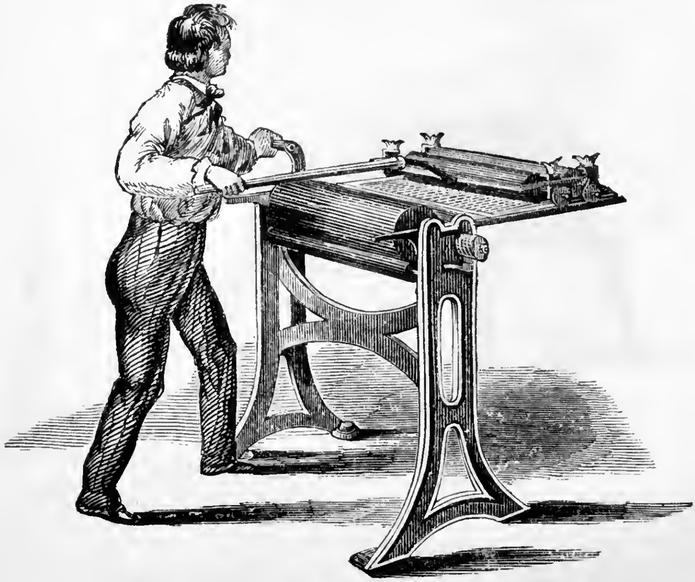


FRANKLIN PRESS.

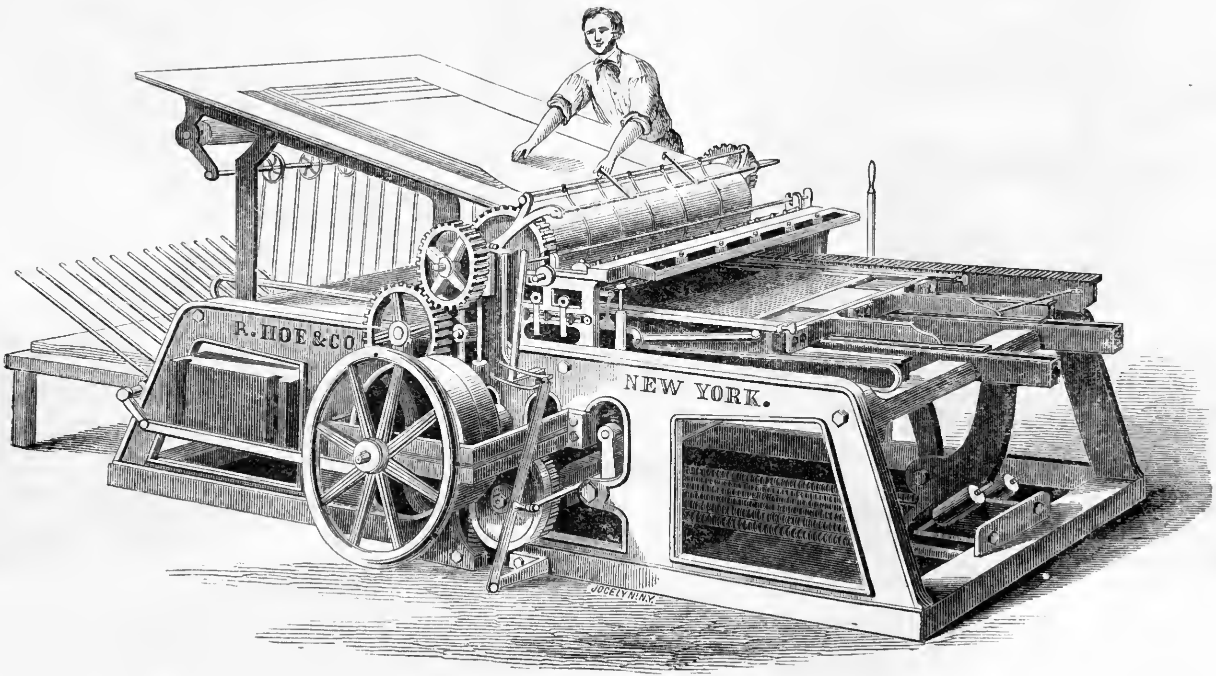
PATENT WASHINGTON PRINTING PRESS.



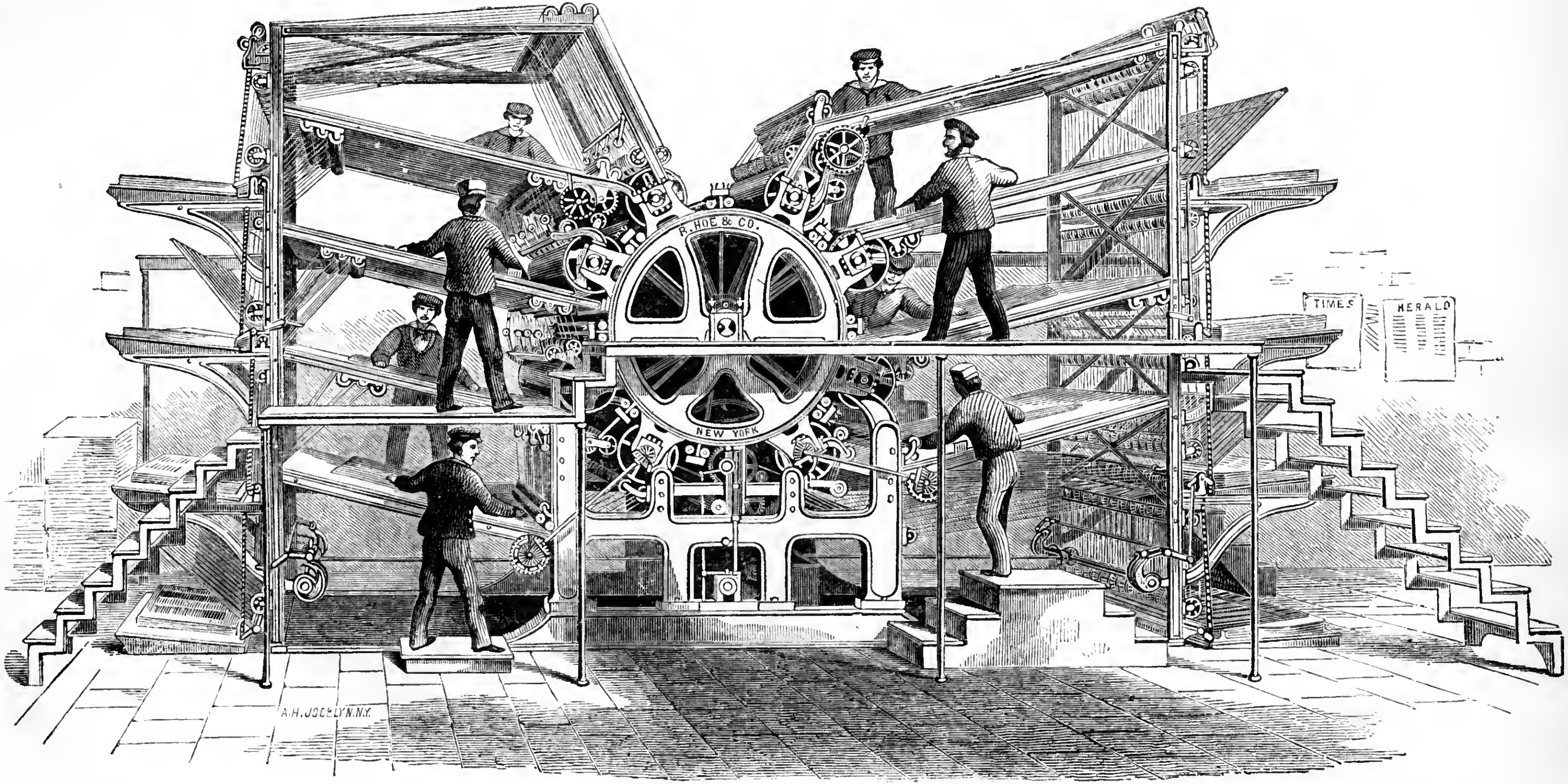
PATENT HAND-PRESS STEAM INKING MACHINE.



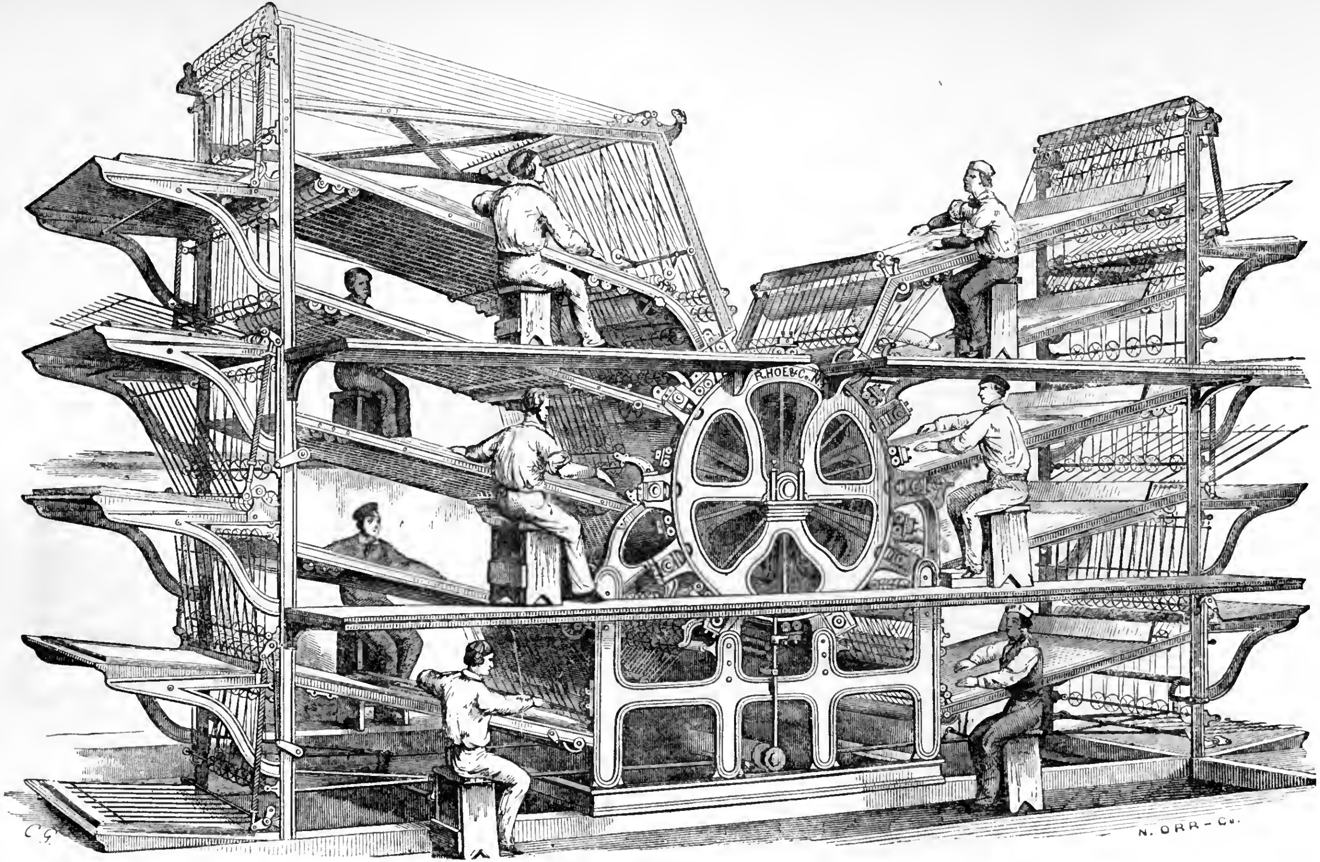
IMPROVED INKING APPARATUS FOR THE HAND-PRESS



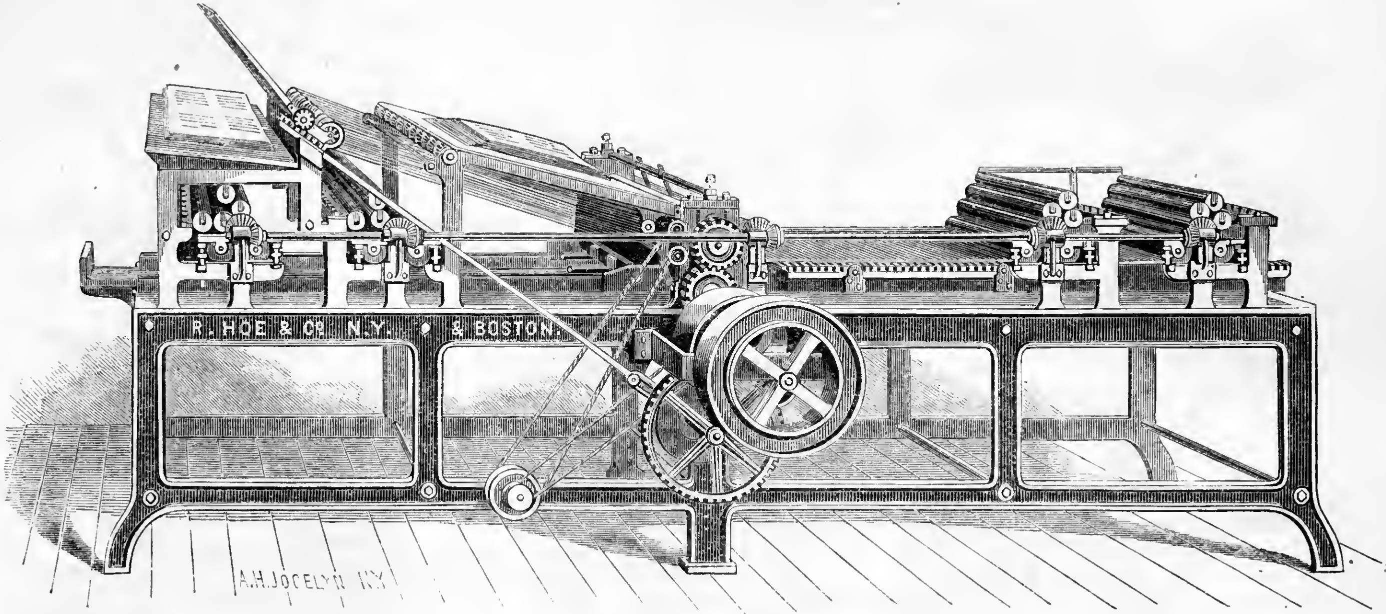
PATENT SINGLE SMALL CYLINDER PRINTING MACHINE.



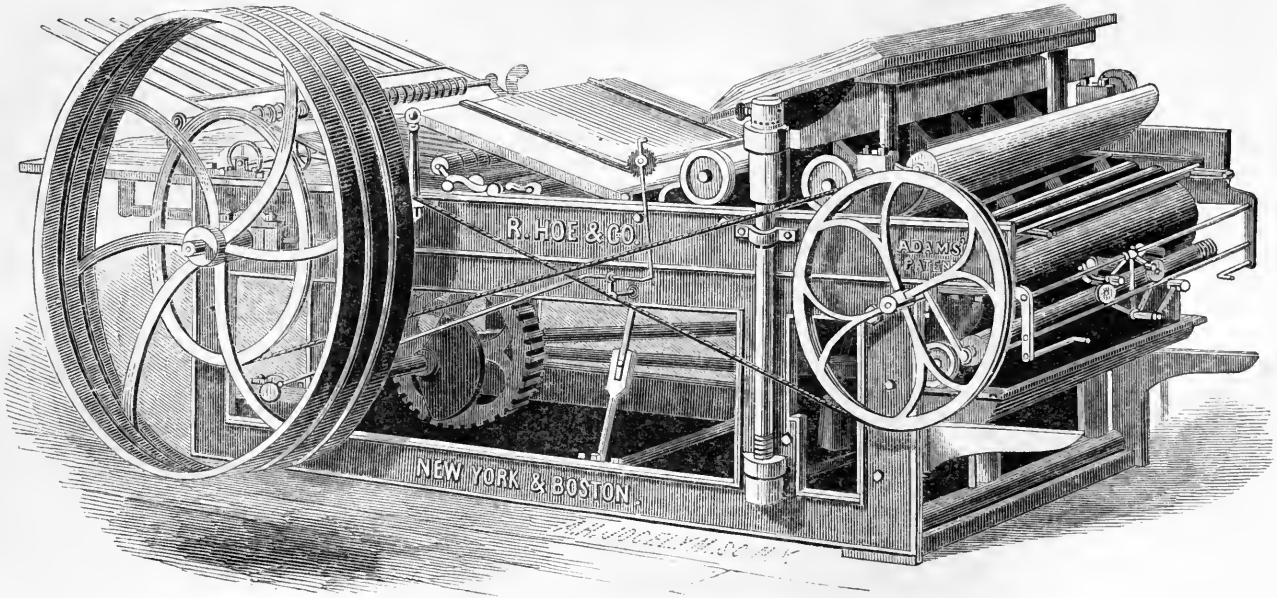
EIGHT CYLINDER TYPE-REVOLVING PRINTING MACHINE



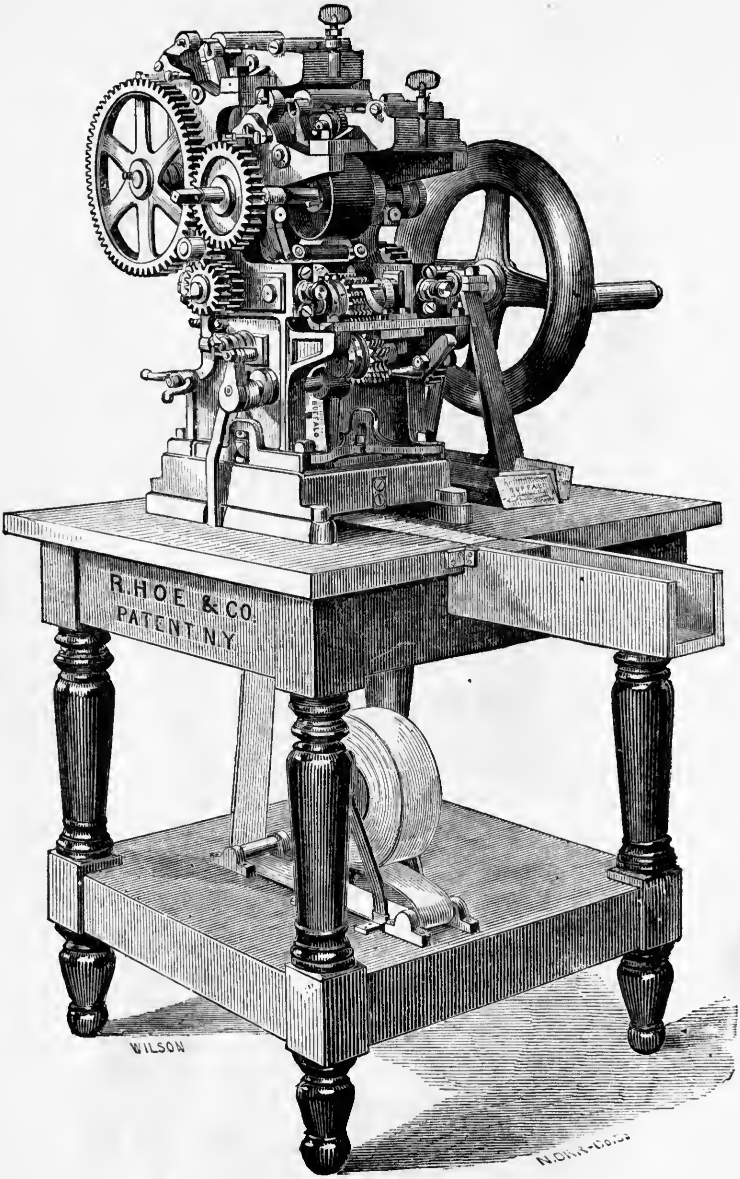
TEN CYLINDER TYPE-REVOLVING PRINTING MACHINE.



FOUR COLOR PRINTING MACHINE.



BED AND PLATEN POWER PRINTING MACHINE.



PATENT RAILROAD TICKET MACHINE.

In this machine the forms are placed on a cylinder which enables it to run with a continuous rotary movement. The tickets are worked from a roll of paper, and are printed, numbered, cut, and deposited in a receptacle in numerical order in a single operation. The numbering apparatus prints the number in a different color from the body of the ticket, and can be set at 0 or any required number with great facility. The machine will print from 10,000 to 12,000 tickets per hour, and occupies a space of about two feet square.

only by the ability of the feeders to supply the sheets. The four-cylinder machine is run at a speed of over 10,000 per hour; the six-cylinder machine, 15,000 an hour; the eight-cylinder machine, 20,000; and the ten-cylinder machine, 25,000. This system combines the greatest speed in printing, durability of the machinery, and economy of labor. As we have said, this great machine delivers seven sheets per second, or 420 per minute. It does in one minute what Franklin required ten hours to do, and the papers contain ten times as much matter, and are eight times as large. Thus, to print as much reading would have required 100 hours in the last century, against one minute now. In other words, 6,000 men with 6,000 presses, would have done very badly what this machine does very well.

The next attempted improvement in the speed of machines has been, to do for the revolving cylinder what was done before with the Napier press. In the case of the latter, another cylinder was introduced to take the type on its return vibration, thus getting two impressions from one movement. In the case of the revolving type, something similar has been attempted. It has been stated that the form of type occupies but a segment of the cylinder. It was conceived that by placing the other form on the vacant space of the cylinder, that both would be printed with one revolution, thus doubling the amount of work done by the same number of revolutions. The mechanical part the Messrs. Hoe succeeded in perfecting, but the difficulty encountered was in the paper. It will be conceived that when the paper is printed with such inconceivable rapidity, that the ink has no time to "set," and to impress it on the other side in almost the same instant of time is more than the nature of the operation will permit, and the type "takes off," so to speak, or will not produce a perfect impression. Some other persons made the same attempt, with similar results. Progress in that direction has, therefore, been given up, but the efforts of genius are being directed anew, and the experience of the past has warned us not to be surprised at what may yet be done. There have been attempts made to simplify the process by fitting stereotype plates to cylinders, and with some success; but the necessary delay in stereotyping defeats the object required, which is to save time. The adaptation of electrotype plates to cylinders in printing presses, has also been made with success, but these also require time in perfecting, and are, therefore, not adapted to the daily press.

The work of the weeklies of large circulation, is done on Hoe's large single-cylinder press. In these cases, where time is not so much an object, the forms are multiplied by the electrotypes and worked on a large number of presses. In some cases, the circulation running up to 400,000 weekly, a press running 1,500 per hour, or 20,000 in a day, will require 10 presses four days to perfect the edition on both sides, and for this purpose, ten separate forms will be required. These machines will take a form 19x23½ inches, and up to 40x57 inches. The cost of the former is $960, and of the latter size, $2,650.

The press most used for book work, differs in principle from either the Napier or the revolving type. It was the invention of Isaac Adams, of Massachusetts, and it bears his name. The type in the press has no movement except slightly up and down. It receives the ink from a self-acting machine, and the paper is fed to it from an inclined plane, when, the impression being made, it is lifted off by the fly and deposited in the rear. It is the most perfect of all presses. The prices of these vary from $600 to $2,980, according to size. The engraving on another page will give a good idea of this machine, of which the patent is secured by the Messrs. Hoe.

The printing on all the machines described admits of but one colored ink, but for fancy work of various kinds, more colors are at times desirable, and for this purpose, Hoe & Co. have devised a machine by which four colors can be printed. It is simply the ordinary single small cylinder press, having the bed sufficiently long to receive four forms (when four colors are to be printed), and provided with four ink fountains, each one of which inks its appropriate form. The sheet is fed from a feed board and taken by fingers in the usual manner, but after receiving an impression from the first form, instead of being thrown off, it is held by the fingers and continues to revolve with the cylinder, and thus receives an impression from the second, third, and fourth forms, as they successively pass under it. The fingers then open, and the sheet is thrown off and down by the sheet-flyer in the ordinary manner. It is thus seen that the sheet is printed in four colors at one operation, and in perfect register, without any pointing being required. These machines are made to print two, three, or four colors, as ordered. An idea of its action may be gathered from the illustration.

TYPES.

CHAPTER I.

TYPE FOUNDING—STEREOTYPING—ELECTROTYPING.

THERE has been little change in the general form of metal types used in printing, but much improvement in the quality of the metal used, in the style of the letters, and in the process of casting. There are many sizes of type used, but the ten following are those most used in books and newspapers. They are mentioned in the order of the sizes, the smallest being first:—Diamond; Pearl; Agate; Nonpareil; Minion; Brevier; Bourgeois; Long Primer; Small Pica; Pica. The size of the type employed in this page is Long Primer.

There are some combinations of these sizes; but these are the leading ones most in use. These have not varied much for a long period of time, although the competition among the type founders has led to the introduction of many styles.

In 1812, on the publication of "The Columbiad," by Joel Barlow, a size of type, known as Columbian, was cut for the work, which was designed to be very perfect. It was embellished by Robert Fulton; and it was the first ever printed upon Clymer's newly invented press, which press took the name of the Columbian in consequence.

The casting of the type was, until within fifteen years, done by hand for each separate letter. The matrix of the type is of copper, $1\frac{1}{4}$ inches long, $\frac{1}{8}$ of an inch deep, and of the breadth of the type to be cast. The form of the letter is made in the end of the copper matrix by a steel die. The copper matrix is then inclosed in a wooden box, which has a hopper to admit the melted metal. There is a spring attached, by which the matrix may be opened to release the letter when cast. The caster, holding this in his left hand, takes from the furnace, with a very small iron ladle or spoon, about as much of the metal as will form one letter. This he pours in, and at the same time gives the matrix a smart upward jerk, which settles the metal into the finest cuts of the letter. He then presses the spring, hooks out the letter, closes the matrix, and proceeds as before. A skilful man will in this way cast 500 types in an hour. In 1811, Mr. David Bruce received a patent for an improvement in the mould, by which 25 per cent. more work was done. This system has changed since the introduction of machinery.

About 15 years since, Mr. Geo. Bruce, Jr., of New York, invented a very beautiful machine for casting type, and it is the best in the world. The patent has been renewed at the last session of Congress for seven years, and the right, title, and interest, have been purchased by Messrs. J. Conner & Sons. By this machine a man can cast three times as much in a day as by the old plan. The wages are less than half, per thousand, what they were before, but the caster, nevertheless, earns more. In these machines the type metal—which is a mixture of lead, tin, and antimony—is contained in a state of fusion in a small iron reservoir, about 5 inches square, and into which it is forced with great power. This is tapped by a nipple, which holds as much melted metal as will cast a type. The mould is of steel, in a small machine which is worked by a crank. It is simply for the body of the type, and is so placed that the lower end, by a movement of the machine, will fit exactly over the orifice of the nipple. Against the other end is applied a copper matrix of the letter, and firmly held by a spring. The operator then causes the metal to jet into the mould. Then, as soon as it is "set," he releases it, opens the mould, and allows the type to drop into a box. In this process, the matrix of the letter is separated from the body of the type. It is formed on a steel die, and impressed into the copper previously prepared, with great force. The adjustment of this matrix to the mould is a work of great care and nicety. After the type is cast, by whatever process—whether by machinery or the ancient spoon method—it has to undergo a smoothing operation. This is performed by young people, principally girls; three or four sitting around tables surmounted with properly prepared stone slabs, and by the fingers rubbing the roughness off each individual type. At this work they earn from $5 to $7 per week. The type goes then into the hands of the dresser. He cuts out what is called the jet end, by which process all the types are made of the exact height. On the nicety of this operation depends the ability to use the type. It may be here remarked that American type comes nearly always perfect into the hands of the dresser, while in England nearly one-fourth is rejected as imperfect.

The types have upon one side a "nick." As the types are perfected, a boy sets them on a "galley," with all the nicks out. They are then assorted into small "fonts," and are then ready for the printer. The proportions in which the different letters are cast to a font of type, and in which they occur in print, are as follows: Letter e, 1500; t, 900; a, 850; n, o, s, i, 800; h, 640; r, 620; d, 440; l, 400; u, 340; c, m, 300; f, 250; w, y, 200; g, p, 170; b, 160; v, 120; k, 80; q, 50; j, x, 40; z, 20. Besides these, are the combined letters: fi, 50; ff, 40; fl, 20; ffi, 15; ffl, 10; æ, 10; œ, 5. The proportion for capitals and small capitals differs from the small letters. In those, I takes the first place, then T, then A and E, etc. The "cases" in which the types are put for use, are arranged in the manner seen in the engraving on another page. The little square boxes in which the type is laid are not arranged in the regular order of the alphabet, but in the order which experience has shown is the most convenient for the compositor. Those letters which occur the oftenest—as e, for instance—occupy the largest squares nearest his hand, and the others in the order of their relative importance; the capitals, small capitals, and marks, each in its proper place, in the upper case. The workman does not look at the type. He reads his copy only, and that frequently tasks his ingenuity to make out. He knows the types from the boxes they occupy, and the "nick" enables him to place them right side up by sense of feeling only. He is paid by the thousand ems when working by the piece. An em is about the space of a letter M, and 2,200 ems go to one of the pages of this book. A good workman will set 5,000 to 6,000 ems in a day. Sometimes they are paid by the week, $12 per week, which is about the amount that an expert workman will earn by the thousand. The type he places in a small iron frame, held in his left hand, and called a "stick," which is adjusted to the breadth of the column or page. When this is full, it is deposited on a "galley," in a long column. From this galley a proof impression is taken to be read by the author and proof-reader. The inaccuracies are marked on this, and when corrected in the type, the foreman "makes up his form." If for a daily paper, this is done by screwing the columns into the "turtle," which is fastened upon the revolving cylinder of the press. When the type has been printed from or worked off, it is immediately washed in a strong alkali, to clear it from the ink. If this is not done thoroughly, it will not print clear. Formerly this washing was done with urine, but of late an alkali is substituted. The clean type has now to be "distributed," or put back into the cases. For this purpose the compositor takes the "matter" in his left hand, reads a line, and drops each letter into its appropriate place. This occupies a good deal of time.

All this type-setting and distributing is done, letter by letter, by hand up to the present time, although the greatest efforts have been made to introduce machinery. A number of type-setting machines have been invented, and many of them work well in the setting of the type—the operator working upon keys, like those of a piano, with the copy before him. The arrangement is such that, by touching the proper key, the appropriate letter falls into line, and the work goes on rapidly and well, even to the punctuation. The difficulty not yet overcome, and which is an obstacle to its usefulness, is that no means of "justifying" have been discovered—that is, of breaking the lines into the suitable length, and "spacing" them out so that each line shall have the exact length of all the rest. This is done by the hand compositor, with great nicety, in his iron stick, as his work progresses. As this must still be done by hand, after the machine has set up the type, no great advantage is derived from its action. In type distributing more success has been obtained. The machine is so constructed that it will distribute 12,000 ems per hour with unerring accuracy, and one man may tend three machines; hence he will distribute, by its aid, 36,000 ems per hour, while a good workman by hand will only distribute 3,000 ems. This seems very desirable, but a new difficulty presents itself. The machine cannot read, so as to distinguish one letter from another, and it is guided in its selection by the "nicks." It follows, that no two of the twenty-four letters of the alphabet should have the same "nicks;" consequently, a special kind of type must be cast for the machine. They are then put into it in a mass, and present themselves alternately until the proper "nick" goes through. The advantages of the machine do not overcome its disadvantages.

In book work the type is not hurried from the compositor to the pressman, as in the case of the daily papers. There is more time, and the type itself is, therefore, not usually printed from, but it is stereotyped. This was introduced in America about the year 1817, by Mr. G. Bruce, the father of the inventor of the type-casting machine.

In this process, the type being locked up in the form, which usually contains 2 to 6 pages, and carefully revised and corrected, is sent to the stereotyper.

Stereotyping is the mode of casting perfect fac-similes, in metal, of the face of movable types. The plan is simple. After arranging the type in pages, and getting it perfectly smooth and clean, it is placed in a frame, the surface being thoroughly oiled, to prevent the mould from adhering, when liquid gypsum, or plaster-of-Paris, is poured over the page. The mould, thus taken, if found perfect, is dressed with a sharp instrument, and is then ready to receive the metal. It is then put into an iron casting-box, and the whole immersed in liquid type metal. Twenty to thirty minutes usually suffice for casting. The box is then swung out of the molten mass into a cooling-trough, in which the under side is exposed to the water. When hard, the caster breaks off the superfluous metal, and separates the plaster mould from the plate. It is then picked, the edges trimmed, the back shaved to a proper thickness, and made ready for the press.

The process of electrotyping has, of late, become an important element, and is generally preferred to the old system of stereotyping. It results from the disposition of copper, held in solution, to deposit itself on a metal surface, when under the influence of magnetism.

This art has a very extended application, since a very small quantity of the metal held in solution will suffice to change the apparent character of that galvanized. A copper pencil, for instance, of elaborate ornamentation by pressure, will require 20 cents worth of gold galvanized upon it, to become solid "gold;" a thimble becomes "gold" for 5 cents worth of that metal; and the most astonishing jewelry can, for a few cents, be made gold. The art of the transmutation of the metals, so long sought after with such assiduity and perseverance by the alchemists of old, seems to have been discovered. It is not altogether a seeming, since the operators have, in many cases, realized fortunes at the expense of the credulous.

Stereotyping by the Electrotype process is conducted as follows: An impression is taken from the corrected forms or engraved block upon a plate of wax, and finely pulverized plumbago is then dusted thinly over the surface of the wax. The excess is blown away in a machine contrived for this purpose, and the fine dust remains uniformly in contact with the wax in every little depression and line, without filling these up. The object of the plumbago is to act as the conducting medium for the galvanic current, until a film of copper is deposited. But by a recent modification of the process, this film is also produced before the article is put into the trough, by the application of a wash of sulphate of copper, (solution of blue vitriol), and dusting over it fine iron filings. The solution is decomposed by the iron, and metallic copper is immediately precipitated, forming a delicate film which uniformly covers the whole surface. The wax plate retaining this film is well washed, and is then ready for the galvanic trough. In this it is left over night under the influence of the electric current, and in the morning when taken out the coating of copper is found to be sufficiently thick for handling. The wax is removed, and the copper sheet, first tinned on the back, is placed face down in an apparatus in which it is covered with melted type metal. Thus backed a plate is obtained, which, after being dressed by planing and squaring, is screwed down upon a mahogany block, the height of the whole being the same as that of type.

Plates for use upon the cylinders of printing machines are made with the curve of the cylinders, the forms themselves in which the type are paged having a convex surface, which gives them the name of "turtles."

In making copper-faced type, ordinary types are set in a frame so arranged as to let only the letter end in the copper solution of the battery. The deposit of copper adheres to this end, which it completely covers. Such type are now extensively used in large establishments, and are very durable.

NEWSPAPERS.

CHAPTER I.

NEWSPAPERS—DAILIES—WEEKLIES—PERIODICALS.

The power and circulation of the daily press are among the marvels of the present day, and they are features peculiarly American. No country presents such a number of news publications, and none such a universal popular demand for them. This result has been obtained mostly in the last twenty-five years, by a combination of causes. The two leading ones, are the introduction of the cheap press and the invention of the means of so multiplying numbers, that much interesting matter can be sold for a little money. Take a leading morning daily. This is equal to a book of more than 100 solid octavo pages, sold to the retailer for one and a half cents every morning, no profit being derived from the sale. This has become possible only through the ability to produce a vast number on one hand, and through the immense receipts for advertising on the other. By the introduction of a cheap press, is not to be understood the mere printing of a mass of matter for a small price, but the introduction of such matter as attracts the attention of persons not previously habitual readers, and exciting in them so strong an interest as to make papers for the future a necessity. It is this which has been done by the cheap press.

The first newspapers of the country were hardly worth the name. In the colonies there was little of interest to draw public attention, and such papers as the *Spectator* and *Tattler* came across the water to meet the literary taste of the more wealthy, while the jealous care of the mother country watched over the colonial papers, lest they should breed sedition. Dr. Franklin informs us that the first start he got in life was through the misfortune of his brother, who owned the paper on which he was an apprentice, in incurring the displeasure of the government for disrespectful remarks. The paper was suspended, as Paris papers are at the present day, and Benjamin's indentures were cancelled in order that he might become the nominal owner. The editor of the *Boston Courant*, in 1732, made his valedictory to the public, because he found it too vexatious to be running with his proof in his pocket to the government house, and the new editor promised to do the best he could under the circumstances. There were few subjects then to interest the general reader, and the restricted state of industry allowed but little range for advertising. The paper was poor, and mostly imported at a high price from England, while the laborious work of a man through the live-long night on the presses of the day, gave but a few hundred to circulate in the morning, and these few were to be sold at a rate that must cover all the expenses—that is to say, for more than they were worth.

The first daily paper published in the United States, was the *Pennsylvania Packet or General Advertiser*, started as a weekly, by John Dunlap, in 1771, and merged into a daily in 1784, at the peace. To one of the conductors of the paper, Washington gave the manuscript of his "Farewell Address, and which, at a recent sale of his executors, was purchased by Mr. Lennox, of New York, for $2,000. The first form in which printed news appeared in England was that of doggerel ballads, which were issued as early as the reign of Queen Mary. These were followed by occasional sheets, or pamphlets, of news; but the first approach to a regular newspaper was the *Weekly Newes from Italy, Germanie, &c.*, May 23, 1622, which was continued, with some variations of title and occasional intermissions, until 1640. The earliest specimen of parliamentary reporting is entitled, *The Diurnal Occurrences or Daily Proceedings of Both Houses in this Great and Happy Parliament, from 3d November,* 1640, *to 3d November*, 1641. More than one hundred newspapers, with different titles, appear to have been published between this date and the death of Charles I., and upward of eighty others between that event and the Restoration. Occasional papers were issued after the civil war began, limited to local or special occurrences, as *News from Hull, Truths from York, Tidings from Ireland.* The more regular newspapers were published weekly at first, then twice or thrice in a week. The impatience of the people soon led to the publication of daily papers; and Spalding, the Aberdeen annalist, mentions that in December, 1642, daily papers came from London, called *Diurnal Occurrences*, declaring what was done in Parliament. In the Scottish campaign of 1650, the army of Charles and that of Oliver Cromwell each carried its printer along with it to report progress, and, of course, to exaggerate successes. It is from this circumstance that the first introduction of newspapers into Scotland has been attributed to Oliver Cromwell.

The stirring events of the American Revolution in like manner gave a great impulse to printing; but that took the form of pamphlets and circulars more than that of the periodical press. The event made the press free, and it began a new career; but the habits of the people had not been overcome, nor were the means of popularizing the press yet in existence. Nevertheless, politics became the staple of newspapers, which were started in most sections as the organs of parties and to support candidates for office; as a matter of course these were read mostly by those who were of the same way of thinking. The circulation could never reach a point that would make it profitable of itself, because the limit was the power of the press to work the papers. In the great cities the chief support of the press was the advertising patronage, bestowed in some degree in the light of political support. The foreign news and domestic items of intelligence made up the general interests, with ship news, that began after the war of 1812 to have a more extended character. These papers, published at $10 per annum, did not much interest the mass of people, beyond whose reach the price for the most part placed them; advertising patronage and government "pap" were therefore the sources looked to for profit. These papers were seldom left in families, but were carried home by those who took them at their places of business. The papers of the early part of the century were very meagre The oldest existing papers of New York are the *Commercial Advertiser*, founded in 1797, and the *Evening Post*, in 1801. The rivalry among the papers of the day was not so much to interest the general reading public, as to conciliate those commercial interests on the patronage of which the means of the paper mostly depended. The *Commercial Gazette*, of New York, became a leading journal through the enterprise of its editor in collecting ship news. He himself rowed a boat, boarding vessels coming up the bay, to collect reports with which he enriched his columns. The other papers of New York and neighboring cities followed the example, and competition was mostly in that direction. In 1827, the *New York Journal of Commerce* was started, chiefly by Arthur Tappan, Esq., of Boston, and David Hale, then an auctioneer in Boston, was made joint editor with Mr. Hallock, of New Haven. About the same time, two papers were united in the *New York Courier and Enquirer*, under James Watson Webb. These two papers employed news schooners to furnish ship news at great expense. This enterprise was promoted by the introduction of a Napier press, which allowed of an increased circulation of larger sized papers, and these became filled with advertising as the speculative years that exploded with 1837 came on. The success of these two rival papers, however, so absorbed the newspaper business, that it was fatal to the other old papers. The *Mercantile Advertiser*, by Butler; the *Daily Advertiser*, by Dwight and Townsend, and the *Commercial Gazette*, by Lang, which had long flourished, died out. There are many who still remember the old gilt head of Franklin, which for so many years surmounted the door of the *Gazette* publication office, and which still looks out upon Wall street from another office, with the inscription, "Old Lang's Sign." Several other papers followed, among which was the *New York American*, evening paper, edited by Charles King, Esq. At that period cheap newspapers, fast presses, telegraph and express companies made their appearance all together, to work out by mutual aid the marvels that we have since witnessed. The first penny paper was published by Benjamin H. Day, in 1833. It was about ten inches square, and sold for one cent, or to the newsboys for sixty-two and a half cents per hundred. It was without editorials, but was filled with news items. It grew rapidly to a large circulation, and acquiring advertisements, swelled into a larger sheet, which got into the hands of Mr. Beach. This was hardly known out of New York, and being confined mostly to local news and without marked character, never became an influential paper, although its circulation ran up to 60,000, and it was one of the first to use Hoe's fast press. This large circulation was obtained at first through the notoriety that the publication of the celebrated Moon Hoax imparted to it. A great number of other penny papers were started as the result of the success of the *Sun.* That paper, however, occupied the ground, and none succeeded, until in 1835 the *New York Herald* was started by James Gordon Bennett, a veteran editor.

From that time really dates the new era of newspapers. The *Herald* was sold at one cent, and Mr. Bennett, with great industry and genius, wrote the whole of it himself. The first week's expenses were $56, and from that time they have not ceased to increase up to the present time, when they are several thousand dollars per week, and the profits probably $150,000 per annum. The principle of the cash press was radically different from that of the old papers. Of the latter, politics had been the staple; every paper was the organ of some clique, and the commercial community the patrons. The new press explored every possible topic of interest, making politics secondary. It excited in the public mind an interest in topics that had been before dormant, and satisfied that interest by selling a very cheap paper. The *Herald* began systematic reports of the money and commercial markets, maintaining them with a vigor that gave it a world-wide reputation, and soon made such reports a necessity for all papers. It sent efficient reporters to the courts, to public meetings, to give graphic descriptions of what actually occurred, instead of (as in the old style) printing the proceedings from manuscript prepared before they took place. It reported religious anniversaries, and opened every avenue of interest with the most persevering industry and in a style that attracted readers. The proprietor was ever on the alert for more efficient means of obtaining news, and spared no expense to be the first in the field. Expresses by railroad were frequently run at great cost, and reporters were sent to any part of the country where events were of an interest to justify it. The appearance of the telegraph was the signal for new enterprises. These, on the part of the *Herald*, have done more to extend the telegraph than all other means together. Its enterprise did for the telegraph what before it had done for the press. In 1847, Mr. Clay spoke in Lexington, eighty miles from Cincinnati, on the Mexican war. There was no telegraph nearer than Cincinnati. The *Herald* reporters took down the speech, and by horses relayed every ten miles, carried it to Cincinnati in eight hours, whence it was sent by telegraph and issued in the *Herald* next morning, at an expense of $500. This is one instance of many by which the *Herald* has impelled enterprise.

The Associated Press, which embraces the New York papers and those of the neighboring cities, together with many of those of the interior cities, pays $200,000 per annum for the daily reports. The *Herald's* proportion of this forms, however, but a small portion of its outlay for telegraph. In two weeks in September, 1860, when the Prince of Wales was in Canada, and the political events of the presidential campaign to be gathered, it expended $2,301 for extra telegraphic reports, and its whole expense for that item will average $1,000 per week during the year. It is such enterprise as this that makes telegraphs possible and the paper indispensable. That the circulation swelled beyond the capacity of the press is, under such circumstances, no matter of surprise. The result was an affluence of circulation that could have been met only by the opportune appearance of the fast presses of Hoe & Co. The first *Heralds* were printed by hand; a single-cylinder turned by hand followed, and was succeeded by the double-cylinder, turned at first by hand and then by steam. In 1848 the four-cylinder press came hardly in time to meet the *Herald's* wants. The six-cylinder, the eight-cylinder, and the ten-cylinder succeeded each other, carrying the printing per hour from 250 to 2,000, to 3,500, to 10,000, to 15,000, to 18,000, and to 25,000, even at which last figure the tardy press still lingers behind the public demand for *Heralds.*

In all this time other papers have followed on the same general plan. The *Ledger* of Philadelphia has as large a circulation as any in the world. It employs two eight-cylinder presses. Baltimore, Boston, and other and distant cities have seen the growth of flourishing papers. In 1841 the *New York Tribune* was started by Horace Greeley. The paper soon reached a paying stage, since when it has been highly successful. The circulation of all its editions reaches nearly 500,000 copies per week.

The *New York Times* was started in 1850, H. J. Raymond, Esq., editor. He had been connected with the *Tribune* and the *New York Courier.* The paper has attained a great success, after struggling a long time to win a paying position. In 1860 the *World* was started on the same principle, with a large capital, subscribed by a company of gentlemen. These three papers are joint-stock concerns. The *Tribune* was divided into shares, which are held by those who are connected with the editorial and publishing departments. The *Times* is owned in a similar manner, and the shares of both are at a high premium. The *Herald* is the only one owned by an individual.

The circulation of the New York dailies is now (1866) about 350,000 against about 10,000 in 1835. The greater part of this is divided among six papers, viz., the *Tribune, Herald, Times, Sun, Staats Zeitung* and *Evening Post.* The following items from the census of 1860 show the extent of newspaper publishing in New York city at that time: it has more than doubled since in value, and greatly increased in the number of issues. There were, in 1860, in the city, 51 newspaper establishments, with a capital of $2,941,200, and employing 2,486 hands, which printed newspapers and periodicals annually to the value of $6,182,946. In the second ward of New York, 134,116,800 newspapers were printed annually, of an estimated value of $3,574,493; and in the fourth ward, 83,541,960 papers and periodicals were printed, having an aggregate value of $2,143,613. We give elsewhere the aggregate numbers of newspapers and periodicals printed in the United States in 1860. These statistics, like all those of manufacturing in the United States, are confessedly far below the truth.

Every family, and almost every individual has his paper, and is interested in its success. The advertising columns of a morning paper contain, in a remarkable degree, the wants, desires, occupations of our people—a photograph, as it were, of their daily life.

The advertisements of one day in the daily *Herald* numbered 1,191, a large number of them being very short, 341, for instance, being comprised under the four headings, Situations Wanted, Males and Females, and Help Wanted, Males and Females, and 308 more under the heads of Houses and Rooms Wanted, To Let and For Sale, and Boarding and Lodging, or thirteen-twenty-fourths of the whole in these items. The *Herald* has a much larger number of these advertisements than any other of the dailies, the *Tribune* having in a single issue only 119 advertisements of these classes, while of all others it had 458, against 542 in the *Herald,* and its advertisements being longer, occupied somewhat more space than those of the *Herald.* The *Times* is about midway in the number of its advertisements between the *Tribune* and the *Herald,* having more short advertisements than the former, and more long ones than the latter. There is very little difference in the actual space occupied by advertisements in the three papers.

The procuring these long advertisements is now a business of itself, employing numerous canvassers, and making large fortunes for the managers. Enterprising men, publishers of newspapers, principals of business colleges, proprietors of sewing and other machines adapted for general use, or of popular articles of food or medicine, have availed themselves of the opportunities afforded by the large circulation of these papers to give one, two, or even four pages of advertising in a single number, and this lavish expenditure, amounting in some instances to $200,000 or $300,000 per annum, has proved immensely profitable in the end.

The *Evening Post* and the *Commercial Advertiser,* though printed as folios, and not as quarto sheets, have a very large advertising patronage, mostly from the shipping and wholesale merchants, book publishers, &c. The advertisements in the morning papers are, to a large extent, fresh advertisements daily, received and paid for the previous day. Those of the evening papers are, many of them, less frequently changed. The advertisements of the morning papers belong to the day on which they appear, and compose a part of the life and the news thereof, like any other matter in the paper—to many people more interesting and more important. No portion of a great metropolitan journal, then, is dead matter; even the advertising columns, which many suppose to be dull and tedious, are full of life and interest, and fresh every day. It is amusing to contrast such a paper with the *Philadelphia Gazette* of 1750, then conducted by Benjamin Franklin. Its dimensions are about eight by ten. The news and reading matter which it contains, could all be put into one of the pages of this book. *It has not a single line of editorial.* Its latest foreign news was about three or four months old. Its domestic news principally related to the Indians. Among its advertisements were several notices of the sale of negroes in Pennsylvania. The progress of the newspaper art is well illustrated by comparing this sheet with those issued in our large cities at the present day.

It is to be remarked that, since the era of the cheap cash press, there have been no papers started on the old or credit system. The *New York Express* was started in 1837, and it has maintained its position only by adopting the cash plan for its evening edition. By the old system of publication, the subscription was taken for the year at generally $10, which was collected at the end of six months by the collector employed. These were served at the houses or offices by carriers, employed by the paper at a weekly salary. The subscriptions from the country were paid the first year in advance, but when the papers are continued on trust, enormous sums accrue in arrear subscriptions—from $10,000 to $50,000 bad debts sometimes accumulating. These being scattered in small sums all over the country, and that at a time when communication was not so prompt as now, did not pay to collect. The advertising was generally $40 per square per annum. A square was twenty lines. This was mostly commercial advertising; the public and retail trade did not advertise much. The system involved much expense in collecting, and inevitable losses in bad debts.

The system with the cheap press is entirely different. The papers were started only by sales to the newsboys, who paid the money when they took the papers. There are no subscriptions taken at the office, and, consequently, no carriers employed. The penny papers sell to the boys at 62½ cents per hundred, and the two cent papers at $1.50 per hundred.

When the city circulation of the papers extended itself, many persons wished to get them regularly at their houses every morning. Thus some of the newsboys got regular subscribers, and became carriers on their own account. Although they were obliged to pay cash every morning for the papers when they took them, they soon acquired as much means as enabled them to leave the papers with their patrons, and collect the twelve cents at the end of the week. This promoted circulation, because the customers could not always have the two cents early in the morning to pay with. The carriers then extended their routes, and became proprietors of them, independent of the newspapers. A carrier who succeeded in getting 1,000 subscribers to serve every morning, paid out to the office every morning $15 for the papers. At the end of the week he collected $120 from the subscribers, which gave him $30 a week profit. This was a good business, and many came to employ boys to serve under them, and serve several different papers on their routes. These routes have been sold by the carriers, according to value, from $200 to $2,000 each. There also arose the publishing agencies, which took large numbers to sell at stations and small shops in the city, and to send to other cities by express, in bundles to be served there.

The country subscriptions are taken for a year in advance. Their subscriptions are all written in "mail books," which are classified North, East, South, West, according to the direction in which they are to be sent. The books are laid off into states, counties, and towns, and the name of the subscriber is written under the appropriate town, with the date up to which he has paid. The wrapping paper being prepared, a number of boys are employed copying the names upon the wrappers, which are then laid in order ready to receive the papers when printed and folded. When the date to which a subscriber has paid is expired, the mail boy crosses it off, unless it has been renewed by a new date. This simplifies the accounts very much, any number of subscribers requiring no other account than these simple mail books, and no one gets a paper that is not paid for. Thus there were grown up four chief avenues for the sale of papers—the mail, the carriers, the newsboys, and the agencies. Each of these wanted their papers *first* in the morning, and the rush of all at once made so great a pressure that it was difficult to count the small sums of money that each offered, and count the papers also. Hence it became the rule for all to go the evening before to the office, pay in their money, and take a ticket for the number wanted. The matter of precedence was settled by the necessities of the case, and the decision of the "cutter," like those of a chief justice, are open to "influences." It is now to be borne in mind that 50,000 daily papers, and in some cases, on the day of publication, 200,000 weekly papers are to be distributed to all these persons at once. There must be no delay. The mail is to swallow its share; the express have its allowance; and the community must not be disappointed at breakfast by either newsboys or carriers. Thirteen tons weight of paper is to be divided up into quantities of from five ounces to thousands of pounds without mistake or delay. Let any one undertake to fold up a wet paper that has never been folded, and he will estimate the difficulty of getting 200,000 folded, wrapped up, and mailed in an hour's time. To facilitate the folding, a machine has been invented, which does the work rapidly and well. A machine has also been invented to direct papers; this does not do so well. The cylinder machine is flinging off the copies seven per second, and newsboys, mail boys, carriers, and agents, are vieing with each other in the rapidity and skill of the operation. Within a short time after the huge machine begins to relax its speed, the whole mass is gone, in bags and bundles, in carts and wagons, while fifty carriers, with lots under their arms, are on their routes, and the newsboys are seeking the ferries and landings, with their shrill cries. Contrast this with the solemn grunting of a hand press thirty years ago, through the live-long night, to work off its seven reams of paper that were to furnish 3,500 copies, as the immense edition of a "crack" daily, to sleepy carriers and a mail clerk!

The operation of the express companies greatly facilitated the sending of the papers to the publication agencies in other cities. These are sent in bundles as they come from the press, and are opened, folded, and served after their arrival. There has been a growing demand in this way for city papers, and an individual recently conceived the magnificent idea of extending, as it were, a carrier's route 300 miles, and ensuring those distant readers their paper at the breakfast-table. He ascertained by calculating time, that if he could procure all the daily papers at a certain time in the morning of each day, he could run a special express up the North River in time to catch the early train going west, and by so doing deliver the papers in all the cities of the North River and on the line of the Central road, to the readers at the same time the readers in New York city get them. To do this, it was necessary for the daily papers to get to press at a certain hour, and deliver to this express the first numbers worked. This they agreed to; at the stated hour the wagon receives the papers in sheets, drives rapidly to the car waiting with steam up at the Hudson River railroad, tosses in the papers, when they are immediately seized by folders and wrappers, and made up into bundles, in the order of the nearest towns first. The locomotive starting the moment the papers reach it, whirls on like a thunderbolt, and as it passes each town and village, the package that belongs there is thrown out to be picked up by expectant hands for distribution. The first towns reached get these before they are wanted, but even with the terrific pace of the iron horse, daylight gradually breaks upon the rapid folding, wrapping, and tossing, as each successive town comes as it were out of the gloom of night, to brighten into gray and catch the gilding of the rising sun as well as the intellectual light emitted from the passing meteor. The race is sustained until the papers are all delivered and the early morning spent. The limit to this enterprise is the rate of speed only, since if that could be doubled, a radius of 600 miles around New York might feel the morning's rays of the press as well as one of 300 miles. The tendency of this is to centralize the power of the press, since, if all the readers of papers within a circle of 300 miles can get the New York papers as early and as cheap as in the city itself, and these papers contain the news of all those cities conveyed by telegraph to be printed and returned, why the carriers' routes of the city press are only extended, and the papers so conveyed will look down, or read down all competition. This enterprise was suspended after a few weeks' operation, as not yet paying sufficiently.

The sale of papers at the steamboats and in the cars has become a large business, and the privilege of doing so is now farmed out by the companies. The privilege is paid for at rates sometimes as high as $5,000 per annum on good routes, say some of the best travelled into New York. The conductor employs boys who start with the out-trains in the morning, supplying all who go. These trains meet others, in an hour's ride, coming in, filled not only with passengers from a distance, but with persons who, doing business in the city, commute on the road, and come in every day; all of them are anxious for the papers, and they are sold at 50 per cent. advance, say 3 cents for the 2 cent papers; a sale of 2,000 papers at this rate gives a profit of $30 per day, or $8,000 per annum.

The Sunday press has become a feature in New York within twenty years. The first Sunday paper was the *Sunday Morning News*, published in 1835, by Samuel Jenks Smith. It had a considerable success, but stopped on the death of Mr. Smith. In 1840, the *Atlas* was started by Herrick, Ropes & West. The last-named had been a reporter on the *Herald*. The paper had a great success, and is still flourishing. The *Sunday Mercury* was next started, and received a great impulse from the "Patent Sermons" of Dow, jr. Then followed the *Sunday Times*, the *Dispatch*, and others, which have attained much success.

The illustrated weekly papers have also become successful in the last ten years. The first was started with a good deal of capital and spirit in 1845, but lived only a short time. Then followed many which did not succeed, until Mr. Barnum and others started the *Illustrated News* in 1853, which failed in a year, although Mr. Barnum had declared that he would carry it on if he had "but one subscription, and paid that himself." A number of papers were started in imitation of the London *Punch*, but without success. The vein of American humor could not be reached until the *Yankee Notions*, a collection of grotesque wood-engravings, cheaply got up, had a success that has earned a fortune for the proprietor. The *New York Journal*, a literary paper without much circulation, introduced a few pictures. It was purchased by Frank Leslie, who, after Barnum's failure, started his successful *Illustrated Newspaper*, having of late a rival in the *New York Illustrated News*. The Messrs. Harper started, in January, 1857, *Harper's Weekly*, which was at first partially illustrated. It gradually, however, acquired the pictorial character, and attained an immense circulation, supported, as it is, by the highest talent at home and abroad. Stories by Dickens, Bulwer, Wilkie Collins, and original tales by American authors appear in it. Hence it is a work of a high character, of which the illustrations are a feature, and not the sole dependence. There were issued in 1865 over 6,000,000 copies of the *Weekly*. The largest circulation of the secular weeklies is perhaps the *Ledger*, which is partly illustrated, and is an instance of singular success. It was, at first, as its name indicates, a commercial paper, struggling to live. During the popularity of Fanny Fern as a writer, it suddenly changed character, gave that lady $100 per week to write for it exclusively, advertised freely, and obtained a circulation of about 400,000 copies weekly, which it still maintains.

We have spoken mostly of the city press, the general features of which apply to the press of most large cities, numerous examples being found in the papers of western and southern cities. The papers which have the most enduring influence upon the public mind are, probably, the country weeklies. These are, from the circumstances of the case, not endowed with the flash and energy of city papers, but their enterprise being confined to their localities, their teachings are concentrated in a manner that is read and makes an abiding impression upon the understanding of the readers. The number of these precludes any attempt at particular description, and some idea of their extent may be formed from the aggregate number as reported by the census of 1860.

		Number of copies.
Daily	387	1,478,435
Tri-weekly	86	107,170
Semi-weekly	79	175,165
Weekly	3,173	7,581,930
Monthly	280	3,411,959
Quarterly	30	101,000
Annual	16	807,750
Total	4,051	13,663,409

The census of 1860 omitted all notice of semi-monthly, or fortnightly periodicals, of which there are a considerable number, and some of them of large circulation.

The aggregate *annual* circulation of these newspapers and periodicals was 927,951,548 copies, an increase of 118 per cent. over 1850, when it was 426,409,000.

TELEGRAPHS—THEIR ORIGIN AND PROGRESS.

CHAPTER I.

TELEGRAPHS—THEIR ORIGIN AND PROGRESS.

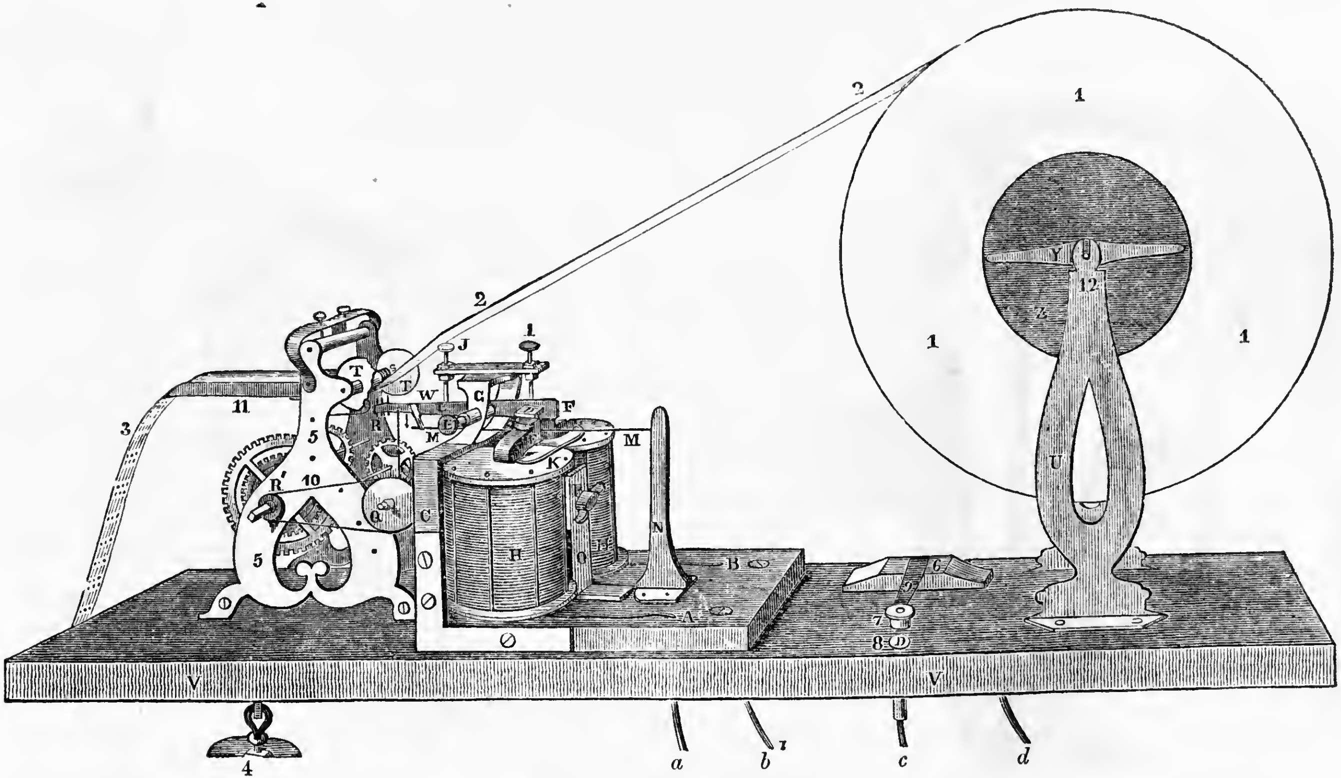
"Canst thou send lightnings, that they may go, and say unto thee, 'Here we are'?"—Job.

The invention and use of electric telegraphs are among the most important of modern improvements; and it is somewhat remarkable that the invention justifies the trite observation, that great inventions are made always at the moment they are wanted. Telegraphs have been used from the remotest antiquity, by signals of various kinds; and one by flags, to signal the arrival of vessels below, has been used during the present century in Boston; and, in New York, one operating by arms has been used for the same purpose from the Narrows to the roof of the Merchants' Exchange in New York. The electric telegraph applied lightning to intelligence as steam was applied to motion, and came into being to exceed, by its rapidity of intelligence, the means just invented to convey more rapidly by rail. Indeed, its action is necessary to the latter, since it would be very difficult to operate long lines of railroad, like the New York Erie and Central, without the aid of the electric telegraph. The patent of Morse, who was the originator of the modern telegraph, was taken out in the year 1840; since then, numerous modes of recording have been invented, and improvements adopted, and there are now three instruments in use—House, Hughes, and Morse—with a fourth, which is a combination of the two former.

It is curious, that just ninety years after Dr. Franklin identified lightning with electricity, by means of his kite, Morse should have schooled electricity to do messages instantaneously, over wire, at limitless distances. We say instantaneously, because the ascertained speed is 288,000 miles per second, which is scarcely perceptible, although, at that rate, it would take six minutes to send a despatch to the sun.

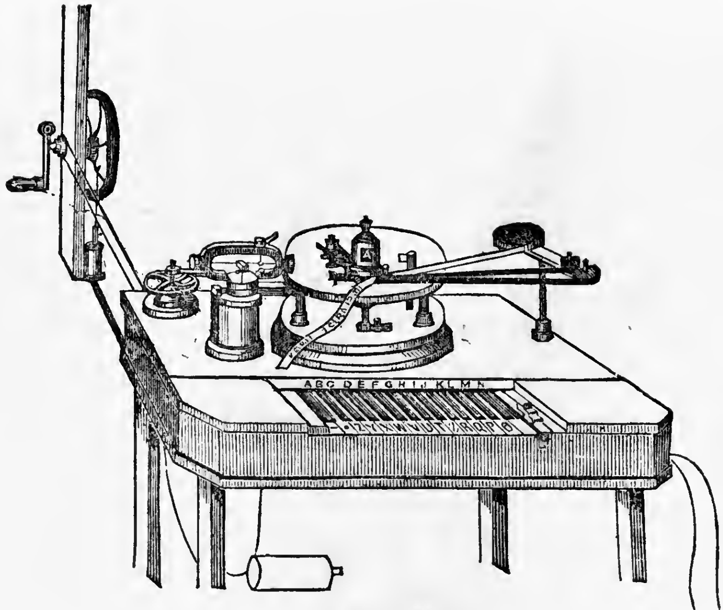
This all-pervading element manifests itself in countless ways—in the sparkling of animal hair; in the rustling of silk, which "betrays your poor heart to woman;" in the aurora that illumines the north; in the meteor that startles the astonished observer; it flashes in the lightning-bolt that rives the oak, without, while it gently penetrates into the lady's parlor and fills her form, as she glides over her warm, thick carpet, until the metal tube of the gas burner will attract enough from her finger to ignite the gas, or from her lips to startle a newly-entered friend. It will also convey to her the thoughts of distant minds with more than the assiduity of Puck, by means of the invention of Morse.

Morse was by no means the discoverer of the analogy between magnetism and electricity, but he was the first who made practicable all former discoveries and improvements. The three leading properties of electricity that make telegraphs possible, are, first, its constant desire to seek an equilibrium, always going where there is less; second, that the production of electricity is always in two currents, one *positive* and the other *negative*, having different tendencies; third, that different substances have very different conducting powers—over some it passes with the utmost freedom, while over others it will not pass at all. On this depends the possibility of telegraphing, since by it the current of electricity may be arrested or conveyed at the will of the operator. It was known that a current of electricity would render steel magnetic, and that to wind wire, in a certain way, round the steel, would greatly increase the effect. This magnet would then attract soft iron, and would remain magnetic as long as the current of electricity ran on it. The telegraph, then, consisted in connecting two of these magnets by a wire of any number of miles in length, and directing through it a current from an electric battery. By cutting off

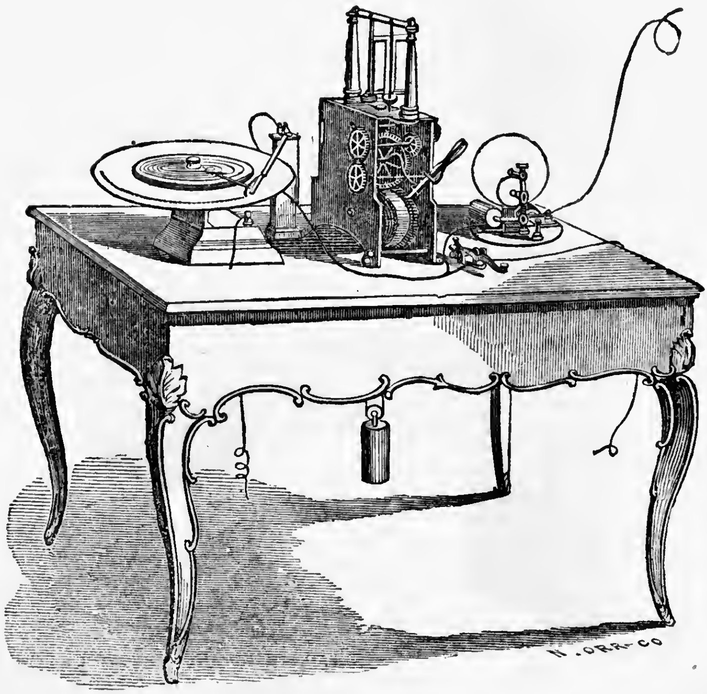


MORSE TELEGRAPH APPARATUS.

H H represents the electro-magnet, L the pen-lever, and F the armature. Numerals 1, 1, 1, represent the reel of paper, with its axle at Y, fitted into the brass standard U at 12; 2, 2, is the paper coming from the reel; 11 is a metallic trough; and 3 is the paper after it has been marked by the pen points R; 4 is the weight that puts in motion the clockwork revolving wheel, to which is fastened the pulley R', with an endless band 10, which puts in motion the wheel Q. The letters *a*, *b*, are the line wires, one running to the battery, and the other to the telegraph poles. When the current passes through the coils H H, the armature F is attracted, and the lever W attached is elevated in the direction of the arrow, causing the small steel points, R, to puncture the paper passing between them and the roller T T. 6, 7, 8, and 9 represent the key. V V is the platform; S is a metallic anvil, with its smaller end appearing below, to which is fastened the wire *c*; 7 is the metallic hammer attached to the brass spring 9, which is secured to the block 6, and the whole to the platform. The copper wire *d* is fastened to the brass spring 9, and the other end to the line wire; *c* to *b*, and *a* runs to the voltaic battery.



HOUSE PRINTING APPARATUS.



BAIN'S ELECTRO-CHEMICAL TELEGRAPH.

the current, the steel becomes alternately charged and at rest with great rapidity. To form the current, it is necessary that each end of the wire should communicate with the ground. The interruption is caused by stopping this communication. The first invention of Morse was to place a small, soft iron bar across the end of a rod supported on pivots, in such a manner that the iron bar should be near the magnet. The moment the electricity excites the latter it attracts the iron, and, by bringing it down, causes the other end of the rod on which it rests to rise. That end is armed with a pen, which, as it rises, is pressed against a slip of paper, making a dot upon it. The distant operator, by making his connections longer or shorter, causes the pen to make marks more or less long, and these marks convey words or ideas. This instrument is called the register. This was improved by a clock-work accompaniment, by which the slip of paper is moved from a spool steadily under the pen in operation, thus receiving the impression conveyed.

The transmitting apparatus is very simple, being designed only for the opening and closing of the circuit in a manner more easy than by holding the ends of the wire in the hands, as is done where there is no apparatus. The two ends of wire are separated by two pieces of metal, on one of which is an ivory button, and on the other piece a steel knob, or "anvil." The operator, by depressing the button, brings the two together, completing the circuit, which is instantly broken by releasing the button; this may be done with great rapidity. To this system, at a later period, was added the "sounder," a simple contrivance, by which signals are conveyed by sound at the will of the operator, when the electric current is weak. Up to 1842 the operator read the despatch from slips of paper to the copyist, who wrote it down. It was soon found, however, that the despatch could be read by the "click" of the instruments, and the operator now copies, himself, from the sound. If a line is well insulated, a despatch may be sent 1,000 miles with as much ease as a shorter one; but variable weather, and other causes, prevent proper insulation, and "repeaters" are used. By this, the breaks and connections of one circuit are transmitted to another for the purpose of renewing the power. These are the chief features of Morse's system.

In 1846, a patent for a printing telegraph was applied for by Mr. House. By this, seventy strokes, or breaks, may be made in a second. A key-board, similar to that of the piano, has the twenty-six letters of the alphabet, and a dot or a dash painted over them. Under the key-board there is a wheel with fourteen cogs and as many spaces. Over all is a spring, which, when it presses against a cog, closes the circuit, and when over a space, opens it; a man turning a crank causes this to revolve, and at each revolution the circuit is opened and closed twenty-eight times. The paper receives its impression from the steel type cut in the surface of the type-wheel, by a press, which forces, by an ingenious contrivance, a blackened silk ribbon upon the type-wheel with sufficient force to make an impression. The type-wheel can make just as many revolutions as the circuit-wheel, and no more, and it has equally as many cogs. The press can only work when the type-wheel is at rest, and that is controlled by the keys. These are leading features of the House system. The first line that used this was the New York and Philadelphia, in 1849, and in the same year it was adopted on the New York and Boston, and others have since adopted it.

The system of Hughes was the most extraordinary of all in point of mechanism, and, in fact, was proved to be too perfect for the state of the other apparatus used. The instrument is not worked by a crank, like that of House, but by clock-work, with weights. Inasmuch, however, as the ordinary pendulum would be far too slow in its movements, he invented a vibrating spring called the "governor." This depends upon a law of acoustics, by which a certain number of vibrations per second produces a certain musical tone, and, per contra, two springs at the same tone will give the same number of vibrations. These springs control the speed of the instrument; hence, if all the instruments on a line of telegraphs are set to the same tone, they will run with the utmost accuracy. So great is this, that Mr. Hughes has run his instruments 140 revolutions per minute, through an entire day, without a perceptible variation—a result of the most surprising character, enabling the type-wheel to present the same letter in the same place all along the line at the same moment. The type-wheel of Mr. Hughes' system is the same nearly as that of House, with the important difference, that it does not stop to print, but imparts an impression with ink on the paper itself while revolving at the rate of 130 revolutions per minute, or, it prints a letter at every pulsation of the telegraph; while that of House requires seven, and Morse three and a half. The sensibility of the combination of Hughes is so great, that the simple contact of zinc with copper wire gives sufficient power to work it. The operating of the type-wheel is very simple and effective. The key-board contains twenty-eight keys, and is operated like that of House. Suppose there are twenty-eight spaces on the circumference of a cylinder, at equal distances, and a peg upon the end of each key, so arranged that, upon being depressed, it enters into an allotted space once during each revolution; upon entering the space it completes the circuit; by so doing it causes the type-wheel to make the impression of a letter; nothing could be more perfect. In practical operation, however, the movement by weights required such a complication as to lead to continual breakage. It was also found that the high degree of sensitiveness, which was to cause the machine to operate longer distances without relays, was a serious objection, since no insulation being perfect, any change in the weather disconcerted it. To obviate these difficulties, a combination of the Hughes and House has been perfected, and is now used by the American Telegraph Company. The combination is so perfect, that six letters may be printed at every revolution, and as the machine runs 140 revolutions per minute, it gives the enormous result of 50,400 letters, or 10,080 words, per hour. This number is, however, far beyond practicability, since no operator could manipulate with such rapidity. The ordinary speed with the electro-magnetic governor of Mr. Phelps is 2,000 words per hour. The usual rate on the Morse line is 1,000 per hour, and on the House, 1,800 per hour.

These are the principal inventions that have brought the telegraph system to its present perfection. It is but fifteen years since the first line was constructed, and there are now 50,000 miles in operation on this continent, having 1,400 stations, and employing 10,000 operators and clerks. The messages are estimated at 5,000,000 per annum, paying $2,000,000; in addition to which, the press pays $200,000 for despatches.

The wire used for the telegraph is of iron, No. 9. This metal conducts only about one-seventh as well as if of copper; but it is preferred for its superior strength and cheapness. The best prepared is coated with zinc. Without such coating, especially near the sea, it would rust off in a very few years. With the coating, it may have been in use ten years, and will still be in good preservation. When the distance between the supports is necessarily great, as river crossings, and the like, steel wire is used. The most important point in the construction of the lines is insulation; and this is very defective. The materials mostly used are glass; glass protected by iron; glass inserted in pine-wood, soaked with shellac; baked clay; white flint; and bone-rubber. All these are very imperfect; and yet, upon every 500 miles of wire, there are 15,000 of these imperfect insulators mostly affixed to chestnut posts, that are green. There is little matter of surprise, therefore, that constant interruptions occur, and that in wet weather most lines are unmanageable. The cost of a line is $61 per mile. The stations, or relays, are at certain distances from each other; and when a break occurs in the line, the operator ascertains on which side of him it has occurred, east or west. If east, he sends out a repairer to search until he comes to the next station. The operator there, meanwhile, has ascertained that the break is west of him, and he sends out a repairer to search until he meets the other repairer coming east, and the two repair the broken wire in a very simple manner.

The Bain system was completed in 1849, and is one of the simplest construction. There is no magnetism used; only the chemical effects of the current are necessary. A metallic disc, moved by clock-work, receives a sheet of prepared paper. Upon the paper rests a screw-plate, which serves to guide a pen in regular spiral lines from the inner to the outer edge of the disc. The current passes through this paper to the earth, and a very small battery will cause the pen to leave a blue mark upon the paper at 250 miles distant. This system was set up on the Boston line, and was afterward united with the Morse system. This adoption of the chemical effects of electricity has led to various modes, by which *fac-similes* of handwriting may be transmitted to long distances with the greatest rapidity, say 19,500 words per hour!

This system it is which excited much interest in the public mind some time since, from the idea that it could transmit signatures; that a person in New York might, supposing the Atlantic cable in operation, sign his name to a bill in London. This was invented by M. Caselli, of Florence. The despatch is written upon tin-foil, and the copy is blue, upon white ground. The ingenuity of the system consists in the fact that the resistance of the ink to the passage of the electricity reverses the polarity in the point of the receiver. From negative it becomes positive, producing upon paper a colored and perfect image of the original despatch. The chemical effect is so delicate, that the minutest traces of writing or drawing are accurately reproduced. The method by which this is done remains a secret with M. Caselli. The commercial world were much interested in the idea of writing to any distance by telegraph, but it is not likely to come speedily into general use.

The first line constructed in the United States was from Washington to Baltimore, in May, 1844, a distance of forty miles. It was then extended to New York, a distance of 250 miles. In 1845 it reached Boston. From this great northern line branched one of 1,000 miles, from Philadelphia to St. Louis; another, of 1,300 miles, *via* Albany and the lake cities, to Milwaukee; a fourth, of 1,395 miles, from Buffalo to Halifax. A line was constructed of 1,200 miles, from Cleveland to New Orleans; and one of 1,700 miles, from Washington *via* Charleston, S. C., and Savannah, Georgia. In 1851 there were seven Bain lines in operation, over 2,000 miles; eight House lines, having 3,000 miles of wire; and 67 Morse lines, having 20,000 miles. In the autumn of that year, the Magnetic Telegraph Company, having lines extending from New York to Washington, and the Bain Company, having lines over the same route, were consolidated. In the following spring, the Morse and Bain lines, Boston and New York, were united under one company. This was followed by the union of the Morse, Bain, and House lines, New York to Buffalo. The Rhode Island Telegraph Company, having lines between Worcester, Providence, Fall River, Taunton, New Bedford, Warren, and Bristol, were sold in 1853 to the Morse and Bain line, called the New York and New England, for $5,000. Their cost was $10,000. In the fall of that year, all the leading lines west, south, and north-west, were united in interest. There then remained in that year only the House lines between New York and Washington, and New York and Boston; all others having been sold out to rival lines. The receipts of the Magnetic Telegraph Company, which was the first organized, were in 1847, $32,810; in 1848, $52,252; in 1849, $63,367; in 1850, $61,383; in 1851, $67,737; in 1852, $103,232. The most profitable of all lines was the Maine Telegraph Company, from Portland to Calais, Maine, 306 miles. This company paid about 20 per cent. per annum up to 1855, when it was leased to the American Company. In 1853 it bought the Portland and Boston lines out of its earnings, and divided 50 per cent. in stock. In 1855 the American Telegraph Company leased that line at a rate that gives 10 per cent. on the stock. It leased many other lines, until, in the beginning of the present year, it had consolidated all the lines from New Brunswick to New Orleans; thus acquiring the exclusive use of all the patents of the various telegraphic apparatus in use. The company has 25,000 miles of wire in operation, and a capital of $1,500,000. The receipts of the company for the six months ending May, 1860, were $485,395, giving net profits of $123,400. This process of consolidation, however, marks an immense loss of money on the part of those who have subscribed for telegraph lines, mostly arising from the severity of the competition. The use of the telegraph by the daily press is such, that the Associated Press pay to the various lines $200,-000 per annum, a sum sufficient to maintain a line from New Orleans to Halifax; and it may at any time become the sole director of the whole. The New York press pays one-half this amount, and the remainder is divided among the papers of other sections; the country papers paying about $30 to $40 per month. The great impulse to telegraphing west was given by the *Herald*, in 1847. In that year Mr. Clay was to speak in Lexington, eighty miles from Cincinnati, on the Mexican war. Horses were relayed every ten miles. When the speech was taken down by the short-hand writers, it was carried to Cincinnati in eight hours, and was issued by the *Herald* next morning. The expense was $500.

At the commencement of 1848 there were 3,000 miles in operation in the United States; in 1850, 22,000; in 1853, they had increased to 26,375; and at the present time there are 50,000 miles on the continent.

The number of messages sent each year is estimated at 5,000,000; giving a revenue of $2,000,000, and employing 10,000 operatives and clerks.

A message throughout the United States and British provinces is scaled to ten words; beyond which, the price for each word is generally about 20 per cent. less. On the line from Savannah to New Orleans it is 50 per cent. less for each added word; from Boston to New York, 25 per cent. less; and from St. Louis, westward, 16 per cent. less. The average may be considered at 20 per cent. discount on all words over the first ten. No charge is made for signature or address. Thus, a message may be transmitted:—

"Tremont House, Boston, Massachusetts, January 1st, 1859.

"To John James Doe, Esq., No. 500 William street, 3rd story, room No. 25, New York city.

"Purchase for me 1,000 bbls. of flour, and ship to me at New Orleans, immediately. 44.33.

"William Richard Roe."

The above is the form of a message, usual on the American lines. There are fifteen words. According to the tariff hereinbefore mentioned, for the first ten words the charge is 40 cents, and the five added words 3 cents each, or 15 cents: total, 55 cents. The figures 44 mean, "Answer immediately by telegraph," and the figures 33 mean, "Answer paid here." These figures are free. Each number is counted as a word. The telegraph companies in the United States and the British provinces solicit particulars as to address, and the policy is good. In Europe, many men locate and remain a lifetime in the same building and in the same business. Like cases rarely occur in America. In the former country, a brief address is sufficient; but in the latter, particulars are necessary. In the regular form, forty-four words are transmitted in one despatch for 55 cents. There is no charge for delivery.

ATLANTIC TELEGRAPH.

Prof. Morse had, in 1843, predicted that there would be, within a few years, an Atlantic telegraph, and Mr. F. N. Gisborne, a practical telegraphic engineer, conceived the project of uniting St. John's, Newfoundland, with the main continent in New Brunswick, by telegraph wires. In 1851 he obtained an appropriation from the Colonial Legislature, and having made a survey for 350 miles through the forest, attempted the prosecution of his work, but met with misfortunes and financial disaster, which ruined him, and postponed the completion of his project. Early in 1854 he came to New York, and attempted to find parties who would renew the enterprise; and, in so doing, was brought into the company of Cyrus W. Field. This gentleman, though willing to hear what he had to say, was not in favor of his enterprise, but in conversation with him conceived the possibility of laying a submarine cable across the Atlantic, and the next day wrote to Lieutenant Maury, to enquire in regard to the possibility of laying such a cable, and to Prof. Morse, to ascertain whether it would serve the purpose designed, if it were laid. Encouraged by cordial and satisfactory letters from both of these gentlemen in reply, Mr. Field resolved to make the effort to form a telegraph company, which should unite New York, by way of Newfoundland, with London. He enlisted four gentlemen of large wealth with him in the enterprise, and obtained from the Colonial Government of Newfoundland a new charter, securing to them, as the New York, Newfoundland, and London Telegraph Co., for fifty years, the exclusive right of laying cables across the Atlantic, which should terminate in the colony or its dependencies; and also to connect St. John's, Newfoundland, with the lines in the United States. This line was completed after two years, and at an expenditure of about a million dollars. Meantime Mr. Field and his associates had been busily making preparations for their greater enterprise. The United States Government, and that of Great Britain, at their request, sent, in 1856 and 1857, vessels to make soundings anew over the proposed route. Both guaranteed the use of their ships of war to aid in laying the cable, and a subsidy of $70,000 premium was granted by each, to cover the cost of transmitting their own messages. The Atlantic Telegraph Company was formed near the close of 1856, in England, with a capital of £350,000 ($1,750,000), of which Mr. Field took for American stockholders, £88,000 ($440,000). This company had a submarine cable prepared, which was to be laid by the *Niagara*, an American steam frigate of the largest size, and the *Agamemnon*, an English steamship of the line; the *Niagara* beginning at Valentia Bay, on the Irish coast, and laying it to mid-ocean, where the *Agamemnon*, uniting the end of the *Niagara's* coil to her own, should proceed with it toward the coast of Newfoundland. Partly by the fault of the engineer, and partly for the want of proper machinery for paying out the cable, it was broken on board the *Niagara* when about three hundred miles from Valentia. The season was so far advanced, that it was deemed inexpedient to make another attempt to lay it that year. About six hundred miles of new cable was made to replace that lost, and the portion remaining on the *Niagara*, and that on the *Agamemnon*, having been landed, were kept in coil on shore.

In 1858 the experiment of laying the cable was again made, beginning this time in mid-ocean. After three failures, from the breaking of the cable, the last of which caused the return of the two war ships to England, they again set sail, and, though not without several alarms from the cessation of continuity, the cable was at length laid, and messages sent through its whole extent on the 5th of August, 1858. Owing to delay in the completion of the connections, Queen Victoria's congratulation to the President was not received till August 16, and President Buchanan's reply was returned the same day. Great was the rejoicing throughout the United States at this wonderful success. In the midst of this universal rejoicing, and on the very day when hundreds of thousands were assembled in New York, to do Mr. Field honor, the public were stunned by the intelligence that the ATLANTIC CABLE WAS DEAD; that there was an absolute cessation of all transmission of telegraphic signals through it. For a time it was hoped that this cessation might be temporary, as several previous ones had been, but no efforts were availing to resuscitate it. Prostrated for the time, but not utterly overwhelmed, by this sudden wreck of four years of intense labor, Mr. Field again crossed the Atlantic, and for two or three years he and his associates, together with a commission appointed by Parliament, were engaged in experiments upon the best modes of construction and insulation of electric cables, the most effective means of operating them without destroying them, and the best methods of laying them. On all these points much valuable light was gained. His next effort was to obtain the necessary capital and guarantees for the construction and laying of a new and better cable. After almost superhuman efforts, he succeeded in obtaining from both Governments fresh guarantees, and from English capitalists (Thomas Brassey, Esq., a merchant of immense wealth, taking the lead) the needed resources to enable him to procure a new cable, the manufacturers, Messrs. Glass, Elliot & Co., taking one-half the stock for the new enterprise, and the *Great Eastern* being purchased by the Telegraph Construction and Maintenance Company, to lay it. On the 15th of July, 1865, the *Great Eastern* set sail with her vast cargo on board, paying out from Valentia, where the shore-end had been landed and secured. They paid out over twelve hundred miles of the cable, and, though they had met with two or three mishaps, were proceeding well, when, in consequence of an accident, it suddenly broke, at a point where the water was about two and a half miles deep. The attempt was made to grapple for it, and three times it was caught and raised nearly a mile; but the grappling apparatus broke each time, and they were compelled to return to England. In 1866, a new cable having been manufactured, and the external protecting wire galvanized, and the remainder of the cable of 1865 also taken on board, the attempt was repeated, the *Great Eastern* leaving Valentia on the 13th of July, and landing the western end of the cable without mishap at Heart's Content, Trinity Bay, Newfoundland, on the 27th of July. The great work was at last completely successful. All the details being completed, the *Great Eastern* next proceeded to the point where the cable of 1865 was broken, and, after some grappling, secured and spliced that cable, and, steaming slowly, laid the remainder of that also. The cables have now been for more than four months (Dec., 1866) in operation, and their power of transmitting signals has constantly improved.

Another telegraphic line is now in course of construction, from St. Petersburg, east, through Siberia, to the mouth of the Amoor (and with a branch connecting with the principal cities of China), and thence through Kamtchatka, across Behring's Straits, and down the interior of Russian America, to British Columbia, Washington Territory, and Oregon, where it connects with the telegraph from San Francisco, across the continent to New York; and a company has been formed to lay a cable by way of the West Indies and Azores to Spain.

THE ARTS OF DESIGN IN AMERICA,

FROM 1780 TO THE PRESENT TIME.

CHAPTER I.

PAINTING, SCULPTURE, AND ENGRAVING.

Horace Walpole says, in his "Anecdotes of Painting in England" (writing in 1762): "As our disputes and politics have travelled to America, is it not probable that poetry and painting, too, will revive amidst those extensive tracts, as they increase in opulence and empire, and where the stores of nature are so various, so magnificent, and so new?"

These lines were penned, perchance, in grave prophetic faith, but it may be that they were only idle speculations—a play of fancy, meaning nothing. Certain it is, that were the critic ever so much in earnest, very little could he have expected the full and noble response which so short a period would make to his query.

Little could he or any one have foreseen the rapid growth of these "extensive tracts" in population and in every phase of material life; still less the wonderful strides which they have made in all branches of mechanical and industrial art; and least of all, their achievements in the higher and æsthetic arts of design. Little could he have dreamed that within a period seemingly insufficient for the construction even of the rude foundations of empire, our country would have reached that point of refinement and intellectual development which gives it, in ample store, its own literature and its own arts—both with a strong and peculiar individuality of character and life.

The only artists in America in Walpole's time were a few strangers—Englishmen for the most part—who had wandered hither in quest of a fortune which their very humble talents had failed to win at home. They did little or nothing toward the development of the public taste, and left no works to honor the future; though they may, perhaps, have served, in some measure, to open the path for the distinguished group of *native* painters who, quickly succeeding them, fairly and surely lighted the lamp of art which now burns with such pure and ever-growing brightness.

The earliest of these pioneers, whose name has been preserved, was John Watson, a native of Scotland. He crossed the seas and set up his easel in Perth Amboy, in New Jersey, in the year 1715. In this little port, which was then thought destined to be what the city of New York is now—the commercial emporium of the country — Watson painted portraits, such as they were, through a long life. He appears to have had plenty of "sitters," and to have grown rich upon the fruits of well-employed industry; but we can gather no intimations of the state of the popular taste at that time through the medium of his works, inasmuch as none of them now remain for our inspection. Watson was buried about the 22d of August, 1768, in the old church-yard of his adopted village, at the venerable age of eighty-three years.

Our next pioneer was John Smybert, a stronger man, much, than Watson, and one who, though he painted no pictures to be treasured in our galleries, yet left footprints of good incentive and example, which we may clearly trace beneath the subsequent march of greater gifts. Copley, though but thirteen years of age at the time of Smybert's death, confesses indebtedness to him and his works. So also does Trumbull, who at one time painted in the apartments he had occupied, and in which many of his pictures still remained; while Allston is thankful for the advantage he enjoyed in the permission to copy a head which Smybert had executed after Vandyke. Smybert accompanied Bishop Berkeley to America in the year 1728, at the age of forty-two. Like Watson, he was a Scotchman, and like him, again, he pursued his craft in the colonies with gratifying financial success. He lived in Boston in high public favor until 1751, leaving behind him many portraits of the distinguished characters of his time.

Nathaniel Smybert, a son of John Smybert, followed his father's profession worthily in Boston for a short time, and, according to the opinion of cotemporary critics, gave promise of more than ordinary talents. No record of him remains beyond the meagre facts here mentioned, and the additional one that he died early.

While the Smyberts were planting the seeds of art in Boston, there was in Philadelphia a Mr. Williams, an Englishman, remembered gratefully by West as the man who awakened his love of pictures by lending him books and by showing him the first works in oil which he had ever looked upon. During the same period, Woolaston and Taylor were also in Philadelphia; a Mr. Hesselius was at Annapolis in Maryland; a Mr. Theus in Charleston, and other laborers were in Virginia.

Besides the foreign adventurers here spoken of, there were a few native artists scattered over the country during the ante-revolutionary period of our history. It is hardly desirable to recall even their names, or to add to our list of the yet earlier strangers; since, despite the service their little light may have done, in the then deep darkness, not one of them all possessed more than the most moderate talent, and not one will be remembered excepting in the way in which they are now so briefly referred to—that is, in consideration of the *initial* times in which they chanced to live.

The birth of American art was not in any portion of our colonial epoch, but singularly and felicitously enough, was in that day of happy augury when our country itself sprang into life, and started upon its conquering course of national development and power; and with equal strangeness and equal felicity, the very beginning of our individual existence as a people produced, on a sudden, full-grown artists of first-rate genius, as it did Minerva-born statesmen, soldiers, and philosophers.

During the progress of our great revolutionary struggle with the mother land, and at the time of our successful emergence from that trial, Benjamin West, born in the forests of Pennsylvania, was reaching the highest honors in the art world of London, surpassing all native competitors, becoming the successor of Reynolds in the presidental chair of the English Academy, and enjoying the most distinguished consideration, the patronage, and the personal friendship of the very monarch against whom his countrymen were waging angry war.

It is, then, with Benjamin West, and with the birth of our country as an independent nation—about eighty years ago, as we now write—that our story of American art properly and prosperously begins. We shall, however, say but little of West, since the space that has been allotted to this subject does not afford room for an extended notice of any one. Though we may rightfully honor him as the father of American painters, and may write his name first on the long catalogue of eminent laborers in the noble field of art which we now possess, yet, the fact that the greater part of his professional life was spent in England, and that his chief success was won there, places him, in one sense, among the painters of that country, rather than of this; just as the life-long residence among us of a foreign-born artist may make him ours, instead of his own countrymen's.

West was born in 1738, in Pennsylvania, as we have already said, near Springfield, Chester county. His parents were Quakers, and their habits of life, together with all surrounding circumstances, were such as to discourage rather than foster a predisposition toward the study of art. The bent of the boy's mind was, nevertheless, early and powerfully manifested. The sight of Williams' pictures inflamed his youthful predilections to such a degree that, in want of better pencils, he manufactured a supply from the stolen fur of his mother's favorite cat; in want of subjects, he, while yet a child, seized upon his infant sister sleeping, all unconscious, in her cradle; and in want of pigments, he borrowed ochres of the Delaware and Mohawk Indians, and indigo from the maternal laundry! He studied after a while in Philadelphia, and subsequently painted portraits in New York. At the age of twenty-one he went abroad, and after a tour through the art cities of the continent, he established himself in London, where he afterward chiefly resided, rising rapidly into popular favor, until, upon the death of Sir Joshua Reynolds, the first president of the Royal Academy, his position as the head of the English school was affirmed by the high honor of his election to the vacant chair. This distinguished position he filled with great dignity until his death, on the 11th of March, 1820, at the advanced age of nearly eighty-two years.

West's fame was won chiefly in the noble field of historical painting—a department which his brother artists of America have not continued fittingly to cultivate; though one in which they cannot, in due time, yet fail to distinguish themselves no less honorably than they have already done in landscape and portraiture; so rich and boundless are the themes at their command, and growing with every passing year yet more beautiful and noble in aspect.

Among the chief productions of his skilful and most industrious pencil, we may mention the Battles of the Hague and the Boyne; the Death of General Wolfe; the Return of Regulus to Carthage; Agrippina Bearing the Ashes of Germanicus; the Young Hannibal Swearing Eternal Enmity to the Romans; the Death of Epaminondas; the Death of Chevalier Bayard; Penn's Treaty with the Indians; Death on the Pale Horse; and Christ Healing the Sick. Many of his works are now in America; among others, Death on the Pale Horse, which is in the galleries of the Pennsylvania Academy of Fine Arts in Philadelphia; and Christ Healing the Sick, also in Philadelphia, in the Pennsylvania Hospital, to which it was given with noble generosity by the artist himself.

In the same year in which West was born in Pennsylvania, John Singleton Copley, another distinguished man in the earlier days of American art, appeared in the city of Boston. The one, like the other, after following his profession at home for some time, went to London, and there continued to live and labor for the rest of his days. The simultaneous appearance of these two gifted men, at this early period of our country's progress, and in sections of the Union then so far separated, was, as Cunningham says, when alluding to the circumstance—most "noteworthy." Copley was occupied for the most part with portraits, though he made successful incursions at intervals into the domains of history. One of his best works in this department of the art, and that to which he first owed his fame, was the large canvas representing the Death of the Earl of Chatham. Copley died in 1815, five years earlier than his *confrère*, Benjamin West. Many of his pictures are now treasured in the galleries and in the private collections of Boston, and in other parts of the Union. Lord Lyndhurst, of England, was a son of this artist.

In 1754, just sixteen years after the birth of West and Copley, Gilbert Stuart, of Rhode Island, came upon the stage, the earliest of that gifted line of portrait painters whose works have placed this branch of the art as high in America as in any part of the old world. Stuart, with Trumbull as a companion, studied under West in London, where he afterward painted successfully, and in due time rose to great eminence. Unlike his distinguished predecessors, West and Copley, he returned after a time, to his native land, and after some years practice of his art in Philadelphia, Washington, and Boston, he died in the latter city in July, 1828, in his seventy-fifth year. His name is familiar to the public at large, through his great picture of Washington, which he repeated for various societies and state legislatures, and which is spread over our land in every style of the graver's art. He painted noble portraits of many other of the distinguished people of his time—from presidents to private gentlemen. His works are cherished among us as master-pieces and models, exerting still, as they have ever done, a marked influence upon the character of American portraiture. The especial characteristics of his style were a marvellous freedom and boldness of touch, a wonderful freshness and fulness of color, and a truth of character which placed the very soul of his sitter before you in the most striking individuality. "He seemed," says a cotemporary writer, "to dive into the thoughts of men—for they are made to rise and speak on the surface;" and Sully is reported to have remarked of one of his portraits: "*It is a living man looking directly at you!*"

Stuart was a man of eminent social disposition and abilities, a famous wag and humorist, fond of a jest, and overflowing with anecdote. Innumerable amusing illustrations of this trait in his character, sprinkle and enliven the recorded and remembered records of his life.

Another pupil of West's, at this period, was Robert Fulton, who was born in Little Britain, in the county of Lancaster, Pa., in 1765. Fulton commenced the practice of art in 1782, at the age of seventeen, but continued it only a few years, being more powerfully led toward those scientific studies to which his genius was, as the end proved, better adapted; and from which sprang that glory of our time, the practical and permanent application of steam to navigation. Fulton's short career as an artist left no legible mark; what might have been his achievements had he continued in the guild, we cannot say, and are, indeed, careless to inquire, in view of his immortal labors otherwise. American art is willing to spare him, as it has since spared the illustrious Morse, to its graver sister, Science; and is no less proud of the practical blessings he has bestowed upon his country, than it would be of the highest æsthetic success. Fulton died upon the 24th of February, 1815.

Next among the men of service and influence in the cause of art in America was William Dunlap, who was born in Perth Amboy, N.J., February 19th, 1766, and who commenced the profession of portrait painter about 1782. Dunlap will be remembered as an artist more for his long life of reverent and persistent devotion to the craft, and for the respect and estimation which his character gained for it, than for his success at the easel; though he both attempted and achieved works which were commended at a less brilliant period than the present. He was also an author of considerable ability. Among his works is a "History of the American Theatre," published in 1832, and another of the New Netherlands, which appeared in 1840; a memoir of Charles Brockden Brown, and various plays of considerable interest. But the most important of his literary labors is the only record we possess of the early story of American art, an invaluable work under the circumstances, and one for which he will be ever remembered, although clumsily constructed and injured by a most wearisome medley of irrelevant matter. In this "History of the Arts of Design," Dunlap gives us his own biography with great discursiveness and fulness, though with humble and characteristic reverence, exhibiting his own career as one to be shunned rather than followed. 'I look back," he says in mournful reflection, "upon a long life, with the persuasion that what is called misfortune in common parlance is caused generally by our own folly, ignorance, mistakes, or vices." To read his story as recorded in his "History of the Arts of Design," is to read a sad record of untoward circumstances, varied effort, and ever-following failure; but, withal, a praiseworthy and even exalted longing to be of use to his fellows and his country. His pictures were generally of a very ambitious character, scriptural themes on canvas twenty feet long. Among these productions of high art were Christ Rejected; Bearing the Cross; Calvary; and Death on the Pale Horse; the first of which was made up in part, and the last wholly, from West's pictures of the same names.

Besides thus remembering Dunlap for the art records which he has preserved with so much honesty and industry, and for what he would have done, and sought to lead others to do at the easel, he must be honored as one of the founders and the first vice-president of our leading art society, the National Academy of Design in New York. Dunlap died on the 28th of September, 1839.

To the life and works of Colonel John Trumbull our early art owes great obligations, though it is much the fashion at this day to disparage and deny his genius. Trumbull's name is familiar to the people through his grand pictures of revolutionary story which decorate the walls of the national capitol. He was the son of the first governor Trumbull of Connecticut, and was born at Lebanon on the 6th of June, 1756. To high birth he added, through life, high character and learning, and great culture and dignity of manners. His early studies were, as was the case with all the artists of his time, pursued abroad and under Benjamin West. He entered the American army at the commencement of the Revolution, and was an eye-witness of, and participant in, some of its most stirring scenes, of which the subsequent delineation won for him his fame as a painter. The four large works executed for the government, are: the Declaration of Independence; the Surrender of Cornwallis; the Surrender of Burgoyne; and Washington's Resignation. An appropriation of thirty-two thousand dollars was made for these pictures, besides which, the artist received considerable emolument from their public exhibition through the country. Among his other historical works may be mentioned the Battle of Bunker Hill; the Death of General Montgomery; Capture of the Hessians at Trenton; and the Death of General Mercer at the Battle of Princeton. In addition, he executed various scriptural subjects, and many portraits, among which was a full-length of Washington, painted in 1792, in the artist's best days. A few years before his death, he presented his collected works to Yale

College, upon the condition that they should be suitably housed, and that he should receive an annuity of one thousand dollars. The college erected a gallery on its grounds in New Haven, where the pictures were placed, and where they now may be seen.

Colonel Trumbull was president of the American Academy of Fine Arts, in New York, until that effete organization was superseded in 1826 by the establishment of the National Academy of Design. Trumbull did not, at any period of his life, possess much of that genial fellowship and social habit so characteristic of artists, and so essential to personal popularity in the profession. He died in 1843, at the venerable age of eighty-seven years, leaving behind him a name unspotted, and a claim to distinguished remembrance in the history of art in America, despite all the faults of his works, and however much they have since been or yet may be surpassed.

Charles W. Peale, born at Chesterton, on the eastern shore of Maryland, April 16th, 1741, was an active colaborer with Trumbull and his fellows, but was not eminently successful at the easel. He was a man of versatile gifts, and at various times dabbled in all sorts of crafts. He made his brothers, sisters, sons, and daughters all artists. He died in 1827, at the age of eighty-five years.

John Vanderlyn was born in Kingston, in the state of New York, in October, 1776, where he died at the age of seventy-six years, in 1852. Aaron Burr was struck with his boyish performances in art while he was a blacksmith's apprentice in his native village, and befriended him at the commencement of his career. At the age of twenty he made the foreign tour, so customary at the time, studying in Paris and other cities of the continent of Europe. In the year 1817, the corporation of New York having given him the lease of the ground, he erected the building in the north-east corner of the City Hall park in New York, afterward used as the Post Office, and always known as the Rotunda. Here he exhibited in succession a series of panoramas, the first seen in this country, of Paris, Athens, Mexico, and Versailles, with his own pictures—Marius, Ariadne, and other subjects. The unexpected cost of the building, and the resumption of the lease by the city before the artist had fairly tried his speculation, made it a matter of serious pecuniary loss to him. Among his chief pictures are the Landing of Columbus, which fills one of the panels of the rotunda of the Capitol in Washington—one of the pendants of those already mentioned by Trumbull; his fine picture of Marius Musing over the Ruins of Carthage, painted in 1808; and his superb full-length figure of Ariadne, so beautifully engraved by Durand; portraits of Presidents Madison, Monroe, and Jackson; of Calhoun, De Witt Clinton, and other distinguished men. He exerted a most healthy influence upon his fellow artists, and his works remain as models for future study.

Edward G. Malbone was born in Newport, Rhode Island, in 1777, and died in Savannah, in May, 1807, in his thirty-second year. During his short life he won high reputation as a miniature painter; and his works in this department are still preserved in various parts of the country as masterpieces of art. One of his most successful productions—a picture of three half-length female figures, called The Hours—is now in the possession of the Athenæum in Providence.

Rembrandt Peale, whose history belongs to this period, though but so recently deceased, was born of a family of artists in Pennsylvania, on the 22d of February, 1778. He was an active, earnest man in his time, and did much in the service of art, by his own works, and the incentive which his example gave to others. His picture of Washington, painted in the artist's boyhood, and afterward often repeated by him, is well known; as also his grand work called the Court of Death. His long and honored career, which embraced nearly the whole period of our art history, was closed on the 3d of October, 1860.

John Wesley Jarvis, one of the most distinguished portrait painters of this era, was born in England in 1780, and brought to America at the age of five years. He painted innumerable pictures, many of them of great merit; and did good service as the instructor of Henry Inman, and other distinguished artists. He was a man of eminently social disposition, with a great turn for humor — traits of character pleasant enough when well employed, but which he unhappily permitted to lead him into low and ruinous dissipation, which impaired his artistic powers, and brought a life begun under the happiest promise to the dreariest end.

Charles B. King, born in Newport, Rhode Island, 1785; Alvan Fisher, born in Needham, Massachusetts, 1792; William E. West, and William James Bennet, born in London, 1787, may be mentioned in this part of our story as men of mark and influence in their day, though they left no works behind them of great excellence. Mr. King, indeed, still lives at an advanced age in the city of Washington, where he for many years virtually filled the fashionable position of court painter, preserving to posterity the likenesses of presidents, ministers, statesmen, and the chiefs of the Indian deputations who came to see their great white father at the capital.

The life of Thomas Sully fills a delightful page in the history of American art. Born in England in June, 1783, he came hither at the age of nine years, struggled bravely through an indigent youth and a laborious manhood to a position of high honor and usefulness. He is still pursuing, at his residence in Philadelphia, the profession which he has through many years so effectually contributed to advance. His pictures are characterized by grace and beauty of feeling, and a daintiness and freshness of color well deserving of most careful study. He has painted many full-length pictures of distinguished personages, among them one of Queen Victoria, which was exhibited with great success in all the Atlantic cities, and numerous fancy heads of great poetic beauty.

Charles Fraser, who was born in Charleston, South Carolina, August 20th, 1782, was an intimate and esteemed associate of the best men of the days of which we write. His works have materially advanced the standard of public taste in his native state. After obtaining a competency by the industrious pursuit of legal studies, he began the profession of artist in earnest at the age of thirty-six. Following the successful lead of his friend Malbone, he turned his attention especially to miniature painting, in which style he executed a picture of Lafayette, and of nearly all of the prominent men of his region. An exhibition of his collected works in 1857, included 313 miniatures, 139 landscapes, and other works in oil.

Chester Harding, a veteran still on the stage, was born in Conway, Mass., September 1st, 1792. His humble parentage sent him at first to farm work and chair-making. After the war of 1812, in which he served, he engaged in cabinet-making in Caledonia, New York. He subsequently went to the head waters of the Alleghany, and thence on a raft to Pittsburg, where he worked at house-painting; he returned home through the forest, two hundred miles, on foot, with no guide but blazed trees. Again visiting the west with his family, he worked from sign painting into portraiture; thenceforth gradually rising in his profession, until he numbered among his sitters such men as Madison, Monroe, Marshall, Wirt, Clay, Webster, Calhoun, and Allston, in America; and the dukes of Norfolk, Hamilton, and Sussex, Lord Aberdeen, and Samuel Rogers, in England.

Washington Allston, one of the most illustrious of our artists, was a native of South Carolina, having been born on his father's plantation at Waccamaw, in that state, on the 5th of November, 1779. He was a high-toned man, of poetic temperament and scholarly tastes, and was eminent as a poet as well as an artist. He was a student of the Royal Academy in London in 1801, and an exhibitor on the walls of that institution the following year. At this early period of his life he became an intimate friend of Coleridge and Thorwaldsen, West and Fuseli, and other distinguished men. In a second visit to Europe, about 1810, he exhibited his famous picture of the Dead Man Revived, which is now in the Pennsylvania Academy at Philadelphia. For this work a prize of 200 guineas was awarded to him by the British Institution. His next considerable works were: St. Peter Liberated by the Angel; Uriel in the Sun, which was painted for the duke of Sutherland; and Jacob's Dream. In 1818 he returned home, with his picture of Elijah in the Wilderness, which afterward went back to England. Within the next twelve years he produced in Boston his Prophet Jeremiah, now in the possession of Miss Gibbs, of Newport; Saul and the Witch of Endor; Miriam Singing the Song of Triumph, and other justly celebrated works. Among his smaller pictures, the Valentine and Beatrice, female ideal heads, are remarkable for their power of expression and strength of color. In the studio in which he finally settled himself at Cambridge, he painted Spalatro's Vision of the Bloody Hand; Rosalie; and his grand unfinished subject, Belshazzar's Feast. In his early life he was an intimate friend of Washington Irving, whom he almost won over to his own studies, as the author's profession may have attracted him, for during his life he made frequent incursions into the literary arena, publishing in London, in 1813, a poem entitled "The

Sylphs of the Season," and afterward the metrical satire entitled, "The Two Painters," the weird story of the "Paint King," "Monaldi, a Tale of Passion in Italy," followed after his death by a volume of "Lectures on Art." He was twice married, first in 1809 to a sister of Dr. Channing, and again in 1830. He died at Cambridge on the 9th of July, 1843.

Thomas Birch, a marine painter, and Joshua Shaw, a landscape painter, were born in England about the time of the Revolution, the latter in the year of the Declaration of our Independence. They became residents of the United States in childhood, and gained a reputation in their respective departments.

Among the popular painters of this time were Samuel L. Waldo and William Jewett. These gentlemen painted an immense number of portraits together, under the famous firm of Waldo & Jewett.

Our narrative now passes the line, as nearly as such a line may be drawn, between the artists of the revolutionary and immediately following years, and the earlier part of the present century. Already have we seen the arts firmly rooted in the love of the people and the genius of their professors; seen native artists grow up, and by their labors reflect high and imperishable honor on their country. In the continuation and the sequel of our history it will be our pleasure to see this glory ever brightening, and the public taste and artistic skill still more rapidly advancing hand in hand. This progress cannot, however, be better understood than by following, step by step, the lives of those from whose genius and works it alone springs. We therefore continue as we have begun, the chronological mention of the men to whom we are the most indebted for it.

We have already seen how our country had no sooner come of age than its early indebtedness to the mother-land for the humble aid of her Smybert and others, was promptly and nobly repaid by the fame which we sent her of a West and a Copley. Not content with this ample acknowledgment, we added to these high names at a later day those of Leslie and Newton, which she has inscribed upon the brightest tablet of her art achievement. Both these eminent artists were Americans by their parentage, though, through the chances of the moment, the former first saw the light in London. The latter was born in Halifax, in Nova Scotia, during a temporary visit of his parents thither from Boston. They established themselves in London, where they passed their lives in such successful labors as to leave a name and fame cherished zealously both by their native and their adopted homes.

The men most distinguished and the most serviceable in the cause of art in America, who came upon the stage at or near the beginning of the present century, are nearly all yet living to see the happy fruits of their toil, in the general diffusion of an appreciative and enduring love of art throughout the land, in the growing up of a community of artists, large and influential enough to have become an acknowledged and revered power in society, and in the firm foundation of a strongly individualized and healthful national school.

Among these great men, we should, perhaps, first of all, mention Samuel Findley Breese Morse, to whom (though he was drawn out of the profession as Fulton was before him, by the allurements of science) we owe much for the excellent labors of his pencil and the yet more excellent effects of his earnest sympathy with his art brethren throughout his long and illustrious life. It is to this strong and indefatigable love that we are, more than to any other agency, indebted for the foundation and success of our chief art society, the National Academy of Design. Morse was the leading spirit in this great enterprise. He was its first president; an office which he continued to fill with high honor for a score of years, and which, only that other duties required him to resign, he would have filled to this day. Prof. Morse was born in Charlestown, Mass., April 29th, 1791. His father was the famous geographer, the Rev. Jedidiah Morse. He was educated at Yale College under Dr. Dwight. In his twentieth year he went to England, and yet two years later successfully exhibited a large picture of the Dying Hercules at the Royal Academy. He had previously executed a plaster model of the Hercules, which he also displayed, and for which, greatly to his own surprise, he received the *gold medal* from the Society of Arts. From this happy commencement of his life as an artist, and from the portraits and other works which he subsequently produced, until other studies drew his mind away from the easel, we may fairly suppose that he would have reached the highest position as a painter had he continued to seek it, and some regret at his loss to the arts may be permitted, even in view of what the world at large owes to his scientific studies in the priceless gift of the Magnetic Telegraph.

Charles C. Ingham, born in Dublin, 1796, is one of the bright lights of this epoch yet shining brightly among us. He was an earnest colaborer with Morse in the establishment of our National Academy, which has always owed and still owes much in its exhibitions to the productions of his easel—his exquisite pictures of fair women and brave men. He at this time fills the office of vice-president of the academy.

Robert W. Weir, who has been for many years, as now, professor of drawing at the Military Academy at West Point, holds a distinguished place among the older of our living artists. He was born on the 18th of January, 1803, at New Rochelle, in the state of New York. It is to his pencil that we owe that best of the pictures in the Capitol at Washington, the Embarkation of the Pilgrims, a work eminently illustrative of the thoughtfulness and conscientiousness of his genius. He has painted numerous historical compositions, *genre* subjects, landscapes, and portraits of great excellence.

Thomas S. Cummings, another of the founders of the academy, and always one of its officers, held high rank at this period in the department of miniature painting. Mr. Cummings was born in Bath, England, in 1804, and became a resident of the United States in early childhood.

John G. Chapman, born in Alexandria, Virginia, on the 11th of August, 1808, now residing in Italy, is well known as the painter of the Baptism of Pocahontas, in the Capitol at Washington, and as the author of innumerable designs in our illustrated books.

William S. Mount, born in Setauket, L. I., November, 1807, was the first American artist who achieved high success in subjects of a purely national character, in a series of happy pictures of the humbler features of our country life. His Bargaining for a Horse, Haymaker's Dance, the Power of Music, and other light themes, have been often engraved, and are familiar to everybody.

Francis W. Edmonds has produced many pleasant pictures in the same vein of quiet humor with Mount.

William Page, born in Albany, January, 1811, has distinguished himself, at home and abroad, in the field of portraiture. He has painted, also, many excellent classic themes, among them the Venus, recently exhibited through the Union with so much applause.

Henry Inman, born in Utica, N. Y., October 20th, 1801, was one of the most eminent artists of the time. He was a pupil of Jarvis, whom he soon surpassed, excellent as Jarvis was. He was a man of remarkable versatility, and worked with equal facility in portraiture, landscape, and history. He was the guest of Wordsworth, during a visit to England in 1844, at which time he painted a characteristic picture of the great poet, and that charming illustration of the scenery of his region, the Rydal Water. While in England, he painted, also, portraits of Dr. Chalmers, Macaulay, and other eminent people. The exhibition which was made, after his death, of his works, was one of the most interesting and varied ever seen in New York. Inman died on the 17th of January, 1846.

In coming now to the life and works of Asher B. Durand, we enter the great field of landscape art, in which our painters are so pre-eminently distinguishing themselves—that field first explored with such brilliant success by Durand, and his fellow-laborers Cole and Doughty, and which is now being brought to such high culture by the present host of younger men. Durand was the first of our landscapists to pursue that course of severe and earnest study of Nature herself, in all her details of form, character, and color, which is now universal among us, and to which (following the richness and variety of our scenery) our wonderful progress in this department of the art may, in a great measure, be ascribed.

Mr. Durand is president of the National Academy, in which office he succeeded Prof. Morse. Though now in the autumn of life (having been born as long ago as 1796), he is still as active and as efficient a worker, in his special field, as he was when he first entered its untrodden paths long years ago. Everybody loves Durand's landscapes, for they appeal to and satisfy the dearest emotions of the soul, in their deep-thoughtedness, their quiet and serene beauty, and their sweet poetic suggestion. No artist has more truly rendered the characteristics of our American scenery, or under a greater variety of aspects. Besides innumerable landscapes, many of them of great size, he has painted a large number of excellent portraits, and various successful figure pieces. He was, too, before he became a landscape painter professionally, perhaps the best of our engravers upon steel; in which art, his skill is well attested by the fine print of Ariadne, after Vanderlyn. He is a native of Jefferson, in New Jersey.

Side by side with Durand—for they worked together through many fruitful years—was Thomas Cole, born on the 1st of February, 1801. He was a native of Bolton-le-Moor, in England, and was eighteen years of age when his father emigrated to America; yet so thoroughly did he acquire the spirit of American landscape, in all its most peculiar idioms, that never would he, of all our artists, be thought of foreign origin. While Durand painted our hills, and valleys, and waters in their more calm and contemplative mood, and in the bright, yet quiet garb of summer green, Cole loved to watch their more stirring and active humors, and to depict them in the gorgeous parti-colored vesture of varied autumn. The one, with delicate and dainty touch, records the gentle whisperings of the meadows, and lakes, and rivulets, while the other, with his freer and bolder pencil, transcribes the grander language of the cloud, or the snow-capped mountain crest, and of the turbulent and roaring torrent.

Cole's earlier professional life was passed among scenes of hardship, trials,and poverty, which only the most persistent spirit and the truest genius could have conquered. It is a pleasant thing to record that the first real encouragement which he met with, the first recognition of his great merit, came from brother artists, when Durand, Trumbull, and Dunlap took him generously by the hand, and led his steps into the pathway of success and fame. His later years sped happily, in a beautiful home on the Hudson, in the midst of that charming mountain and river scenery, which his pencil has done so much to endear to us. His earnest, poetic temperament did not permit him to rest content with the literal delineations of natural beauty, but led him to embody them in imaginative conceptions, with high moral meanings. To this noble ambition, we owe that great series of works representing the rise, progress, and fall of Empire, now in the gallery of the Historical Society in New York; that famous epic, in four parts, familiar to the world under the name of the Voyage of Life, in the possession of the Rev. G. D. Abbott, of New York; and the third group, left unfinished at his death, and now, we think, in the possession of his family, at Catskill, called the Cross and the World. Apart from these great serials, his principal productions are the Allegro and the Penseroso, the Home in the Woods, the Mountain Ford, the Hunter's Return, the Mount Etna, the Dream of Arcadia, the Cross in the Wilderness, and the Departure and the Return.

Cole died at his home, in Catskill, on the 11th of February, 1848, universally lamented, scarcely less as an artist than as a man of exalted principle, singular kindness of heart, and rare literary tastes and ability.

With the name of Thomas Doughty, we end our mention of the trio of which we have spoken, as the founders of our American school of landscape art. If his works, with all their poetical beauty, were, even in his best days, behind those of his *confrères*, and do not preserve the place they once had in the public esteem, it may be set down, probably, to the fact that, at the earlier period at which he commenced his studies, it was not the custom, as it soon after came to be, to go directly and implicitly to Nature for instruction. Doughty was born in Philadelphia, July 19th, 1793, and died in New York, July 24th, 1856. In his youth, he was apprenticed to a leather manufacturer, and afterward became a leather dealer on his own account. It was not until he was nearly twenty-eight years of age that he turned painter, and then against the counsels of good friends. He practised his art for many years in New York, and also in London and Paris.

Daniel Huntington was born in New York, October 14th, 1816. No pencil has contributed more to the healthful progress of our art, in elevation of theme, and refinement of treatment, than that of Huntington. Every thing he does is, in all the higher æsthetic qualities of art, a lesson to both artists and the public. His genius is of the greatest versatility, being equally at home in portrait, landscape, or history, sacred and profane.

Charles L. Elliott, born in Scipio, N. Y., in 1812, and now pursuing his art in the city of New York, sustains, in his vigorous style of portraiture, the fame early reflected upon this department of American art by Stuart and his cotemporaries. He is pre-eminent for the bold execution of male heads.

George A. Baker, of New York, is equally distinguished for his heads of women and children. Henry Peters Gray, also of New York, holds a high position as a painter of portraits, and of small pictures of *genre* and history. Of the latter class of works, his Pride of the Village, from Irving, is a most charming example. Thomas P. Rossiter is familiarly known by numerous large works, chiefly from scripture history, which have been exhibited to admiring throngs throughout the country. He has recently established himself in a pleasant home, at Cold Spring, on the Hudson. Arthur F. Tait is particularly happy in pictures of game and sporting life, a branch successfully followed by the late William Ranney. Thomas Hicks is among the most popular of the present group of portrait painters in New York. Hicks is now engaged upon a large picture of the living authors of America. Edwin White's great picture of Washington Resigning his Commission, painted for the legislature of Maryland, is a fair example of this artist's style and class of subjects.

Emanuel Leutze stands at the head of the living historical painters of the country. Much of his life has been passed in Dusseldorf, but he has lately returned home, and is pursuing his art in New York. A large picture of Washington Crossing the Delaware, is an excellent example of his vigorous and effective style.

P. F. Rothermel is one of the leading artists of Philadelphia, in historical subjects. The Lambdins, of Philadelphia, father and son, hold a distinguished place in the art, the elder as portrait painter, and the latter as painter of poetical and dramatic scenes.

F. O. C. Darley has achieved a world-wide fame, by his designs and book illustrations. Nothing can surpass, in beauty of conception, his charming outline drawings from Irving's "Rip Van Winkle" and "Sleepy Hollow," or his compositions from Judd's novel, "Margaret." He is now illustrating an edition of Cooper's works in thirty-two volumes, containing upward of five hundred designs. John W. Ehninger has been most successful in the same walk with Darley, besides which he has made many happy *genre* pictures in oil. E. D. E. Greene is justly famous for the classic beauty of his female heads; J. T. Peele for his dainty pictures of childhood; Rowse and Colyer for their charming heads in crayon; W. J. Hays for his animal subjects; Eastman Johnson for his domestic passages of negro and other humble life; Healy and Lang for brilliant portraiture; Wenzler and Stone for their female heads, and May in historical subjects.

Nearly all our landscape painters, after the trio already mentioned as the first who entered the field, are young men, many of them giving promise of a success even beyond that of their gifted fathers in art. The pictures of Church, who has not yet reached the middle of man's three-score years and ten, are famous the world over. Everybody has seen his wonderful picture of Niagara, and his still more popular Heart of the Andes. No works have done so much as those of Church to increase the foreign estimate of American art. Cropsey is now extending in London a fame fairly won at home. Kensett's pictures of our forest scenery are admired and loved by all. Mignot and the brothers Hart are among the best landscapists of this or any land, which may be said also in brief of Casilear, Gignoux, Gifford, Hubbard, Weber, Gay, Bierstadt, Brown, Shattuck, Colman, and Inness.

Our catalogue of bright names might run on almost forever, now that we have fully entered among the artists of our own day; but of them, great as is their genius—greater, indeed, in many instances, than that of any of their predecessors of whom we have said so much—it was not our intention to speak at length. Their name and fame is still rising; we meet them in our daily life, and gain of them that cotemporary knowledge which is better than all historic record; besides, our only desire was to gather up the fast fading mementoes of the early condition of art among us, and of the steps by which it has risen to its present noble state. This present is before us all, to delight our eyes, and encourage our hearts for the future.

We pass now to a brief glance at the remarkable performance of our young land in the noble art of Sculpture, a performance confessedly surpassed by no modern school.

Sculpture, as the more costly art, and as the less intelligible to the popular eye, of course *followed* painting in its progress among us as elsewhere. The surprise is that it should have followed so speedily and with such grand strides. It is possible that this happy result may have sprung in a measure from the circumstance that our first foreign visitors and instructors in marble art were men of the highest genius, instead of the third-rate talent only which our early *painters* brought to us. It is seldom amiss to make a good start, and much is saved where there is nothing left to be *un*learned.

One of our first heralds of the chisel appeared in 1791, when Ceracchi, an eminent Italian sculptor, arrived at Philadelphia. He was scarcely less celebrated as a revolutionist than as an artist, and leaving France when the dangers there grew too thick around him, he marched over to the New World, with a scheme for building us a grand marble monument to Liberty. His project was submitted to Congress, which was then in session, but that body supposed that the public funds could be employed, at the moment, more advantageously in the cause of Liberty, than in honoring her with sculptured shrines. Washington, however, gave his personal assent to the idea, and headed a private subscription, by means of which it was hoped the required thirty thousand dollars could be procured. Not an inch, though, of the proposed hundred feet of stone ever rose from the ground. Instead of the monument, the sculptor employed his chisel upon busts; and, among others, executed fine portraits of the commander-in-chief, of Alexander Hamilton, of Thomas Jefferson, Geo. Clinton, John Jay, and Paul Jones.

On returning to France, Ceracchi's red republicanism reappeared in a madder form than ever, and he plotted to take the hated life of Napoleon, then first consul, even in the sanctity of his own studio, and while he should be sitting for his bust. He was afterward guillotined on a charge of complicity in the famous scheme of the "infernal machine."

Yet earlier than the time of Ceracchi's residence in the United States, Houdon, a celebrated French sculptor, was invited to visit this country for the express purpose of perpetuating in marble the form and features of Washington. The result of his visit was the full-length statue which now adorns the vestibule of the Capitol at Richmond, in Virginia. The sculptor's legend on this work reads thus: "*Fait par Houdon, Citoyen Français*, 1788." The Father of his country is here represented of life size, and in the military style of the Revolution. The figure stands, resting on the right foot, having the left somewhat advanced, with the knee bent. The left hand rests on a bundle of fasces, on which hang a military cloak and a small sword, a plough leaning near.

Another noble statue of Washington, by Canova, adorned the Capitol of North Carolina, at Raleigh, until that edifice was unhappily destroyed, and the statue with it, by fire, in 1831.

Of our native sculptors, perhaps the first who gave indications of talent above the humblest mediocrity, was John Frasee, born in Rockaway, in New Jersey, July 18th, 1790. A bust which he executed in 1824 of John Wells, now in Grace Church, in New York, was, says Dunlap in his "Arts of Design," the first portrait in marble ever attempted in the United States. Ceracchi's works were probably only modelled here, and were afterward put into stone at home. Frasee made excellent busts of Chief Justice Marshall, of Daniel Webster, and others. "He had advanced," adds Dunlap in 1834, "to a perfection which leaves him without a rival at present in this country." To those who know any thing of our sculptors of *this* day we hardly need say, that Dunlap lived too long ago to witness the real beginning of its brilliant history, and that the talent of Frasee, excellent as it was, did not even indicate the high rank the art now holds.

Shobal Vail Clevenger, who was born at Middleton, Ohio, in 1812, and died at sea in 1843, left behind him admirable busts of Webster, Clay, Allston, Van Buren, and others. His early death interrupted a progress which might have extended far toward the point which our sculptors have since reached.

In the year 1805, on the 6th of September, Horatio Greenough was born in Boston, to fill a distinguished place in the annals of American sculpture. He received his earliest instruction from a resident French artist named Binon, and at the age of twenty went abroad. After modelling busts of John Quincy Adams, Chief Justice Marshall, and many others, he executed, at the order of Fenimore Cooper, the novelist, his Chanting Cherubs, which was the first original group from the chisel of an American artist. This work was made in Florence, where he had permanently established his studio at this time. In 1831 he went to Paris to model the bust of Lafayette, and thenceforward received liberal commissions, especially from his countrymen abroad.

Through the influence of his generous friend, Cooper, he received a commission from Congress for the colossal statue of Washington, which now stands so grandly on the great lawn opposite the east front of the national Capitol. This work was completed in 1843, after many years of industrious toil. Among others of Greenough's works at this period, were the Medora, commissioned by Mr. Robert Gilmor, of Baltimore; the Venus Victrix, in the Boston Athenæum; and the Angel Abdiel. In 1856 he returned to the United States to superintend the placing at Washington of his group of the Rescue, symbolizing the triumph of civilization, which he had executed in fulfilment of an order from Congress. It is supposed that the vexatious delays in the arrival of this work from Italy, together with the hurly-burly of American life, to which his long residence abroad had unaccustomed him, contributed to induce the attack of brain fever, from the effects of which he died, December 18th, 1852.

Greenough was educated at Harvard, and was a man of elegant attainments and accomplished manners. He was engaged in the delivery of a course of art lectures in Boston at the time of his last illness. An interesting memorial of Greenough was published by the poet Tuckerman in 1853.

The first general and popular acknowledgment, at home and abroad, of our success in sculpture, was won for us by the genius of Hiram Powers, and dated from the time of the exhibition of his Greek Slave. Not that this is by any means the best performance our artists have reached—for other men have followed with yet greater works; and among these others, one, of whom we shall speak, who has cast off the conventionalities of old art, and has, upon his own native soil, not that of Europe, gone beyond mere classic beauty, to the higher attainment of individual and national character and truth. Yet, as we have said, it was from the popular success of this statue of the Greek Slave that the world picked up and recognized the fact of the genius of American sculptors.

Powers is a native of Vermont; but, like most of our men of marble, resides and works abroad. He established himself long years ago in Florence, since which time we do not know that he has even visited his native land. He is an industrious worker, and has made innumerable busts, in addition to his more ambitious ventures into the field of poetry and the imagination. It is, indeed, in portraiture that his strength lies—with a temperament more practical than fanciful, and with a sympathy more with the real than with the ideal. His colossal figure of Eve, and his full-length statue of Calhoun, are preserved in South Carolina.

In the lamented Crawford, who was born in New York, March 22d, 1814, and who died in London, October 10th, 1857, we possessed a man of stronger and nobler grasp than any of his predecessors; a man, who not only *could* have done great things had he lived, but who did them even without living to the full years of ripe experience. Crawford was a poor boy, and began his art life in the humble occupation of a wood-carver. At the age of nineteen he was promoted to a place in the studio of Frasee and Launitz, in New York; and, when about twenty-one, he went to Rome, and became a pupil of the Danish sculptor Thorwaldsen. Here he toiled so unremittingly that he is said to have modelled no fewer than seventeen busts in the space of ten weeks, besides copying, in marble, the figure of Demosthenes in the Vatican. In 1839, when in his twenty-fifth year, he exhibited his Orpheus, with the warm congratulations of his master, Thorwaldsen, and other sculptors, and with the hearty approval of the public. From that period his fame continued to increase up to the hour of his untimely death. The Orpheus—which is now in the Athenæum in Boston—was followed by numerous admirable subjects from classical and scriptural history. Among his greater and later works, was the remarkable statue, in bronze, of Beethoven, executed for the Boston Music Hall; and the completion of which, at the foundry in Munich, was celebrated by a musical festival, at which the royal family of Bavaria, and a grand concourse of people, assisted. Afterward came the equestrian statue of Washington, which now adorns the Capitol hill at Richmond; where it was placed by the patriotism and liberality of the people of Virginia. This great work was cast in bronze in Munich, and sent home in 1857. Its pedestal rests upon a star-shaped elevation, with six points, upon which statues of Jefferson, Henry, Lee, and other illustrious sons of Virginia are to be placed. He executed orders from Congress for various works for the new Capitol, some of the most successful of which were his designs for the pediment and the great bronze doors. His grandest effort is, perhaps, the model for the colossal statue of the Genius of America, which is to be cast in bronze, and placed upon the pinnacle of the

Capitol dome. This statue represents a female figure, fully draped, and posed with marvellous grace and dignity. During his brief career, Crawford finished more than sixty works, many of them of the grand size; besides which, he left nearly as many sketches in plaster, and numerous designs, which his assistants are to complete. In 1844, he married Miss Louisa Ward, daughter of the late Samuel Ward, of New York. Soon after his return from his last visit to his native land, in 1856, he was afflicted with a cancerous tumor on the brain, from the effects of which he died, after many months of acute suffering, borne with heroic patience.

Henry Kirke Brown, another of the most eminent of our American sculptors, was born at Leyden, Massachusetts, in 1814. He began the study of portrait painting in Boston, when eighteen years of age; and afterward he became a railroad engineer in Illinois, much to the injury of his health, and at length repaired to Italy to pursue the grave art of the statuary. Among his more famous works, are the well-known marbles of Hope; the Pleiades; the Four Seasons; the bronze statue of De Witt Clinton at Greenwood Cemetery, and the noble equestrian statue of Washington, which stands in Union square in the city of New York. Most, if not all of these works, were executed in Brooklyn, New York; though, of late years, the artist has established himself in a pleasant cottage at Newburgh, on the Hudson. Brown's Washington was the first statue ever cast in bronze in this country.

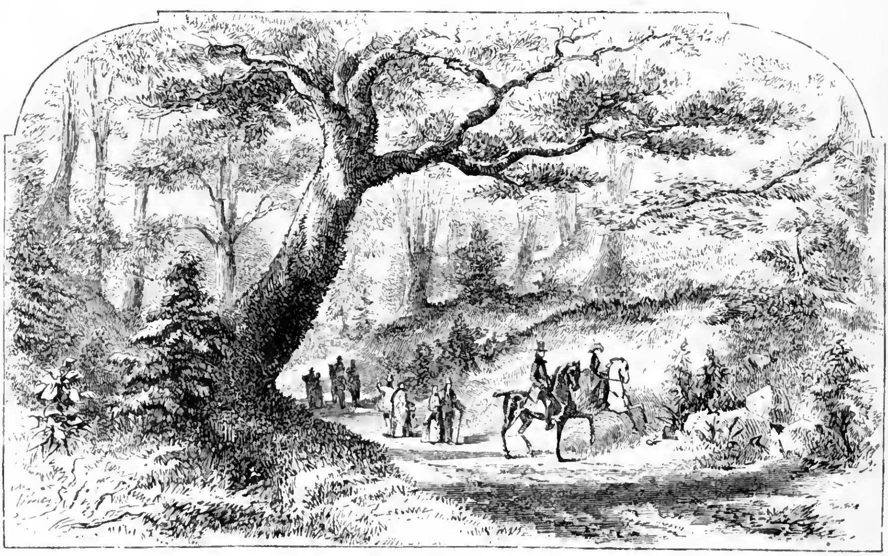
Palmer, who is, perhaps, the most popular of American sculptors at the present day, was born in the interior of the state of New York. His noble character—no less personal than professional—is seen in all the interesting incidents of his career, from the humblest boyhood to his present high position, social and artistic. In his younger days he toiled hard at the carpenter's craft; afterward he rose to the dignity of a carver in wood, of models and moulds for stove and other iron castings; and at length he became a cutter of cameos. He was a married man, with a young family growing up around him, before he finally made that venture in marble which has brought such high honor to himself and his country. His works are marked with singular simplicity, truth, and naturalness of treatment, and with a finish and delicacy of execution rarely obtained in obdurate stone. Among his chief and best known productions, are the full-length, life-like figures of the Indian Girl, and the White Captive; the Moses, and many beautiful bas-reliefs and female heads, both portrait and ideal. An exhibition of his collected works was made a few years ago, with great advantage to his own fame and fortune, and to the public pleasure and profit.

Launt Thompson, a young pupil of the eminent sculptor above named, is pursuing his art in New York with a success which promises the most enviable results.

Clark Mills, a self-educated man, in the proper sense of the phrase, is known by his popular equestrian statues of Jackson and Washington, executed by the order of Congress, for the embellishment of the national Capitol.

Harriet Hosmer, of Watertown, Massachusetts, is achieving a fair fame in this difficult field of art as we now write. She is scarcely thirty years of age, yet is already intrusted with important public commissions. The approval which followed her first original work—a bust of Hesper—induced her father to send her to Rome, where she at present resides. She began her studies in the eternal city, as a pupil of Gibson, in 1852. Her first works abroad were the busts of Daphne and Medusa, and a statue of Œnone. Afterward came the well-known reclining figure of Beatrice Cenci; and, in 1855, the charming statue of Puck, and a pendant thereto, entitled Will-o'-the-Wisp. In 1859, she completed her statue of Zenobia in Chains, which is of colossal size, and is said to be, thus far, her best work.

Mosier, Rogers, Story, Akers, Bartholomew, Ball, Hart, Ball Hughes, and Stone, with many others whom it would be pleasant and profitable for us to name, did our opportunity allow, have each won most honorable distinction by their admirable creations in the sculptor's art. They are all well employed either with public or private orders. Such orders, from states and from individuals, are now, happily, no longer things of rare occurrence. They come numerously and generously from all quarters, and always, by preference, to our native artists; not at rare intervals, and then to foreign *ateliers*, as at the commencement of the period of which we are writing—a com-



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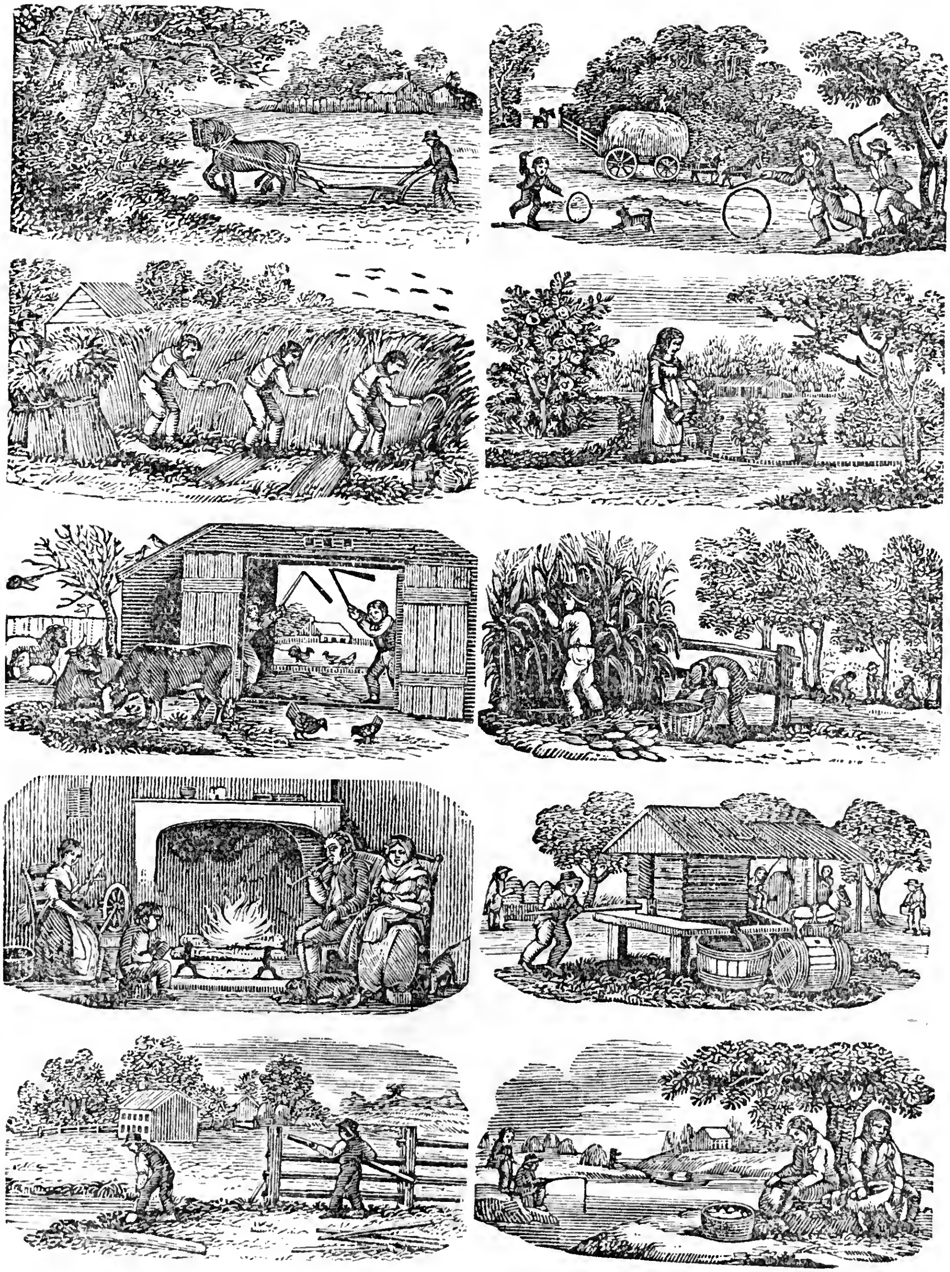

The above engravings, representing the Seasons, are from the *Farmer's Almanac*, showing the Anderson style of engraving; the opposite page, engraved from sketches about Newport, R. I. by A. H. Jocelyn, illustrates the improvement in the art.

mencement lying back, by our rapid reckoning, eighty long years in the remote past.

The love of pictures, so general among our people of all grades, has been greatly fostered and cultivated, of late years, by the universal diffusion of engravings. Besides the best of this class of works, more accessible examples, in the form of book illustrations, and especially in illustrated magazines and newspapers, have been scattered, through a cheap press, broadcast over the land, and have penetrated its remotest corners, doing the labors of the missionary in the great cause of art. It is true that these heralds—the pictorial papers, at least—are not always the best possible teachers; yet have they cleared the way for greater things to follow, and it is gratifying to know that they are themselves every day reaching toward a higher standard. It would, indeed, be quite beyond the power of our mathematics, to cipher out the good effect upon the art progress of the nation, of even one of our best pictorial magazines, with the immense audience which they are wont to address; such a magazine, for example, as that of the Harpers—read, or at least seen, every month, by millions of people.

This grand aggregate of the good influence of the graver, is gained through the agency, not of the ambitious steel-plate, but the humble wood-cut. The art of working on wood—which has thus of late become the chief medium of the engraver, and has almost superseded all other mediums—has, though an old art, so greatly improved during the eighty years life of our republic, that it may fairly be said to have grown up with it, and in a great degree *from* it.

The general demand among us for cheap art, and the general ability to buy, at least, such cheap art, obviously required the wood-cut; and so the wood-cut—which had kept its humble place from a period even far beyond the invention of types—was brought from its obscurity, and made—in our own hands, as much as in those of any people—to fill its present exalted office.

The art was, really, almost reinvented in America, and soon after the great Revolution, when Dr. Anderson, in 1794, left his *materia medica*, and set up in New York as a wood-engraver. Anderson's first considerable performance was the repetition, in a work called the "Looking-Glass," of some cuts by Bewick. Some of these pictures he executed on type metal, and only a portion of them on the wood-block. For these he had to invent his own tools, and then manufacture them. He continued to improve, and all through his professional career he contributed greatly to develop the resources of the art, and to put it upon the track of its present mature power. In 1812, the art was introduced and successfully practised in Boston by Abel Brown, and in Philadelphia by William Mason.

About the year 1826, Mr. Adams entered the profession, and by his industry and skill gave it a great impetus toward the perfection to which it has since been brought. The innumerable illustrations which he produced in his superb pictorial edition of the Bible, published by the Harpers, called forth all the talent which the country possessed in this direction, and exercised it to yet greater excellence. This great work served, also, no doubt, to promote the popular appreciation of the art, now so universally manifested in the demand for illustrated books and pictorial papers of all kinds. From the time of Mr. Adams, the number of our engravers on wood has steadily and rapidly increased; and so, too, has the quality of their work, until the present day shows us pictures on wood which are, in many respects—as in delicacy of finish, softness of texture, and vigor of expression—quite equal, if not superior to the best examples of work on copper or steel. The greater cheapness of the wood-block; its capacity of use, in printing *with* the type (which metal plates do not possess); and the ease with which it may be duplicated by stereotyping or by electrotyping—have caused it to supersede copper and steel-plates in a great measure, except for very large and costly subjects, and for bank note engraving. The invention, in recent times, of Lowry's "ruling machine;" of improved methods of printing, as in the process called "overlaying," by means of which the nearer parts of the picture are made to receive a stronger pressure than the more distant portions; and various mechanical aids—have contributed to the present wonderful perfection of the art among us. The country now possesses a host of excellent wood engravers, who find full and remunerative employment.

For the finer class of wood-engravings, box-wood (imported chiefly from Germany) is used; while, for coarser and larger work, that of the pear-tree will answer, and sometimes even that of the apple-tree, beech, and even mahogany and pine. The wood is cut across the ends of the fibre, of the thickness of type; and after being smoothly planed, a thin covering of white is rubbed over the surface; after which the drawing to be engraved is made upon it with a lead pencil, or with India-ink, or both combined. The block is then cut away with the graver, in such manner as to leave the lines of the drawing all in *relief*, like type. On copper or steel, on the contrary, the drawing is *sunk* into the plate, and is necessarily printed with greater slowness and care, and at a greater cost. In engravings printed in colors, a separate block is made for each tint.

Copper-plate engraving is an art as old, almost, as xylography or wood-cutting. A picture upon this metal is preserved in Germany of as ancient a date as 1461. Instead of the simple wooden blocks of other days, our cotton manufacturers now print their calicoes from copper plates of cylindrical form, by which improvement the fabrics are made infinitely more beautiful and greatly cheaper. Most of the larger print-works employ skilful artists and engravers to produce their designs, paying them large salaries for their labors. In some establishments thousands of dollars are thus profitably expended each year. Copper-plate engraving, after reaching the highest degree of excellence, both at home and abroad, has, within the present century, given way in a great measure to the superior capacity of the steel plate, a capacity revealed to the world and developed in the highest degree by Jacob Perkins, of Newburyport, in Massachusetts. Mr. Perkins, who began his experiments about 1805, may, indeed, almost be said to have invented steel engraving, since the metal had been used only once before his time, in an English print in Smith's "Topographical Illustrations of Westminster." Mr. Perkins discovered the present invaluable processes by which the steel plate is so hardened after being engraved, that by the pressure upon it of other soft plates, the picture can be transferred in relief and again repeated so as to duplicate the work to any extent. The first impression in *relief*, from which duplicates of the original engraving are made, is taken upon a soft steel cylinder by repeated rollings over the hardened plate. By this process any bank note vignettes can be transferred, in *combination*, at will, from the separate original plates to the steel cylinder, and from that to other plates for the printer. The product is thus greatly cheapened, inasmuch as all the pictures, the central vignette, the end scene or portrait, and the bottom or tail piece, usually put upon a bank note, can be furnished for the cost of a special engraving of one of them. Mr. Perkins' system is employed throughout England and the continent of Europe, no less than all over the United States. By it the art of bank note engraving has been so perfected among us that only the highest skill and the costliest machinery can now produce successful counterfeits. Nothing remains but to insure the bank note against the wonderful power of the art of photography, and this security our engravers will no doubt soon effectually provide. In 1858-9 the principal bank note engravers of the country formed themselves into two associations, the American and the National Bank Note Companies, and these companies furnish nearly all the engraving and printing required on the western continent, and thus give employment to the best talent of the land in this department of art. Among the most successful of American steel engravers of bank notes and other works, are Durand, Smillie, Cheney, Sartain, Danforth, Deck, Casilear, and Alfred Jones. All these eminent men have worked in the greatest perfection upon steel in the several styles of line, stipple, mezzotint, aquatint, etc. Engraving on copper or steel is practised in its most simple form, called line engraving, by covering the face of the polished metal with a thin surface of melted white wax; on this the sketch is transferred by laying, face down, a tracing of the design in black lead pencil upon the wax, and subjecting it to a heavy pressure; the lines are then seen distinctly upon the wax when the paper is removed. The workman then with a fine graver makes the lines through upon the metal; after which the wax is melted off and the engraver proceeds to complete the work by cutting the lines to the proper depth and shade. The graver, when in use, is pressed forward, cutting a furrow and raising burrs on each side. The burr, pushed up by the graver in its progress, is removed by the scraper. Lines are softened by rubbing over with a smoothly pointed burnisher. In some instances the burrs made by the finest etching needles being allowed to remain, produce a pleasing effect, seen in some of Rembrandt's engravings. The parallel lines that are sometimes required in series are cut by a ruling machine. The fainter shades, too delicate for the graver, are scratched in with a needle.

In the stippling or dotted style, the effect is produced by dots made in curved lines, with the graver. The more closely the dots are grouped together, the darker the shade, and the whole effect is more like painting than the line engraving. In the shadows of the limbs of the human figure it is much used, and sometimes in portraits the line and stipple are combined with good effect.

The style called etching is practised upon other metals, also upon glass. By this process the coating of wax is formed of white wax, Burgundy pitch, and asphaltum, and is applied in silk bags, through which the composition oozes. When the plate is covered it is held over a smoking lamp until the wax is covered with lamp-black. The lead pencil design is then laid upon this lamp-black and pressed. The lines are then drawn through the wax, and nitric acid with four parts water is poured upon the plate. This remains until the fainter portions of the sketch are corroded. The acid is then poured off and the plate washed with water. An application of lamp-black and turpentine, called stopping, is applied with a camel's hair brush to those portions sufficiently corroded; a reapplication of the acid eats deeper into those parts that require deeper lines. This process of stopping is repeated until the work is complete. Being then cleaned of the wax, those portions of the plate that require it are gone over with the graver, and not unfrequently the shades are stippled.

Aquatinta is a French invention of 1662, and takes its name from the resemblance it has to water colors on India-ink drawings. After the design is etched in outline and the wax removed, a solution of Burgundy pitch in alcohol is poured over the plate as it lies in an inclined position. The alcohol evaporating, the pitch remains. The design is then drawn with a gummy syrup called the bursting-ground, which is applied only wherever a shade is wanted. The whole is then covered with a turpentine varnish; water being left on it for fifteen minutes, the bursting-ground cracks open and exposes the copper. The etching process is then pursued. Sometimes colors are applied and printed from the plate; but when there are different tints, it is customary to use a distinct plate for each one.

The mezzotinto, or half-painted style, was introduced into England by Prince Rupert. The invention has been ascribed to Sir Christopher Wren. The plate is roughed up by running over its surface little toothed wheels of different degrees of fineness, called cradles, which by a rocking motion are caused to raise little burrs, pointing in different directions. The whole plate being thus made rough, the burrs are rubbed off with scrapers, wherever light shades are required, and the shades are deepened by increasing the burrs. The effect is fine where dark grounds are desired. This method combined with etching, produces an improved style. Some mezzotints are now prepared for the trade by a machine. The prints wear much better on steel than on copper.

Admirable examples of these branches of the art may be seen in the superb landscape works of Smillie, especially those from the four pictures of Cole's Voyage of Life, in Durand's works after Vanderlyn's, in our many beautiful illustrated books, in the publications of the late American Art Union, and, as already intimated, in the dainty vignettes which embellish our myriad bank notes.

In the art of die sinking—a process conducted in a similar manner to that already described of the transfer in relief of the impression from a hardened plate or plug of steel to a soft plate, and from that again, when hardened, to yet another—many admirable works have been produced. Excellent examples may be seen in the medals of Allston, Stuart, and other subjects executed for the American Art Union by the late C. C. Wright.

By the assistance of the electrotype process, the work of the engraver is now repeated, in as many copies as may be desired, each of the copper transcripts thus produced being an absolute duplicate of the original plate or block. It is these electrotyped copies which are now used by the printer, the same picture sometimes on several presses at once, while the original wood block is preserved untouched, except to form the mould for other copies in metal when they may be required. The effect of this power of perfect and inexpensive repetition of engraved blocks has been to reduce the cost of pictorial illustrations to a point within the compass of the most unpretending purse, and thus to send good examples of the engraver's art to the remotest and humblest corners of the land.

What may be the consequences of the many processes, now more or less perfected, for the mechanical production of engraving by the aid of photography, it is hardly possible to imagine: not other than advantageous, however, even to the engravers themselves, since their field of labor will be higher, if not broader, when their pictures shall be, as they promise to be, not only drawn for them on their plates and blocks by photography, but even etched and engraved besides!

In the art of lithography, or drawing upon stone, a steady advance may be witnessed; though our works of this class cannot yet claim comparison with those of the continent of Europe.

The introduction of the daguerreotype, the perfection to which the art has been brought in the skilful hands of American operators, and the immense extent to which it is used among us (apart from its share in the work of other arts), have had, no doubt, a most wonderful influence upon our art progress. Furnishing pictures which are, through their cheapness, accessible to all classes, it has worked, like the engraving, as an elementary instructor, while its truthfulness has been a constant lesson to the artist himself. Better pictures have, unquestionably, been painted through the hints of the daguerreotype and photograph; and many people who, but for them, would never have dreamed of pictures, have become intelligent lovers and liberal patrons of the arts.

We must not, in ever so cursory a glance at the history of the arts, forget the service of our academies and schools of painting, little as some affect to think of art academies—so far, at least, as their *honorary* character is concerned.

The first attempt to found an institution of this nature in the United States, was made in Philadelphia, in 1791, by Charles Wilson Peale, the father of the painter Rembrandt Peale. The elder Peale was a very energetic laborer in the cause of art, all through his long life. This first attempt of his to found an academy, was seconded by the Italian sculptor Ceracchi, who was in the country at the time. The attempt failed, however, from some cause or other, and a second and rather more fortunate venture was made in 1794, when the Columbianum was established. This society lived a year, held one exhibition, and was forgotten.

In 1802, some art-loving citizens of New York, headed by Edward Livingston, founded the New York, afterward the American Academy of Fine Arts. There were so few artists in this society, and the governing influence was so little of a professional character, that it was an academy of art only in name, and quite failed in its office of an academy. The necessary result was an inefficient life, until it was, in due time, superseded by a better organized establishment. This result followed in 1826, in the institution of the present National Academy of Design.

The National Academy, thus founded by Morse, and his brother artists of the period, has steadily advanced to this day in position and usefulness, and now numbers among its academicians and associates nearly all the leading painters of the land. Its annual exhibitions have been prepared, without interruption, from 1826 until now, with a catalogue of works extended gradually from less than two hundred, to over eight hundred, and with an aggregate of receipts from less than nothing up to six or seven thousand dollars annually. The academy has always supported free (evening) schools for the study of the antique statuary, and the living model-schools, to which any student has access, when coming with the required preparatory knowledge of the use of the crayon. Membership in the academy, except in the grade of "student," is awarded only to professional artists, and then by ballot, as a mark of honorary distinction. The progress of art in America during the last thirty or forty years cannot be better seen than in the continued growth of the National Academy, and in its present large and varied exhibitions as compared with those of days gone by.

The Pennsylvania Academy of Fine Arts in Philadelphia is doing a good work, though it is not so fully an association of artists only as is the National Academy at New York. Conducted in part by laymen, it labors under some of the disadvantages of the old superseded American Academy. It was founded as early as 1807, and is now a flourishing and most useful institution, keeping a valuable permanent gallery always open to the public view, and providing besides an annual display of the current productions of our artists. It possesses also a fine collection of casts from the antique, gratuitously accessible to all students.

The art gallery of the Athenæum in Boston, serves, in a measure, the purposes of an academy in that city. Of late years Academies of Art have sprung up in some form, and with more or less success, in many other of our chief cities, as in Baltimore, Charleston, St. Louis, Cincinnati, and elsewhere, giving us a fair promise of picture galleries and facilities for art study, as general and as liberal as our wants demand.

Besides these institutions for the use of the profession itself, there is happily a rapid extension throughout the Union of drawing schools for all classes of the population. Professorships of drawing are being introduced into our universities and colleges, and a higher standard is being everywhere set up in our seminaries of all grades. Schools of Design for women are springing up in our larger cities, and such an institution has been recently incorporated with the Cooper Union of New York, under the highest promise of successful result. When the principles of art become universally known to us, as we have good cause to believe they soon will be, we shall realize the fact not only in the increased excellence and fame of our pictures and our sculptures, but in the higher beauty, utility, and value of our manufactures and fabrics of all kinds, from the rarest luxury to the simplest article of necessary use. In another and less material sense we shall feel it and enjoy it, in breathing the air of a more refined and more beautiful social and national life.

EDUCATION AND EDUCATIONAL INSTITUTIONS.

CHAPTER I.

EDUCATIONAL DEVELOPMENT IN THE COLONIAL PERIOD.

INTRODUCTION.

The origin, nomenclature, and early peculiarities of the systems, institutions, and methods of instruction adopted in the original colonies, which now constitute a portion of the United States of America, will be found in the educational institutions and practices of the countries from which these colonies were settled—modified by the education, character, motives of emigration, and necessities of the settlers themselves.

The earliest effort to establish an educational institution in the English dominions in America, was made under the auspices of King James I, and by contributions of members of the Church of England from 1618 to 1623. In a letter addressed to the Archbishops, he authorizes them to invite the members of the Church throughout the kingdom to assist "those undertakers of that Plantation [Virginia], with the erecting of some churches and schools for the education of the children of those barbarians" [the Aborigines] and of the colonists. Under these instructions, a sum of £1500 was collected for the erection of a building for a college at Henrico—a town whose foundations, or site even, cannot now be certainly determined, but which according to the best authorities was situated near Varina on Cox's Island, about fifty miles above Jamestown. Authority was given by the Company to the Governor to set apart 10,000 acres of land for the support of the college, and one hundred colonists were sent from England to occupy and cultivate the same, who were to receive a moiety of the produce as the profit of their labor, and to pay the other moiety toward the maintenance of the college. In 1620, George Thorpe was sent out as superintendent, and 300 acres of land was set apart for his sustenance. Other donations and legacies were made for the endowment of this institution of learning.

In 1619, the Governor for the time being was instructed by the company to see "that each town, borough, and hundred procured by just means a certain number of their children to be brought up in the first elements of literature; that the most towardly of them should be fitted for college, in the building which they purposed to proceed as soon as any profit arose from the estate appropriated to that use; and they earnestly required their help in that pious and important work." In 1621, Rev. Mr. Copeland, chaplain of the Royal James, on her arrival from the East Indies, prevailed on the ship's company to subscribe £100 toward a "free schoole" in the colony of Virginia, and collected other donations in money and books for the same purpose. The school was located in Charles City, as being most central for the colony, and was called the "*East India School.*" The company allotted one thousand acres of land, with five servants and an overseer, for the maintenance of the master and usher. The inhabitants made a contribution of £1500 to build a house, for which workmen were sent out in 1622.

The "college" and "free school" thus projected and partially endowed were in the style of the "college" and "free school" and the "free grammar school" of England, and were intended to be of the same character as the college afterward established at Cambridge, and the institution for which "the richer inhabitants" of Boston in 1636 subscribed toward "the maintenance of a free schoolmaster," and the same as, according to Governor Winthrop, in his journal, was erected in Roxbury in 1645, and other towns, and for which every inhabitant bound some house or land for a yearly allowance forever, and many benevolently disposed persons left legacies in their last wills, and the towns made "an allowance out of the common stock," or set apart a portion of land "to be improved forever, for the maintenance of a free schoole forever."

The same leading idea can be traced in the educational policy of the Dutch West India Company—which bound itself, in receiving its charter of colonization, "to maintain good and fit preachers, schoolmasters, and comforters of the sick." The company recognized the authority of the established Church of Holland, and the establishment of schools and the appointment of schoolmasters rested conjointly with the company and the classis (ecclesiastical authorities) of Amsterdam. When the company granted a special "Charter of Freedom and Exemptions" to the "Patroons," for the purpose of agricultural colonization, they were not only to satisfy the Indians for the lands upon which they should settle, but were to make prompt provision for the support of a minister and schoolmaster, that thus the service of God and zeal for religion might not grow cold, and be neglected among them. In 1633, in the enumeration of the company's officials at Manhattan, Adam Roelandsen is mentioned as the schoolmaster, and that school, it is claimed, is still in existence in connection with the Reformed Dutch Church of New York. In the projected settlement at New Amstel on the Delaware, the first settlers were encouraged to proceed by certain conditions, one of which was that the city of Amsterdam should send thither "a proper person for a schoolmaster;" and we find among the colonists who embarked, "Evert Pietersen, who had been approved, after examination before the classis, as schoolmaster." In these early efforts to establish schools, we trace the educational policy of the Reformed Church of Holland as indicated by the synod of Wesel in 1568, and matured at the synod of Dort in 1618, by which the training of Christian youth was to be provided for—"I. *In the house, by parents.* II. *In the schools, by schoolmasters.* III. *In the churches, by ministers, elders, and the catechists especially appointed for this purpose.*" Owing in part to the commercial purposes entertained by the companies having charge of the colonization of New York, Virginia, and some other portions of the country, and to the educational and religious institutions of the colonists being not so much a matter of domestic as of foreign policy, these institutions never commanded the regular and constant attention of the local authorities, or of the settlers themselves.

The outline and most of the essential features of the system of common schools now in operation in the New England states, and the states which have since avowedly adopted the same policy, will be found in the practice of the first settlers of the several towns which composed the original colonies of Massachusetts, Connecticut, and New Haven. The first law on the subject did but little more than declare the motive, and make more widely obligatory the practice which already existed in the several neighborhoods and towns, which had grown up out of the education of these colonists at home, and the circumstances in which they were placed. They did not come here as isolated individuals, drawn together from widely separated homes, entertaining broad differences of opinion on all matters of civil and religious concernment, and kept together by the necessity of self-defence in the eager prosecution of some temporary but profitable adventure. They came after God had set them in families, and they brought with them the best pledges of good behavior, in the relations which father and mother, husband and wife, parents and children, neighbors and friends, establish. They came with a foregone conclusion of permanence, and with all the elements of the social state combined in vigorous activity—every man expecting to find or make occupation in the way in which he had been already trained. They came with earnest religious convictions, made more earnest by the trials of persecution; and the enjoyment of these convictions was a leading motive in their emigration hither. The fundamental articles of their religious creed, that the Bible was the only authoritative expression of the divine will, and that every man was able to judge for himself in its interpretation, made schools necessary, to bring all persons "to a knowledge of the Scriptures," and an understanding "of the main grounds and principles of the Christian religion necessary to salvation." The constitution of civil government adopted by them from the outset, which declared all civil officers elective, and gave to every inhabitant who would take the oath of allegiance the right to vote and to be voted for, and which practically converted political society into a partnership, in which each member had the right to bind the whole firm, made universal education identical with self-preservation. But aside from these considerations, the natural and acknowledged leaders in this enterprise—the men who, by their religious character, wealth, social position, and previous experience in conducting large business operations, commanded public confidence in church and commonwealth, were educated men—as highly and thoroughly educated as they could be at the best endowed free and grammar schools in England at that period; and not a few of them had enjoyed the advantages of her great universities. These men would naturally seek for their own children the best opportunities of education which could be provided; and it is the crowning glory of these men, that, instead of sending their own children back to England to be educated in grammar schools and colleges, these institutions were established here amid the stumps of the primeval forests; that, instead of setting up "family schools" and "select schools" for the ministers' sons and magistrates' sons, the ministers and magistrates were found, not only in town meeting, pleading for an allowance out of the common treasury for the support of a public or common school, and in some instances for a "free school," but among the families, entreating parents of all classes to send their children to the same school with their own. All this was done in advance of any legislation on the subject, as will be seen from the following facts gleaned from the early records of several of the towns first planted.

TOWN ACTION IN BEHALF OF SCHOOLS.

The earliest records of most of the towns of New England are either obliterated or lost, but among the oldest entries which can now be recovered, the school is mentioned not as a new thing, but as one of the established interests of society, to be looked after and provided for as much as roads and bridges and protection from the Indians. In the first book of records of the town of Boston, under date of April 13, 1634, after providing by ordinance for the keeping of the cattle by "brother Cheesbrough," "it was then generally agreed upon that our brother Philemon Purmont shall be entreated to become schoolmaster for the teaching and nurturing of children with us." This was doubtless an elementary school, for in 1636 we find a subscription entered on the records of the town "by the richer inhabitants," "for the maintenance of a free schoolmaster, for the youth with us—Mr. Daniel Maude being now also chosen thereunto." Mr. Maude was a clergyman, a title at that day and in that community which was evidence of his being an educated man. This "free school" was, in the opinion of the writer, not necessarily a school of gratuitous instruction for all, but an endowed school of a higher grade, of the class of the English grammar school, in which many of the first settlers of New England had received their own education at home. Toward the maintenance of this school, the town, in 1642, in advance of any legislation by the General Court, ordered "Deer Island to be improved," and several persons made bequests in their last wills. Similar provision can be cited from the early records of Salem, Cambridge, Dorchester, and other towns of Massachusetts Bay.

The early records of the town of Hartford are obliterated, but within seven years after the first log-house was erected, thirty pounds are appropriated to the schools, and in April, 1643, it is ordered "that Mr. Andrews shall teach the children in the school one year," and "he shall have for his pains £16, and therefore the townsmen shall go and inquire who will engage themselves to send their children; and all that do so, shall pay for one quarter, at the least, and for more if they do send them, after the proportion of twenty shillings the year; and if they go any week more than one quarter, they shall pay sixpence a week; and if any would send their children and are not able to pay for their teaching, they shall give notice of it to the townsmen, and they shall pay it at the town's charge." Mention is also made of one "Goody Betts," who kept a "Dame School" after the fashion of Shenstone's "schoolmistress" at Leasower, in England. Similar entries are found in the town records of Windsor and Wethersfield in advance of any school code by the colony of Connecticut.

The records of the town of New Haven are full of evidence of the interest taken by the leading spirits of the colony, particularly by Governor Theophilus Eaton and Rev. John Davenport, in behalf of schools of every grade, and of the education of every class, from the apprentice boy to those who filled the high places in church and state. The first settlement of the colony was in 1638, and within a year a transaction is recorded, which, while it proves the existence of a school at that early period, also proclaims the protection which the first settlers extended to the indigent, and their desire to make elementary education universal. In 1639, Thomas Fugill is required by the court to keep Charles Higinson, an indentured apprentice, "at school one year;" or else to advantage him as much in his education as a year's learning comes to. In 1641, the town orders "that a Free School be set up," and "our pastor, Mr. Davenport, together with the magistrates, shall consider what yearly allowance is meet to be given to it out of the common stock of the town, and also what rules and orders are meet to be observed in and about the same." To this school "that famous schoolmaster," Ezekiel Cheever,* "was appointed," "for the better training up of youth in this town, that, through God's blessing, they may be fitted for public service hereafter, in church or commonwealth." Not content with a Grammar School, provision was early made for "the relief of poor scholars at the college at Cambridge," and in 1645 forty bushels of wheat were sent forward for this purpose, and this was followed by other donations, and by a richer consignment of young men to enjoy the advantages of the institution. In 1647, in the distribution of home lots, it was ordered in town meeting, that the magistrates "consider and reserve what lot they shall see meet, and most commodious for a college, which they desire may be set up so soon as their ability will reach thereunto." Among the active promoters of education and schools, the name of Governor Eaton, in connection with Mr. Davenport, is particularly prominent. In 1652, he calls a meeting of the magistrates and elders "to let them know what he has done for a schoolmaster;" that he had written a letter to one Mr. Bower, a schoolmaster of Plymouth, and another to Rev. Mr. Landron, a scholar; and many of the town thought there would be need of two schoolmasters—"one to teach boys to read and write," as well as the "Latin schoolmaster." At another time he reports his correspondence with a teacher in Wethersfield, then with one at old Plymouth, and again with one at Norwalk, "so that the town might never be without a sufficient schoolmaster." He seems to have been considerate of the health of the teachers, and proposes to excuse one "whose health would not allow him to go on with the work of teaching," which he seems to regard as more laborious than that of the ministry. On another occasion he introduces to the committee a schoolmaster who has come to treat about the school. He is allowed £20 a year, and 30 shillings for his expenses in travel, besides his board and lodgings. He wished to have liberty to visit his friends, "which he proposed to be in harvest time, and that his pay be such as wherewith he may buy books." These particulars show the considerate interest taken by men in local authority in the school and the teacher, in advance of any directory or compulsory legislation of the colony of New Haven. It was owing, in part, to the timely suggestions of Rev. Mr. Davenport, that Gov. Edward Hopkins, of Connecticut, by his will, dated London, March 7, 1657, bequeathed the residue of his estate (after disposing of much of his estate in New England) to trustees residing in New Haven and Hartford, "in full assurance of their trust and faithfulness" in disposing of it, "to give some encouragement in those foreign plantations for the breeding up of hopeful youths both at the grammar school and college, for the public service of the country in future times." By the final disposition and distribution of this estate three grammar schools were established at New Haven, Hartford, and Hadley, which are in existence at this day, among the oldest institutions of this class in America.

The early records of the several towns which subsequently constituted a portion of the colony of New Hampshire, exhibit evidence of a different character and spirit in the first settlers. The plantations on the Piscataqua river were made by proprietors from mere commercial motives, and the settlers were selected in reference to immediate success in that direction; and in these settlements we find no trace of any individual or town action in behalf of education until after their union with the colony of Massachusetts, whose laws made the establishment of schools obligatory.

In the early records of the Rhode Island and Providence Plantations, we find traces of the same educational policy which marked the early history of towns in Massachusetts and Connecticut. According to Callender, in Newport, "so early as 1640, Mr. Lenthal was by vote called to keep a public school for the learning of youth, and for

*See Barnard's *American Teachers and Educators*, vol. i., art. "Ezekiel Cheever."

his encouragement there were granted to him and his heirs, one hundred acres of land, and four more for a house lot. It was also voted that one hundred acres should be appropriated for a school for encouragement of the poorer sort to train up their youth in learning. And Mr. Robert Lenthal, while he continues to keep school, is to have the benefit thereof." The proprietors of other plantations reserved a portion of land for the maintenance of schools, and generally of a "free schoole;" and "Mr. Schoolmaster Turpin," petitions the town of Providence, that he and his heirs, so long as any of them should maintain the worthy art of learning, may be invested in the lands set apart for a school.

These citations show the action of the towns independent of any general legislation by the several colonies of New England—action prompted by their own consciousness of the advantages of education in "Dame Schools," in "Free Schools," in "Grammar Schools" and in "Colleges" at home—aided by the presence among them of "masters" and "ushers," and also of "schoolmasters" and "schoolma'ams" willing to engage in the same vocations in the new townships and villages—stimulated by magistrates and ministers, who had themselves received the best education that such schools could give in England, who inculcated the reading of the Scriptures as of daily obligation, and who believed that the foundations of the state should be laid in the virtue and intelligence of the whole people.

COLONIAL LEGISLATION AND ACTION.

We shall now notice briefly the legislation respecting children and schools of each of the colonies, in the order of their settlement.

Virginia.—Although several attempts were made to establish "Free Schools" and a "College" in Virginia, by the Virginia Company and benevolent individuals, at an earlier day, the first general legislation respecting the education of children by the Colonial Assembly was in 1631, when it was enacted: "It is also thought fit, that upon every Sunday the mynister* shall, halfe an hour or more before evening prayer, examine, catechise, and instruct the youths and ignorant persons of his parish in the ten commandments, the articles of the beliefe, and in the Lord's prayer; and shall diligentlie heere, instruct, and teach the catechisme, sett forth in the book of Common Prayer. And all fathers, mothers, maysters, and mistrisses, shall cause their children, servants, or apprentices, which have not learned their catechisme, to come to church at the time appoynted, obedientlie to heare, and to be ordered by the mynister untill they have learned the same. And yf any of sayd fathers, mothers, maysters & mistresses, children, servants, or apprentices, shall neglect their duties, as the one sorte in not causinge them to come, and the other in refusinge to learne as aforesayd, they shall be censured by the corts in these places holden." To secure the execution of this last clause, it is provided in the oath of the warden, taken before "the justices for the monthlie corts"—"they shall present such mastyrs and mistresses as shall be delinquent in the catechisinge the youth and ignorant persons. So help you God."

In 1660 an attempt was made to found a college for the supply of educated clergymen. "Whereas the want of able and faithful ministers in this country deprives us of those great blessings and mercies that always attend upon the service of God; which want, by reason of the great distance from our native country, cannot in all probability be always supplied from thence: *Be it enacted*, that for the advance of learning, education of youth, supply of the ministry, and promotion of piety, there be land taken for a college and free school with as much speed as may be convenient, houses erected thereon for entertainment of students and scholars." In the same year it was ordered that a petition be drawn up by the General Assembly to the king for a college and free school; and that there be his letters patent "to collect the charity of well disposed persons in England, for the erecting of colledges & schools in this countrye," and also to bestow universities "to furnish the church here with ministers for the present." And this petition was recommended to the right honorable Governor, Sir William Berkeley. Sir William does not appear, in his reply to the Lords Commissioners of Foreign Plantations, dated 1670, to have been very kindly disposed to public schools of high or low degree.

"Question 23. What course is taken about the instructing the people within your government in the Christian religion;

* In this and some other quotations we have followed the orthography of the original.

and what provision is there made for the payment of your ministry?"

"*Answer.* The same course that is taken in England out of towns; every man according to his ability instructing his children. We have forty-eight parishes, and our ministers are well paid, and by my consent should be better if they would pray oftener and preach less. But of all other commodities, so of this, the worst are sent us, and we had few that we could boast of, since the persecution in Cromwell's tyranny drove divers worthy men hither. But I thank God there are no free schools, nor printing, and I hope we shall not have these hundred years; for learning has brought disobedience and heresy and sects into the world, and printing has divulged them, and libels against the best government. God keep us from both!"

In 1691, "the good design of building a free school and college for the encouragement of learning," was recognized, but it was not till 1693 that an act was passed locating the college, for which a royal charter had been obtained April 8, 1692, with the title of William and Mary, at Middle Plantation, afterward Williamsburgh. Toward its endowment the royal founders granted £2000 in money, land, and a revenue duty on tobacco; and the Assembly enacted an export duty on skins and furs. The money grant of £2000 did not meet with much encouragement from the English Attorney General (Seymour) who was instructed to prepare the charter, who remarked to the Rev. James Blair, the agent of the colony for this purpose, that the money was wanted for other purposes, and that he did not see the slightest occasion for a college in Virginia. The agent represented that the intention of the colony was to educate and qualify young men to be ministers of the Gospel, and begged Mr. Attorney would consider that the people of Virginia had souls to be saved as well as the people of England. "Souls!" said he; "damn your souls! make tobacco." The plan of the building was designed by Sir Christopher Wren. The first commencement was held in 1700, at which, according to Oldmixon, "there was a great concourse of people; several planters came thither in their coaches, and several sloops from New York, Pennsylvania and Maryland; it being a new thing in America to hear graduates perform their academical exercises. The Indians themselves had the curiosity to come to Williamsburgh on this occasion; and the whole country rejoiced as if they had some relish of learning." After the English fashion, the college had a representative in the General Assembly. As a quitrent for the land granted by the Crown, the students and professors every year marched to the residence of the royal Governor, and presented, and sometimes recited, some Latin verses. On the breaking out of the Revolution the endowments of the college were cut off, and its constitution was somewhat changed.

No general school law was established in Virginia until 1796, although a plan was proposed by Mr. Jefferson in 1779, which recognized three degrees of public instruction, viz.: 1. Elementary schools for all children. 2. Colleges for an extension of instruction suitable for the common purposes of life. 3. A university, an extension of the means of higher culture on the basis of the college at Williamsburgh.

Scattered through the colony were schools in connection with churches, both Episcopal and Presbyterian, and in many families private teachers were employed, and in some cases sons were sent out to England to complete their education.

MASSACHUSETTS.—In 1636, six years after the first settlement of Boston, the General Court of the colony of Massachusetts Bay, which met in Boston on the 8th of September, passed an act appropriating £400 toward the establishment of a college. The sum thus appropriated was more than the whole tax levied on the colony at that time in a single year, and the population scattered through ten or twelve villages did not exceed five thousand persons; but among them were eminent graduates of the university of Cambridge, in England, and all were here for purposes of permanent settlement. In 1638, John Harvard left by will the sum of £779 in money, and a library of over three hundred books. In 1640 the General Court granted to the college the income of the Charlestown ferry; and in 1642 the Governor, with the magistrates and teachers and elders, were empowered to establish statutes and constitutions for the infant institution, and in 1650 granted a charter which still remains the fundamental law of the oldest literary institution in this country.

In 1642 the attention of the General Court was turned to the subject of family instruction in the following enactment:—

"Forasmuch as the good education of children is of singular behoof and benefit to any commonwealth; and whereas many parents and masters are too indulgent and negligent of their duty in this kind:

"*It is therefore ordered by this Court and the authority thereof*, That the selectmen of every town, in the several precincts and quarters where they dwell, shall have a vigilant eye over their brethren and neighbors, to see, first, that none of them shall suffer so much barbarism in any of their families, as not to endeavor to teach, by themselves or others, their children and apprentices so much learning as may enable them perfectly to read the English tongue, and knowledge of the capital laws, upon penalty of twenty shillings for each neglect therein; also, that all masters of families do, once a week, at least, catechise their children and servants in the grounds and principles of religion, and if any be unable to do so much, that then, at the least, they procure such children or apprentices to learn some short orthodox catechism, without book, that they may be able to answer to the questions that shall be propounded to them out of such catechisms by their parents or masters, or any of the selectmen, where they shall call them to a trial of what they have learned in this kind; and further, that all parents and masters do breed and bring up their children and apprentices in some honest lawful calling, labor or employment, either in husbandry or some other trade profitable for themselves and the commonwealth, if they will not nor cannot train them up in learning to fit them for higher employments; and if any of the selectmen, after admonition by them given to such masters of families, shall find them still negligent of their duty in the particulars aforementioned, whereby children and servants become rude, stubborn and unruly, the said selectmen, with the help of two magistrates, shall take such children or apprentices from them, and place them with some masters for years, boys till they come to twenty-one, and girls eighteen years of age complete, which will more strictly look unto and force them to submit unto government, according to the rules of this order, if by fair means and former instructions they will not be drawn unto it."

In the same year the following general school law was enacted:—"It being one chief project of that old deluder, Satan, to keep men from the knowledge of the Scriptures, as in former times, keeping them in an unknown tongue, so in these latter times, by persuading from the use of tongues, so that at least the true sense and meaning of the original might be clouded and corrupted with false glosses of deceivers; and to the end that learning may not be buried in the grave of our forefathers, in church and commonwealth, the Lord assisting our endeavors:

"*It is therefore ordered by this Court and authority thereof*, That every township within this jurisdiction, after the Lord hath increased them to the number of fifty householders, shall then forthwith appoint one within their town to teach all such children, as shall resort to him, to write and read, whose wages shall be paid, either by the parents or masters of such children, or by the inhabitants in general, by way of supply, as the major part of those who order the prudentials of the town shall appoint; provided, that those who send their children be not oppressed by paying much more than they can have them taught for in other towns.

"*And it is further ordered*, That where any town shall increase to the number of one hundred families or householders, they shall set up a grammar school, the masters thereof being able to instruct youths so far as they may be fitted for the university, and if any other town neglect the performance hereof above one year, then every such town shall pay five pounds per annum to the next such school, till they shall perform this order."

With various modifications as to details, but with the same objects steadily in view, viz., the exclusion of "barbarism" from every family, by preventing its having even one untaught and idle child or apprentice, the maintenance of an elementary school in every neighborhood where there were children enough to constitute a school, and of a Latin school in every large town, and of a college for higher culture for the whole colony, the colonial legislature, and the people in the several towns of Massachusetts, maintained an educational system, which, although not as early or as thorough as the school code of Saxony and Wirtemberg, has expanded with the growth of the community in population, wealth, and industrial development, and stimulated and shaped the legislation and efforts of other states in behalf of universal education.

The early records of the colony of Plymouth contain no trace of the zeal for schools which characterized the colonies of Massachusetts Bay, Connecticut, and New Haven. In 1662 the profits of the codfishery were appropriated to the maintenance of grammar schools in such towns as would make arrangements for the same; and in 1669 towns having fifty families were authorized to raise by rate on all the inhabitants the sum of twelve pounds for this class of schools, "for as much as the maintenance of good literature doth much tend to the advancement of the weal and flourishing state of societies and republics." After the union of the two colonies under one charter, several towns in the old colony were fined for not complying with the provisions of the law of 1647 respecting children and schools.

In addition to the grammar school which each town having one hundred families was obliged by law to maintain, to enable young men to fit for college, in several counties endowed schools were set up; and in 1763 the first of that class of institutions, known and incorporated as academies, was established in the parish of Byfield in the town of Newbury, on a legacy left by Gov. William Dummer. Its objects were the same as those of the town grammar school, but its benefits were not confined to one town, nor was it supported in any degree by taxation.

Rhode Island.—In this colony education was left to individual and parental care, no trace of any legislation on the subject being found in the proceedings of the General Assembly, except to incorporate in 1747 the "Society for the Promotion of Knowledge and Virtue," which was established in Newport in 1730 by the name of the "Company of the Redwood Library;" and in 1764 to grant the charter to the College of Rhode Island, which was first located in Warren, and in 1770 removed to Providence, and in 1804 called, after its most liberal benefactor, Brown University.

Connecticut.—In 1646, Mr. Roger Ludlow was requested to compile "a body of laws for the government of this commonwealth," which was not completed till May, 1650, and is known as the code of 1650. The provisions for the family instruction of children and the maintenance of schools are identically the same as in Massachusetts, and remained on the statute-book, with but slight modifications to give them more efficiency, for one hundred and fifty years. In the chapter on "capital" offences, it is enacted that if any child above sixteen years of age, and of sufficient understanding, shall curse or smite his father or mother, he shall be put to death, "unless it can be sufficiently testified that the parents have been unchristianly negligent in the education of such children." In the chapter respecting schools, the proposition made by the "Commissioners of the United Colonies," that it be commended to every family which "is able and willing to give yearly but the fourth part of a bushel of corn, or something equivalent thereto," "for the advancement of learning," was approved, and two men were appointed in every town to receive and forward the contributions. This was done in the larger towns of the colonies of Connecticut and New Haven, from time to time, until ten of the principal ministers, in 1700, at Branford, brought each a number of books, and as they laid them on the table, declared—"*I give these books for founding a College in Connecticut*;" and on that foundation rose Yale College. To fit young men for the college at Cambridge, and subsequently for Yale, in 1672 it was ordered by the General Court, "that in every county there shall be set up a grammar school for the use of the county, the master thereof being able to instruct youths so far as they may be fitted for college;" and to aid the county towns in maintaining their schools, six hundred acres of land were appropriated by the General Court to each, "to be improved in the best manner that may be for the benefit of a grammar school in said towns, and to no other use or end whatsoever;" and in 1677 a fine of ten pounds annually is imposed on any county town neglecting to keep the Latin school. In 1690, the county Latin schools of Hartford and New Haven are denominated "Free Schools," probably in reference to the partial endowment of schools of this class by the trustees of the legacy of Governor Hopkins.

As early as 1700, the system of public instruction in Connecticut embraced the following particulars:

1. An obligation on every parent and guardian of children, "not to suffer so much barbarism in any of their families as to have a single child or apprentice unable to read the holy word of God, and the good laws of the colony;" and also, "to bring them up to some lawful calling or employment," under a penalty for each offence.

2. A tax of forty shillings on every thousand pounds of the lists of estates, was collected in every town with the annual state tax, and payable proportionably to those towns only which should keep their schools according to law.

3. A common school in every town having over seventy families, kept for at least six months in the year.

4. A grammar school in each of the four head county towns to fit youth for college, two of which grammar schools were free or endowed.

5. A collegiate school, toward which the General Court made an annual appropriation of £120.

6. Provision for the religious instruction of the Indians.

The system, therefore, embraced every family and town, all classes of children and youth, and all the then recognized grades of schools. There were no select or sectarian schools to classify society at the roots, but all children were regarded with equal favor, and all brought under the assimilating influence of early associations and similar school privileges. Here was the foundation laid, not only for universal education, but for a practical, political, and social equality, which has never been surpassed in the history of any other community.

New Hampshire.—From 1623 to 1641, the early records of the first settlements within the present limits of New Hampshire exhibit no trace of educational enactments; from 1641 to 1680, the school laws of Massachusetts prevailed, and the presence of such men as Philemon Purmont and Daniel Maude, who were the first schoolmasters of that colony, must have contributed to inaugurate the policy of local and endowed schools. When the necessities of the college at Cambridge were made known, the people of Portsmouth, in town meeting, made a collection of sixty pounds, with a pledge to continue the same amount for seven years, "for the perpetuating of knowledge both religious and civil among us and our posterity after us." In the original grants for towns one lot was reserved for the support of schools.

In 1680 New Hampshire became a separate colony, and in 1693 the Colonial Assembly enacted "that for the building and repairing of meeting houses, ministers' houses, and allowing a salary to a schoolmaster in each town within this province, the selectmen shall raise by an equal rate an assessment upon the inhabitants;" and in 1719 it was ordained that every town having fifty householders should be constantly provided with a schoolmaster to teach children to read and write; and those having one hundred should maintain a grammar school, to be kept by some decent person, of good conversation, well instructed in the tongues. In 1721 it was ordered that not only each town but each parish of one hundred families should be constantly provided with a grammar school, or forfeit the sum of twenty pounds to the treasury of the province. This system of elementary and secondary instruction continued substantially until the adoption of the state constitution in 1792.

In 1770 Dr. Wheelock removed a school which he had established in Lebanon, Connecticut, under the name of "Moor's Indian Charity School," to the depths of the forests in the western part of New Hampshire. Here, side by side with the school for Indians, he organized another institution, termed a college in the charter granted by Governor Wentworth in 1769, and which held its first commencement in 1771, with four graduates, one of whom was John Wheelock, the second president of the institution, which was called Dartmouth College after Lord Dartmouth, one of the largest benefactors of the Charity School.

At the close of the colonial period of our history, according to Noah Webster, the condition of the educational system in Connecticut and New England was as follows:

"The law of Connecticut ordains that every town or parish containing seventy householders, shall keep an English school, at least eleven months in the year; and towns containing a less number, at least six months in the year. Every town keeping a public school is entitled to draw from the treasury of the state a certain sum of money, proportioned to its census in the list of property which furnishes the rule of taxation. This sum might have been originally sufficient to support one school in each town or parish, but in modern times is divided among a number, and the deficiency of money to support the schools is raised upon the estates of the people, in the manner the public taxes are assessed. To extend the benefits of this establishment to all the inhabitants, large towns and parishes are divided into districts, each of which is supposed able to furnish a competent number of scholars for one school. In each district a house is erected for the purpose by the inhabitants of that district, who hire a master, furnish wood, and tax themselves to pay all expenses not provided for by the public money. The school is kept during the winter months, when every farmer can spare his sons. In this manner, every child in the state has access to a school. In the summer, a woman is hired to teach small children, who are not fit for any kind of labor. In the large towns, schools, either public or private, are kept the whole year; and in every county town, a grammar school is established by law.

"The beneficial effects of these institutions will be experienced for ages. Next to the establishments in favor of religion, they have been the nurseries of well-informed citizens, brave soldiers and wise legislators. A people thus informed are capable of understanding their rights and of discovering the means to secure them. In the next place, our forefathers took measures to preserve the reputation of schools and the morals of youth, by making the teaching them an honorable employment. Every town or district has a committee, whose duty is to procure a master of talents and character; and the practice is to procure a man of the best character in the town or neighborhood. The wealthy towns apply to young men of liberal education, who, after taking the bachelor's degree, usually keep school a year or two before they enter upon a profession. One of the most unfortunate circumstances to education in the Middle and Southern states, is an opinion that school-keeping is a mean employment, fit only for persons of low character. The wretches who keep the schools in those states very frequently degrade the employment; but the misfortune is, public opinion supposes the employment degrades the man: of course no gentleman will undertake to teach children while in popular estimation he must forfeit his rank and character by the employment. Until public opinion is corrected by some great examples, the common schools, what few there are in those states, must continue in the hands of such vagabonds as wander about the country."

"Nearly connected with the establishment of schools is the circulation of newspapers in New England. This is both a consequence and a cause of a general diffusion of letters. In Connecticut, almost every man reads a paper every week. In the year 1785, I took some pains to ascertain the number of papers printed weekly in Connecticut and in the Southern states. I found the number in Connecticut to be nearly eight thousand; which was equal to that published in the whole territory south of Pennsylvania. By means of this general circulation of public papers, the people are informed of all political affairs; and their representatives are often prepared to deliberate on propositions made to the legislature.

"Another institution favorable to knowledge is the establishment of parish libraries. These are procured by subscription, but they are numerous, the expense not being considerable, and the desire of reading universal. One hundred volumes of books, selected from the best writers, on ethics, divinity, and history, and read by the principal inhabitants of a town or village, will have an amazing influence in spreading knowledge, correcting the morals, and softening the manners of a nation. I am acquainted with parishes where almost every householder has read the works of Addison, Sherlock, Atterbury, Watts, Young, and other similar writings; and will converse well on the subjects of which they treat."

New York.—In the early history of the settlements of the New Netherlands, the school was regarded as an appendage of the church, and the schoolmaster was paid in part out of the funds of the government. Down to its organization as a royal province of England, a parochial school existed in every parish. In 1658 a petition of the burgomasters and schepens of New Amsterdam was forwarded to the West India Company, in which "it is represented that the youth of this place and the neighborhood are increasing in number gradually, and that most of them can read and write, but that some of the citizens and inhabitants would like to send their children to a school the principal of which understands Latin, but are not able to do so without sending them to New England; furthermore, they have not the means to hire a Latin schoolmaster, expressly for themselves, from New England, and therefore they ask that the West India Company will send out a fit person as Latin schoolmaster, not doubting that the number of persons who will send their children to such teacher will from year to year increase, until an academy shall be formed whereby this place to great splendor will have attained, for which, next to God, the honorable company which shall have sent such teacher here shall have laud and praise." In compliance with this petition, Dr. Alexander Carolus Curtius, a Latin master of Lithuania, was sent out by the company. The burgomasters proposed to give him five hundred guilders annually out of the city treasury, with the use of a house and garden, and the privilege of collecting a tuition of six guilders per quarter of each scholar. Dr. Curtius proved not to be a good disciplinarian, and parents complained to the authorities that "his pupils beat each other, and tore the clothes from each other's backs." The doctor retorted that he could not interfere, "as his hands were tied, as some of the parents forbade him punishing their children." He accordingly gave up his place and returned to Holland, and was succeeded in the mastership by Rev. Ægidius Luyck in 1662. His school had a high reputation, and was resorted to by pupils from Virginia, Fort Orange, and the Delaware.

After the establishment of the English authority, the governor claimed the privilege of licensing teachers even for the church schools, but no general school policy was established. In 1702 a free grammar school was founded and built on the King's Farm, and in 1732 a "Free School," for teaching the Latin and Greek and practical branches of mathematics, was incorporated by law. The preamble of the act of incorporation opens as follows: "Whereas the youth of this colony are found by manifold experience to be not inferior in their natural genius to the youth of any other country in the world, therefore be it enacted," etc. In 1710, the Society for the Propagation of the Gospel in Foreign Parts established a charity school in connection with the Episcopal church, which is still in existence, and is now known as the Trinity School. In 1750, Charles Dutens announced to the public "that he taught a school for the use of young ladies and gentlemen, whose love of learning might incline them to take lessons from him in French, at his house on Broad street, near the Long Bridge, where he also makes and vends finger and ear rings, solitaires, stay-hooks and lockets, and sets diamonds, rubies, and other stones. Science and virtue are two sisters, which the most part of the New York ladies possess," etc.

Judge Smith, in his "History of the Province of New York," when speaking of the action of the legislature for founding a college in 1746, says: "To the disgrace of our first planters, who beyond comparison surpassed their eastern neighbors in opulence, Mr. Delancy, a graduate of the University of Cambridge (England), and Mr. Smith, were for many years the only academics in this province, except such as were in holy orders; and so late as the period we are now examining (1750), the author did not recollect above thirteen men, the youngest of whom had his bachelor's degree at the age of seventeen, but two months before the passing of the above law, the first toward erecting a college in this colony, though at a distance of above one hundred and twenty years after its discovery and settlement of the capital by Dutch progenitors from Amsterdam."

In 1754 a royal charter was obtained for a college in New York, with the style of King's College, which came into possession of a fund raised by a lottery authorized for this purpose by the Assembly in 1746, and of a grant of land conveyed to its governors by Trinity Church in 1755. Out of this grant, Columbia College is now (1860) realizing an income of $60,000 a year. The first commencement was celebrated in 1758.

"For the advantage of our new intended college" (King's), "and the use and ornament of the city," a number of eminent citizens of New York, in 1754, united in an association to form a library, which in 1772 was incorporated with the title of the "New York Society Library."

Maryland.—The first settlement was effected within the present limits of Maryland in 1634; and in the years immediately following, we find no record of any marked individual or legislative effort to establish institutions of learning. The first act of the colonial Assembly is entitled a "Supplicatory Act to their sacred majesties for erecting of schools," which was passed in 1694, and repealed or superseded by an act entitled a "Petitionary Act" for the same purpose. Appealing to the royal liberality, which had been extended to the neighboring colony of Virginia in the institution of the college, "a place of universal study," the Assembly ask, "that for the propagation of the Gospel, and the education of the youth of this province in good letters and manners, that a certain place or places for a free school or schools, or place of study of Latin, Greek, writing and the like, consisting of one master, one usher, and one writing-master or scribe to a school, and 100 scholars," be established in Arundel County, of which the Archbishop of Canterbury should be chancellor, and to be called "King William's School;" and a similar free school is asked for in each county, to be established from time to time as the resources of the several counties may suffice. To increase the educational resources of the counties, in 1717 it was enacted that an additional duty of twenty shillings current money per poll should be levied on all Irish servants, being papists, to prevent the growth of popery by the importation of too great a number of them into this province, and also an additional duty of twenty shillings current money per poll on all negroes, for raising a fund for the use of public schools. In 1723, "an act for the encouragement of learning, and erecting schools in the several counties," was passed, with a preamble setting forth that preceding Assemblies have had it much at heart, "to provide for the liberal and pious education of the youth of the province, and improving their natural abilities and acuteness (which seem not to be inferior to any), so as to be fitted for the discharge of their duties in the several stations and employments in it, either in regard to church or state." By this act seven visitors are appointed in each county, with corporate powers to receive and hold estate to the value of £100 per annum; and they are authorized with all convenient speed to purchase, out of funds realized from revenues already set apart for this purpose, one hundred acres more or less, one moiety of which is to serve for making corn, grain, and pasturage for the benefit and use of the master, who is prohibited growing tobacco, or permitting it by others on said farm. The visitors are directed to employ good schoolmasters, members of the Church of England, and of pious and exemplary lives and conversation, and capable of teaching well the grammar, good writing, and the mathematics, if such can be conveniently got, on a salary of £20 per annum, and the use of the plantation. In 1728 the master of each public school is directed "to teach as many poor children gratis as the majority of the visitors should order."

Up to the establishment of the state government in 1777, there was no system of common schools for elementary instruction in operation in Maryland. "A free school," like the free endowed grammar school of England, was established in a majority of counties, two of which were subsequently converted into colleges, that of Charlestown in Kent county, into Washington College in 1782, and the second at Annapolis into St. John's College in 1784—the former "in honorable and perpetual memory of his excellency General Washington, the illustrious and virtuous commander-in-chief of the armies of the United States."

In 1696, Rev. Thomas Bray, then residing in the parish of Sheldon, England, was made commissary of Maryland, to establish the Church of England in the colony. His first act was to inaugurate a plan of parochial libraries for the use of ministers in each parish. Through his influence, Princess Anne made a benefaction for this purpose, and in acknowledgment of the honor of having the capital of the province called after her name (Annapolis), donated books to the value of four hundred pounds to the parish library, which he called "the Annapolitan Library." By his influence in England a plan of "lending-libraries" was projected in every deanery throughout the kingdom, and carried out.

New Jersey.—In the history of New Jersey as a colony we find no trace of any general legislation or governmental action in behalf of schools. Scattered at wide intervals over the state were schools kept by clergymen in connection with their churches.

In 1748 a charter of incorporation for the College of New Jersey was obtained from George II., during the administration of Governor Belcher, "for the instruction of youth in the learned languages and liberal arts and sciences." During the administration of Governor Franklin in 1770, a second college was chartered, with the name of Queen's (now Rutger's) College, as a school of theology for the Reformed Dutch Church. Neither of the institutions received any aid from the government.

Pennsylvania.—The frame of government of the province of Pennsylvania, dated April 25th, 1682, drawn up by William Penn before leaving England, contains the following provision: "The governor and provincial council shall erect and order all public schools and reward the authors of useful sciences and laudable inventions in said province." In the laws agreed upon a few months later in the same year by the governor and divers freemen of the province in England, it is provided "that all children within this province of the age of twelve years shall be taught some useful trade, or skill, to the end that none be idle, but that the poor may work to live, and the rich, if they become poor, may not want." In 1683 the governor and council in Philadelphia, "having taken into their serious consideration the great necessity there is of a schoolmaster in the town of Philadelphia, sent for Enoch Flower, an inhabitant of said town, who for twenty years past hath been exercised in that care and employment in England, to whom having communicated their minds, he embraced it upon the following terms: to learn to read English, 4s. by the quarter;" to learn to read and write, 6s.; read, write and cast accounts, 8s.; for boarding a scholar, £10 per year. In 1689 the Society of Friends established a Latin school of which George Keith was the first teacher. In 1725 Rev. Francis Alison, a native of Ireland, but educated at Glasgow, became pastor of the Presbyterian church in New London, in Chester county, and opened a school there, which had great reputation. He at one time resided at Thunder Hill, in Maryland, where he educated many young men who were afterward distinguished in the Revolutionary struggle. He was subsequently Provost of the college at Philadelphia.

In 1749 Benjamin Franklin published his "*Proposals relating to the Education of Youth in Pennsylvania*," out of which originated subsequently an academy and charity school, and ultimately the University of Pennsylvania. At the head of the English department of the academy in 1751 was Mr. Dove, who was then engaged in giving public lectures in experimental philosophy with apparatus—an early lyceum or popular lecturer.

In 1743 the American Philosophical Society originated in a "Proposal for Promoting Useful Knowledge," published by Benjamin Franklin, which, after various forms of organization, took its present name and shape on the 2d of January, 1769.

In 1765 the Medical School originated with the appointment of Dr. Morgan to the professorship of the theory and practice of physic; in 1767 it was fully organized, and in 1768 degrees in medicine were for the first time conferred.

Among the denominational schools which grew up in the absence of any general legislation on the subject, was a Moravian school for boys at Nazareth in 1747, and for girls at Bethlehem 1749, both of which are still in existence, and the latter, especially, since 1789, has been one of the most flourishing female seminaries in this country.

Delaware.—In the early settlements of the Swedes and Dutch in Delaware, the policy of connecting a school with the church was probably imperfectly carried out, but there is no historical trace of its existence. The only school legislation of the colony extant, is an act incorporating "the Trustees of the Grammar School in the borough of Wilmington, and county of New Castle," dated April 10, 1773.

North Carolina.—In North Carolina for fifty years, the policy of the provincial authorities was to discourage all forms of religious and educational activity outside of the Church of England, to the extent of forbidding expressly the establishment of printing presses. The first act on record relating to schools, in 1764, was "for the building of a house for a school, and the residence of a schoolmaster in the town of Newbern"—appropriating the half of two lots, before set apart for a church, for this purpose. In 1766 another act was passed incorporating trustees for this school, with the preamble "that a number of well-disposed persons, taking into consideration the great necessity of having a proper school, or public seminary of learning established, whereby the present generation may be brought up and instructed in the principles of the Christian religion, and fitted for the several offices and purposes of life, have at great expense erected a school-house for this purpose;" and providing that the master of the school shall be "of the established Church of England, and licensed by the governor." Similar acts were passed in 1770 and 1779 for schools at Edenton and Hillsborough. In 1770 an act, reciting that a very promising experiment had been made in the town of Charlotte in the county of Mecklenburg, with a seminary of learning "a number of youths there taught making great advancement in the knowledge of the learned languages, and in the rudiments of the arts and sciences, having gone to various colleges in distant parts of America," incorporates the same with the name of Queen's College. This act was repealed by proclamation in the next year, but in 1777 it was reincorporated by name of "Liberty Hall." With the downfall of the royal authority, and the religious party which had swayed the colony, a new educational policy was inaugurated.

South Carolina.—In the early history of the colony of South Carolina, as of several other colonies, the first efforts to establish schools were in connection with the predominant church of the settlers, *i. e.*, of the Church of England, through the aid of the "Venerable Society for Propagating the Gospel in Foreign Parts." By the missionaries of that society charity schools were established in several parishes, some of which were afterward endowed by individuals, and incorporated by act of the legislature, and called "Free Schools." In 1710 a free school of this character was established at Goosecreek, and in 1712 in Charleston; and by the general act of February 22, 1722, the justices of the county courts were authorized to erect a free school in each county and precinct, to be supported by assessment on land and negroes. These schools were bound to teach ten poor children each, if sent by said justices. In 1724, a memorial to the "Venerable Society" from the parish of Dorchester sets forth—"The chief source of irreligion here is the want of schools; and we may justly be apprehensive, that if our children continue longer to be deprived of opportunities of being instructed, Christianity will of course decay insensibly, and we shall have a generation of our own as ignorant as the native Indians." The society sent out schoolmasters to this and other parishes, and about 2000 volumes of bound books. In 1721 Mr. Richard Beresford bequeathed to the parish of St. Thomas and St. Dennis, in trust, for the purpose of educating the poor, £6500; and in 1732 Mr. Richard Harris, for the same object, £1000. In 1728 Rev. Richard Ludlam bequeathed his whole estate to the parish of St. James, which in 1778 amounted to £15,272. Other bequests for the same objects were made at different times before the Revolution. In 1743 Rev. Alexander Garden wrote to the society that the negro school consisted of thirty children, and in 1750 that it was going on with all desirable success. In 1748 a library was founded in Charleston by an association of seventeen young men, whose first object was to collect new pamphlets and magazines published in Great Britain, but in the course of a year embraced the purchase of books. After many delays and refusals, an act of incorporation was obtained in 1754. There is but one older library in this country.

Georgia.—The earliest effort to establish schools in Georgia was made by the Rev. George Whitefield. Before leaving England in 1737, he had projected an Orphan House, after the plan of that of Dr. Franké, at Halle, of which an account about that time appeared in English. His first visit to Savannah in 1738 satisfied him of the necessity of a charity school for poor and neglected children, and in the course of that year he returned to England to obtain his ordination as priest and collect funds for his educational enterprise. The trustees of the colony gave him five hundred acres of land upon which to erect his buildings. These were selected about ten miles out of Savannah, and on the 25th of March, 1740, he laid the first brick of the house, which he called Bethesda, or House of Mercy, and opened his school in temporary shelters with forty children. In the fall of the same year he made a collection and preaching tour in New England, during which he collected over £800 for his charity. After disasters by fire, etc., the Orphan House property was bequeathed to Selina, Countess of Huntingdon, in trust for the purposes originally designed, and subsequently incorporated for this purpose. On her death, and after the Revolution, the legislature transferred the property to thirteen trustees, to manage the estate and make regulations for an academy in the county of Chatham. Schools were established by the missionaries sent out by the Society for the Propagation of the Gospel at Savannah, Augusta, and Frederica, and by the Moravians and Huguenots in their respective settlements.

RESULTS AT THE CLOSE OF OUR COLONIAL HISTORY.

The educational systems and provisions of the colonial period of the United States were, especially in its earlier portion, closely connected with the ecclesiastical systems of the colonies. Schools were maintained by individual youth trained up in very many cases, because it was a duty to prepare useful future members of the church, which in some of the colonies was also the state.

In three states, Massachusetts, Connecticut, and New Hampshire, it was very early made the legal duty of parents and towns to make provision for the education of youth. Elsewhere, such efforts as were made, aside from the natural desire of parents to afford their children such an education as was suitable to their rank in life, or such as would aid their subsequent progress and prosperity, were, generally speaking, put forth by clergymen, ecclesiastical bodies, or pious laymen, for colonial institutions for secondary education were not very numerous, including the town grammar schools of New England, and a small number of endowed or free schools. In these two classes of institutions, a small number of pupils were prepared to enter college. A far greater number of college students, more especially in the middle and southern states, were prepared by clergymen, who received each a small number of pupils into his family, as a means of securing some additional income. There were also a few private schools of considerable reputation and value.

In connection with these educational agencies, the small parochial and social libraries, and the two or three associations for the increase and dissemination of science, should also be referred to.

The institutions of superior education, established during the colonial period, were seven in number; namely, Harvard, William and Mary, Yale, Nassau Hall, Rutgers, Brown, and Columbia. From these came forth nearly all the liberally educated men of that day, though it was a custom of a few of the wealthiest families of the day to grad uate their sons at a European university, Oxford or Cambridge being commonly selected. The colonial colleges, like the schools preparatory to them, were substantially church institutions, their pupils being the stock from which the clerical body was reinforced.

It was not until the very close of the colonial period that a few special or professional schools were established. A school of medicine, sufficiently entitled to the name, gave degrees in New York in 1769; a sort of theological seminary was founded in Pennsylvania in 1778; while the first law school only arose the year after the peace of 1783. Professorships, however, in these departments, had afforded a certain amount of instruction in all of them as part of the college course, long before; indeed, from the foundation of the earliest colleges.

Female education was comparatively neglected in the colonial period. Girls were taught housewifely duties far more assiduously than learning, and often depended upon home instruction for whatever education they received; neither the common schools nor those for secondary education affording or being designed to afford accommodation for them.

That special supplementary training which at the present day does so much to alleviate the misfortunes of the blind, the deaf and dumb, and the feeble minded, was quite unknown, nor was the idea entertained that such a training was practicable.

CHAPTER II.

REVOLUTIONARY AND TRANSITIONAL PERIOD.

The immediate effects of the war of the Revolution were adverse, and, in certain aspects, disastrous to the interests of education. Dangers so great and imminent almost engrossed all thought and absorbed all exertion and resources. Children, indeed, were not left without the instruction of the family and the local elementary school, and they were, thank God, everywhere surrounded with the most stirring exhibitions of heroic patriotism and the self-sacrificing virtues. But too generally the elementary school and the teacher, never properly appreciated, gave way to more pressing and universally-felt necessities. Higher education for a time experienced a severe shock. The calls of patriotism withdrew many young men from the colleges and the preparatory schools, and prevented many more from resorting thither. The impoverishment of the country, and the demand for immediate action, compelled others to relinquish an extended course of professional study. In some cases the presence of armies caused a suspension of college instruction and the dispersion of faculty and students, and even converted the college buildings into barracks. But the action and influence of this period were not wholly adverse or disastrous to schools and higher education. The public mind was stimulated into greatly increased activity—now, for the first time, assuming a collective existence and national characteristics. The heart of the people was thoroughly penetrated by the spirit of self-sacrifice, in cheerfully bearing the burdens of society with diminished resources, and in repairing the waste and destruction of the war. The examples of wisdom and eloquence in council, and courage and heroism in the field, and of patient endurance of privation and hardship, and towering above all and outshining all, the colossal greatness and transparent purity of the character of Washington—these were lessons for the head and the heart of a young nation, which amply compensated for the partial and temporary suspension of schools. In the discussion and reconstruction of political society, in framing constitutions and organic legislation, and in the disposition of unsettled territory, the importance of the elementary school, the academy, and the college, was recognized and provided for.

Among the earliest to do justice to this great subject was Noah Webster, who, in a series of essays, first published in a New York paper, and copied extensively by the press in other parts of the country, and afterward embodied in a volume with other fugitive pieces, advocated a liberal policy by the national and local governments in favor of a broad system of education. "Here every class of people should know and love the laws. This knowledge should be diffused by means of schools and newspapers; and an attachment to the laws may be formed by early impression upon the mind. Two regulations are essential to the continuance of republican governments: 1. Such a distribution of lands and such principles of descent and alienation as shall give every citizen a power of acquiring what his industry merits. 2. Such a system of education as shall give every citizen an opportunity of acquiring knowledge, and fitting himself for places of trust." "Education should be the first care of a legislature; not merely the institution of schools, but the furnishing them with the best men for teachers. A good system of schools should be the first article in a code of political regulations; for it is much easier to introduce and establish an effectual system for preserving morals, than to correct by penal statutes the ill effects of a bad system. I am so fully persuaded of this, that I should almost adore that great man who shall change our practice and opinions, and make it respectable for the first and best men to superintend the education of youth." As specimens of the utterances of eminent public men on this subject, we cite the following:

"Promote, as an object of primary importance, institutions for the general diffusion of knowledge. In proportion as the structure of a government gives force to public opinion, it is essential that public opinion should be enlightened." GEORGE WASHINGTON.

"The wisdom and generosity of the legislature in making liberal appropriations in money for the benefit of schools, academies and colleges, is an equal honor to them and their constituents, a proof of their veneration for letters and science, and a portent of great and lasting good to North and South America, and to the world. Great is truth—great is liberty—great is humanity—and they must and will prevail." JOHN ADAMS.

"I look to the diffusion of light and education as the resources most to be relied on for ameliorating the condition, promoting the virtue, and advancing the happiness of man. And I do hope, in the present spirit of extending to the great mass of mankind the blessings of instruction, I see a prospect of great advancement in the happiness of the human race, and this may proceed to an indefinite, although not an infinite, degree. A system of general instruction, which shall reach every description of our citizens, from the richest to the poorest, as it was the earliest, so shall it be the latest of all the public concerns in which I shall permit myself to take an interest. Give it to us, in any shape, and receive for the inestimable boon the thanks of the young, and the blessings of the old, who are past all other services but prayers for the prosperity of their country, and blessings to those who promote it."

THOMAS JEFFERSON.

"Learned institutions ought to be the favorite objects with every free people; they throw that light over the public mind which is the best security against crafty and dangerous encroachments on the public liberty. They multiply the educated individuals, from among whom the people may elect a due portion of their public agents of every description, more especially of those who are to frame the laws: by the perspicuity, the consistency, and the stability, as well as by the justice and equal spirit of which, the great social purposes are to be answered."

JAMES MADISON.

"Moral, political and intellectual improvement, are duties assigned by the Author of our existence to social, no less than to individual man. For the fulfilment of these duties, governments are invested with power, and to the attainment of these ends, the exercise of this power is a duty sacred and indispensable." JOHN QUINCY ADAMS.

"For the purpose of promoting the happiness of the State, it is absolutely necessary that our government, which unites into one all the minds of the State, should possess in an eminent degree not only the understanding, the passions, and the will, but above all, the moral faculty and the conscience of an individual. Nothing can be politically right that is morally wrong; and no necessity can ever sanctify a law that is contrary to equity. Virtue is the soul of a Republic. To promote this, laws for the suppression of vice and immorality will be as ineffectual as the increase and enlargement of jails. There is but one method of preventing crime and of rendering a republican form of government durable; and that is, by disseminating the seeds of virtue and knowledge through every part of the State, by means of proper modes and places of education; and this can be done effectually only by the interference and aid of the legislature. I am so deeply impressed with this opinion, that were this the last evening of my life, I would not only say to the asylum of my ancestors and my beloved native country, with the patriot of Venice, '*Esto perpetua*,' but I would add, as the best proof of my affection for her, my parting advice to the guardians of her liberties, establish and support PUBLIC SCHOOLS in every part of the State." BENJAMIN RUSH.

"There is one object which I earnestly recommend to your notice and patronage—I mean our institutions for the education of youth. The importance of common schools is best estimated by the good effects of them where they most abound and are best regulated. Our ancestors have transmitted to us many excellent institutions, matured by the wisdom and experience of ages. Let them descend to posterity, accompanied with others, which, by promoting useful knowledge, and multiplying the blessings of social order, diffusing the influence of moral obligations, may be reputable to us, and beneficial to them." JOHN JAY.

"The first duty of government, and the surest evidence of good government, is the encouragement of education. A general diffusion of knowledge is the precursor and protector of republican institutions, and in it we must confide as the conservative power that will watch over our liberties and guard them against fraud, intrigue, corruption and violence. I consider the system of our Common Schools as the palladium of our freedom, for no reasonable apprehension can be entertained of its subversion, as long as the great body of the people are enlightened by education. To increase the funds, to extend the benefits, and to remedy the defects of this excellent system, is worthy of your most deliberate attention. I can not recommend in terms too strong and impressive, as munificent appropriations as the faculties of the State will authorize for all establishments connected with the interests of education, the exaltation of literature and science, and the improvement of the human mind."

DE WITT CLINTON.

"The parent who sends his son into the world uneducated, defrauds the community of a lawful citizen, and bequeaths to it a nuisance." CHANCELLOR KENT.

In the discussions which have taken place in the press and in the halls of legislation on the subject, the experience of the New England States is constantly cited as an irrefutable argument in favor of public schools and universal education. The character and value of this example are admirably set forth by Daniel Webster:

"In this particular, New England may be allowed to claim, I think, a merit of a peculiar character. She early adopted and has constantly maintained the principle, that it is the undoubted right, and the bounden duty of government, to provide for the instruction of all youth. That which is elsewhere left to chance, or to charity, we secure by law. For the purpose of public instruction, we hold every man subject to taxation in proportion to his property, and we look not to the question, whether he himself have, or have not, children to be benefited by the education for which he pays. We regard it as a wise and liberal system of police, by which property, and life, and the peace of society are secured. We seek to prevent in some measure the extension of the penal code, by inspiring a salutary and conservative principle of virtue and of knowledge in an early age. We hope to excite a feeling of respectability, and a sense of character, by enlarging the capacity, and increasing the sphere of intellectual enjoyment. By general instruction, we seek, as far as possible, to purify the whole moral atmosphere; to keep good sentiments uppermost, and to turn the strong current of feeling and opinion, as well as the censures of the law, and the denunciations of religion, against immorality and crime. We hope for a security, beyond the law, and above the law, in the prevalence of enlightened and well-principled moral sentiment. We hope to continue and prolong the time when, in the villages and farmhouses of New England, there may be undisturbed sleep within unbarred doors. And knowing that our government rests directly on the public will, that we may preserve it, we endeavor to give a safe and proper direction to that public will. We do not, indeed, expect all men to be philosophers or statesmen; but we confidently trust, and our expectation of the duration of our system of government rests on that trust, that by the diffusion of general knowledge and good and virtuous sentiments, the political fabric may be secure, as well against open violence and overthrow, as against the slow but sure undermining of licentiousness."

The action of Congress, and of the early constitutional conventions of the several states, shows how nobly the public mind responded to these appeals.

On the 17th of May, 1784, Mr. Jefferson, as chairman of a committee for that purpose, introduced into the old Congress an ordinance respecting the disposition of the public lands; but this contained no reference to schools or education. On the 4th of March, 1785, another ordinance was introduced—by whom does not appear on the journal—and on the 16th of the same month was recommitted to a committee consisting of Pierce Long of New Hampshire, Rufus King of Massachusetts, David Howell of Rhode Island, Wm. S. Johnson of Connecticut, R. R. Livingston of New York, Charles Stewart of New Jersey, Joseph Gardner of Pennsylvania, John Henry of Maryland, William Grayson of Virginia, Hugh Williamson of North Carolina, John Bull of South Carolina, and William Houston of Georgia. On the 14th of April following, this committee reported the ordinance—by whom drawn up no clue is given—which, after being perfected, was passed the 20th of May following, and became the foundation of the existing land system of the United States.

By one of its provisions, the sixteenth section of every township was reserved "*for the maintenance of public schools;*" or, in other words, one section out of the thirty-six composing each township. The same provision was incorporated in the large land sale, in 1786, to the Ohio Company, and the following year in Judge Symmes' purchase. The celebrated ordinance of 1787, for the government of the territory north-west of the River Ohio, and which confirmed the provisions of the land ordinance of 1785, provides further, that, "RELIGION, MORALITY and KNOWLEDGE being necessary to good government and the happiness of mankind, SCHOOLS, AND THE MEANS OF EDUCATION, SHALL BE FOREVER ENCOURAGED." From that day to the present, this noble policy has been confirmed and extended, till its blessings now reach even the distant shores of the Pacific, and FIFTY MILLIONS OF ACRES of the public domain have been set apart and consecrated to the high and ennobling purposes of education, together with five per cent. of the net proceeds of the sales of all public lands in each of the states and territories in which they are situated.

During this period individual beneficence and associated enterprise began to be directed to the building up, furnishing, and maintaining libraries, colleges, academies, and scientific institutions. Societies for the promotion of science and literature, and schools for professional training, were founded and incorporated, and men of even moderate fortune began to feel the luxury of doing good, and to see that a wise endowment for the relief of suffering, the diffusion of knowledge, the discovery of the laws of nature, the application of the principles of science to the useful arts, the conservation of good morals, and the spread of religious truth, is, in the best sense of the term, a good investment—an investment productive of the greatest amount of the highest good both to the donor and his posterity, and which makes the residue of the property from which it is taken both more secure and more valuable.

CHAPTER III.

PROGRESS OF COMMON OR ELEMENTARY SCHOOLS.

To understand the real progress which has been made in the organization, administration, and instruction of institutions of learning in this country, and at the same time to appreciate the importance of many agencies and means of popular education besides schools, books and teachers, we must, as far as we can, look into the schools themselves, as they were fifty and sixty years ago, and realize the circumstances under which some of the noblest characters of our history have been developed. As a contribution to our knowledge of the early history of education in the United States, we bring together the testimony of several eminent men who were pupils or teachers in these schools, and who assisted in various ways in achieving their improvement.

LETTER FROM NOAH WEBSTER, LL.D.

"New Haven, March 10th, 1840.

"Mr. Barnard: *Dear Sir*—You desire me to give you some information as to the mode of instruction in common schools when I was young, or before the Revolution. I believe you to be better acquainted with the methods of managing common schools, at the present time, than I am; and I am not able to institute a very exact comparison between the old modes and the present. From what I know of the present schools in the country, I believe the principal difference between the schools of former times and at present consists in the books and instruments used in the modern schools.

"When I was young, the books used were chiefly or wholly Dilworth's Spelling Books, the Psalter, Testament and Bible. No geography was studied before the publication of Dr. Morse's small books on that subject, about the year 1786 or 1787. No history was read, as far as my knowledge extends, for there was no abridged history of the United States. Except the books above mentioned, no book for reading was used before the publication of the Third Part of my Institute, in 1785. In some of the early editions of that book, I introduced short notices of the geography and history of the United States, and these led to more enlarged descriptions of the country. In 1788, at the request of Dr. Morse, I wrote an account of the transactions in the United States, after the Revolution; which account fills nearly twenty pages in the first volume of his octavo editions.

"Before the Revolution, and for some years after, no slates were used in common schools; all writing and the operations in arithmetic were on paper. The teacher wrote the copies and gave the sums in arithmetic; few or none of the pupils having any books as a guide. Such was the condition of the schools in which I received my early education.

"The introduction of my Spelling Book, first published in 1783, produced a great change in the department of spelling; and from the information I can gain, spelling was taught with more care and accuracy for twenty years or more after that period, than it has been since the introduction of multiplied books and studies.*

"No English grammar was generally taught in common schools when I was young, except that in Dilworth, and that to no good purpose. In short, the instruction in schools was very imperfect, in every branch; and if I am not misinformed, it is so to this day, in many branches. Indeed there is danger of running from one extreme to another, and instead of having too few books in our schools, we shall have too many.

"I am, sir, with much respect, your friend and obedient servant, N. Webster."

Dr. Webster, in an essay published in a New York paper in 1788, "On the Education of Youth in America," and in another essay published in Hartford, Ct., in 1790, "On Property, Government, Education, Religion, Agriculture, etc., in the United States,"† while setting forth some of the cardinal doctrines of American education as now held, throws light on the condition of schools and colleges in different parts of the country at that date.

"The first error that I would mention is a

* "The general use of my Spelling Book in the United States has had a most extensive effect in correcting the pronunciation of words, and giving uniformity to the language. Of this change, the present generation can have a very imperfect idea."

† These essays were afterwards collected with others in a volume entitled "A Collection of Essays and Fugitive Writings, etc." By Noah Webster, Jr. Boston: 1790.

too general attention to the dead languages, with a neglect of our own. . . . This neglect is so general that there is scarcely an institution to be found in the country where the English tongue is taught regularly from its elements to its pure and regular construction in prose and verse. Perhaps in most schools boys are taught the definition of the parts of speech, and a few hard names which they do not understand, and which the teacher seldom attempts to explain; this is called learning grammar. . . . The principles of any science afford pleasure to the student who comprehends them. In order to render the study of language agreeable, the distinctions between words should be illustrated by the difference in visible objects. Examples should be presented to the senses which are the inlets of all our knowledge.

"Another error which is frequent in America, is that a master undertakes to teach many different branches in the same school. In new settlements, where the people are poor, and live in scattered situations, the practice is often unavoidable. But in populous towns it must be considered as a defective plan of education. For suppose the teacher to be equally master of all the branches which he attempts to teach, which seldom happens, yet his attention must be distracted with a multiplicity of objects, and consequently painful to himself, and not useful to his pupils. Add to this the continual interruptions which the students of one branch suffer from those of another, which must retard the progress of the whole school. It is a much more eligible plan to appropriate an apartment to each branch of education, with a teacher who makes that branch his sole employment. . . . Indeed what is now called a liberal education disqualifies a man for business. Habits are formed in youth and by practice; and as business is in some measure mechanical, every person should be exercised in his employment in an early period of life, that his habits may be formed by the time his apprenticeship expires. An education in a university interferes with the forming of these habits, and perhaps forms opposite habits; the mind may contract a fondness for ease, for pleasure, or for books, which no efforts can overcome. An academic education, which should furnish the youth with some ideas of men and things, and leave time for an apprenticeship before the age of twenty-one years, would be the most eligible for young men who are designed for active employments.

* * * * * *

"But the principal defect in our plan of education in America is the want of good teachers in the academies and common schools. By good teachers I mean men of unblemished reputation, and possessed of abilities competent to their station. That a man should be master of what he undertakes to teach is a point that will not be disputed; and yet it is certain that abilities are often dispensed with, either through inattention or fear of expense. To those who employ ignorant men to instruct their children, let me say, it is better for youth to have no education than to have a bad one; for it is more difficult to eradicate habits than to impress new ideas. The tender shrub is easily bent to any figure; but the tree which has acquired its full growth resists all impressions. Yet abilities are not the sole requisites. The instructors of youth ought, of all men, to be the most prudent, accomplished, agreeable, and respectable. What avail a man's parts, if, while he is 'the wisest and brightest,' he is the 'meanest of mankind?' The pernicious effects of bad example on the minds of youth will probably be acknowledged; but, with a view to improvement, it is indispensably necessary that the teachers should possess good breeding and agreeable manners. In order to give full effect to instructions it is requisite that they should proceed from a man who is loved and respected. But a low-bred clown or morose tyrant can command neither love nor respect; and that pupil who has no motive for application to books but the fear of the rod, will not make a scholar."

LETTER FROM REV. HEMAN HUMPHREY, D.D.

"PITTSFIELD, Dec. 12th, 1860.

"HON. HENRY BARNARD: *Dear Sir*—I am glad to hear from you, still engaged in the educational cause, and that you are intending to 'give a picturesque survey of the progress of our common schools, their equipment, studies and character.' If my early recollections and experience will give you any little aid, I shall esteem myself happy in affording it.

"The first school I remember was kept a few weeks by a maiden lady, called Miss Faithy, in a barn. I was very young, as were most of the children. What I learned then, if any thing, I have forgotten. This was in the summer, of course. The next was a school, so called, kept a month or two by a neighbor of ours, who was the best *trout fisher*, with his horse-hair line, in all those parts. He wrote a fair hand, as I remember, on birch bark. What he taught us, but to say *tue* and *due*, has escaped my recollection. We had no school-house then in our district, and we met as much for play as any thing, where we could find shelter. The next winter, another neighbor took us a few weeks into one of the rooms of his own house, where every thing but learning was going on. His speech bewrayed him of Rhode Island origin, and whatever he knew, he certainly could never have had much if any chance of being whipped in school when he was a boy. I remember his tremendous *stamp* when we got noisy in school-time, and that is all. This, however, is not a fair sample of school accommodations in my boyhood; and I had a better chance for two or three winters afterward.

"School Houses.—Most of the other districts in the town had school-houses, but not all. The first winter that I kept school myself, was in a room next to the kitchen in a small private house. Some of the school-houses were better than others; but none of them in that or the adjoining towns were convenient or even comfortable. They were rather *juvenile penitentiaries*, than attractive accommodations for study. They were too small, and low from the ceiling to the floor, and the calculation of the builders seemed to have been, to decide into how small a space the children could be crowded, from the fire-place till the room was well packed. Not unfrequently sixty or seventy scholars were daily shut up six hours, where there was hardly room for thirty. The school-houses were square, with a very narrow entry, and a large fire-place on the side near the door. There were no stoves then. They were generally roughly clapboarded, but never painted. They had writing-desks, or rather, long boards for writing, on two or three sides, next to the wall. The benches were all loose; some of them boards, with slabs from the saw-mill, standing on four legs, two at each end. Some were a little lower than the rest, but many of the smaller children had to sit all day with their legs dangling between the bench and the floor. Poor little things! nodding and trying to keep their balance on the slabs, without any backs to lean against, how I pity them to this day. In the coldest weather, it was hard to tell which was the most difficult, to keep from roasting or freezing. For those nearest to the fire it was sweltering hot, while the ink was freezing in the pens on the back side of the room. '*Master*, I am too hot'—'Master, may I go to the fire?' That was the style of address in those days, and we did our best to be *masters*, anyhow.

"All the school-houses that I remember stood close by the travelled road, without any play-grounds or enclosures whatever. If there were any shade trees planted, or left of spontaneous growth, I have forgotten them. And in most cases, there were no outside accommodations, even the most necessary for a moment's occasion. I now marvel at it, but so it was. In that respect, certainly, the days of the children are better than the days of their fathers were.

"For the most part, the winter schools were miserably supplied with wood. I kept school myself in three towns, and in but one of the schools was there any wood-shed whatever; and no wood was got up and seasoned in summer against winter. Most of what we used was standing in the forests when the school began, and was cut and brought sled length by the farmers in proportion to the number of scholars which they sent. Not exactly that, either; for sometimes, when we went to the school-house in a cold morning, there was *no wood* there. Somebody had neglected to bring his load, and we were obliged to adjourn over to the next day. In many cases, the understanding was, that the larger boys must cut the wood as it was wanted. It always lay in the snow, and sometimes the boys were sent to dig it out in school-time, and bring it in, all wet and green as it was, to keep us from freezing. That was the fuel to make fires with in the morning, when the thermometer was below zero, and how the little children cried with the cold, when they came almost frozen, and found no fire burning; nothing but one or two boys blowing and keeping themselves warm as well as they could, by exercise, in trying to kindle it. Such were our school-houses and their disaccommodations.

"Branches Taught in the Schools.—They were reading, spelling, and writing, besides the A B C's to children scarcely four years old, who ought to have been at home with their mothers. They were called up twice a day by the master pointing with his penknife 'What's that?' 'A.' 'What's that?' 'D.' 'No, it's B.' 'What's that?' 'N.' 'No, you careless boy, it's C;' and so down to *czand*. 'Go to your seat, you will never learn your lesson in the world, at this rate.' Our school-books were the Bible, 'Webster's Spelling Book,' and 'Third Part,' mainly. One or two others were found in some schools for the reading classes. Grammar was hardly taught at all in any of them, and that little was confined almost entirely to committing and reciting the rules. Parsing was one of the occult sciences in my day. We had some few lessons in geography, by questions and answers, but no maps, no globes; and as for *black-boards*, such a thing was never thought of till long after. Children's reading and picture books, we had none; the fables in Webster's Spelling Book came nearest to it. Arithmetic was hardly taught at all in the day schools. As a substitute, there were some evening schools in most of the districts. Spelling was one of the leading daily exercises in all the classes, and it was better, a good deal, I think, than it is now.

"The winter schools were commonly kept about three months; in some favored districts *four*, but rarely as long. As none of what are now called the higher branches were taught beyond the merest elements, parents generally thought that three or four months was enough. There were no winter *select* schools for the young above the age of sixteen or seventeen, as I remember, till after I retired from the profession, such as it then was. There may have been here and there an academy, in some parts of the state; but not one within the range of my acquaintance.

"Our Spring Exhibitions.—At the close of the winter schools we had what we used to call our *Quarter-days*, when the schools came together in the meeting-house, with a large congregation of parents and friends. The public exercises were reading, spelling, and speaking single pieces, and dialogues. Some of the dialogues we wrote ourselves, for our own schools. Most of them were certainly very flat; but they brought down the house, and answered the purpose as well as any we could pick up. We thought then, as I think now, that those quarter-days were of great advantage to the schools. The anticipation of them kept up an interest all winter, and stimulated both teachers and scholars to do their best in the way of preparation. As the time approached, we had evening schools for reading and rehearsing the dialogues, so as to be sure not to fall behind in the exhibitions. None of our college commencements are now looked forward to with greater interest than were those vernal anniversaries.

"Another thing that helped us a good deal was the occasional afternoon visits of the parents and other friends of the schools. They came in by invitation, or whenever they chose, and their visits always did us good.

"Still another practice we found to be quite stimulating and useful. We had a mutual understanding that, without giving any notice, any teacher might dismiss his own school for an afternoon, and, taking along with him some of the older boys, call in to see how his brother teacher got along in the next or some other district. The arrangement worked well. We made speeches, complimented one another as politely as circumstances would allow, and went home resolved not to fall behind the best of them.

"In the school, we made up our minds to be masters, in *fact* as well as in name. Though of late years I have not had very good advantages for making the comparison, I believe the schools were quite as well governed sixty years ago as they are now. Among other things which we did to maintain our authority, was to go out now and then and have a snowball skirmish with the boys, and though we commonly got beat, nothing we could do was more effectual.

"*Corporal* punishments, I believe, were sparingly resorted to in most of our schools. Though I myself believed in Solomon fully, I never flogged but one scholar in my life, though I shook the mischief out of a great many. I think Sam was of the opinion, in the premises, that the rod was laid on rather smartly, for I understood he promised, some day, to pay me in kind, which, however, I suppose he never found it quite convenient to undertake.

"We schoolmasters within convenient distances used to meet in the winter evenings for mutual improvement, which, to own the truth, we needed a good deal. Our regular exercises were reading for criticisms, reporting how we were getting along, and conversing upon the best method of managing our schools. This was very profitable, as we thought, to us all.

"In those ancient times, it was an almost universal custom in the rural towns of Connecticut, for the teachers to *board round*, and upon the whole I liked it. It was a good school for us. By going into all the families we learned a great deal. We were looked upon as having more in our heads than we could fairly claim, and they always kept us on the best they had. It is true, the cooking was not always the best, nor sheets always so clean as to guard against infection; and if, perchance, it sometimes broke out, we knew how to cure it.

"Our wages were generally screwed down to the lowest notch by the school committees, under the instruction of the districts. For my first campaign I received *seven* dollars a month and board; for the next, *nine;* for the third, *ten;* and I think I never went above thirteen till quite the last of my teaching before I went to college. As I had some reputation in that line, I suppose I was as well paid as my brethren.

"With regard to the summer schools of that period, I have very little to say. They were kept by females upon very low wages, about as much a week as they could earn in families by spinning or weaving. They took good care of the little children, and taught them as well as they could.

"As we had no grammar schools in which the languages were taught, we most of us fitted for college with our ministers, who, though not very fresh from their classics, did what they could to help us.

"Finally, you ask me whether there were any schools for young ladies in those old times? There may possibly have been in two or three of the largest towns, but the only one of which I had any knowledge was in Litchfield, kept by Miss Pierce, and I am not quite sure that her school was established as early as your question contemplates.

"These, dear sir, are some of my old remembrances, which you may make such use of as you please.

"Respectfully yours,

"H. HUMPHREY."

LETTER FROM HON. JOSEPH T. BUCKINGHAM.

"CAMBRIDGE, Dec. 10th, 1860.

"HENRY BARNARD, ESQ.: *My Dear Sir*—I cheerfully comply with your request to give you some account of the schools and the educational books that were in use about the close of the last century. I never had the privilege of attending any higher institution of learning than the common district schools of Connecticut, in the town of Windham; but I have no doubt that those of that town were a fair type of many others, probably most of them, except such as were kept in the larger towns or thickly populated villages.

"According to the best of my remembrance, my school-days began in the spring of 1783. The school to which I was admitted was kept by a lady, and, like most of the district schools, was kept only for the younger pupils, and was open for two months during the summer season. The upper class in the school was formed entirely of females—such as could read in the Bible. The lower classes read in spelling books and the New England Primer. The spelling books, of which there were not, probably, more than three or four in the school, I believe were all by Dilworth, and were much worn and defaced, having been a sort of heir-loom in the families of the pupils. The teacher of this school was the daughter of the minister of the parish. She kept a rod hanging on the wall behind her chair and a ferule on the table by her side; but I do not recollect that she used either of them. The girls who constituted the first class were required, every Monday morning, to repeat the text or texts of the preceding day's discourse, stating the book, chapter, and verse whence it was taken. The next summer, 1784, the same lady, or one of her sisters, kept school in the same district. The same books were in use, and there was the same routine of exercises. It was kept on the first floor of the steeple. The lower end of the bell-rope lay in a coil in the centre of the floor. The discipline was so strict, that no one, however mischievously disposed, I believe ever thought of taking hold of it, though it was something of an incumbrance. I was then four years and a half old, and had learned *by heart* nearly all the reading lessons in the Primer, and much of the Westminster Catechism, which was taught as the closing exercise every Saturday. But justice to one of the best of mothers requires that I should say that much the greater part of the improvement I had made was acquired from her careful instruction.

"In December, 1784, the month in which I was five years old, I attended, for a few days, the school kept by a master—I do not remember his name. When asked up for examination, he asked me if I could read without spelling? I said I could read in the Bible. He hesitated a moment, and then placed me on one of the benches, opened a Bible at the fifth chapter of Acts, and asked me to read. I read ten or a dozen verses—being the account of Ananias and his wife falling dead before Peter for telling a lie. Whether he had any suspicion that I had told a falsehood, and took this method to reprove me, I know not; but he dismissed me with approbation. He used his ferule on the hands of some of the elder boys; but the severest punishment that he inflicted for any violation of order, was compelling a boy who had brought into the school the breast-bone of a chicken, (commonly called the *wishing-bone,*) and with which he had excited some noise among the pupils, to stand on one of the benches and wear the bone on his nose till the school was dismissed. I am strongly impressed with the belief that Webster's spelling book made its first appearance in the schools during this winter. The following summer I attended, but very irregularly, a school kept as before in the steeple of the meeting-house,* and had a copy of Webster. Whether there were any other copies in the school or not I am not able to say. The next two winters, circumstances which I have no desire to recall, and which you would not care to be acquainted with, prevented my attending any school. In the summer of 1786, these same circumstances caused me to be removed to another district three miles distant from the central village. The farmer with whom I lived thought I could read well enough, and as the district school-house was a mile or more distant, he considered it unnecessary to send me that distance in the winter, merely *to read;* and consequently for two or three winters I went to school not more than eight or ten days in each. At length, in 1790 or 1791, it was thought I was old enough to learn to *cipher*, and accordingly was permitted to go to school more constantly. I told the master I wanted to learn to cipher. He set me a *sum* in simple addition—*five columns* of figures, and *six figures* in each column. All the instruction he gave me was—add the figures in the first column, carry one for every ten, and set the overplus down under the column. I supposed he meant by the *first* column the left hand column; but what he meant by carrying one for every ten was as much a mystery as Samson's riddle was to the Philistines. I worried my brains an hour or two, and showed the master the figures I had made. You may judge what the amount was, when the columns were added from left to right. The master frowned and repeated his former instruction—add up the column *on the right*, carry one for every ten, and set down the remainder. Two or three afternoons (I did not go to school in the morning) were spent in this way, when I begged to be excused from learning to cipher, and the old gentleman with whom I lived thought it was time wasted; and if I attended the school any further at that time, reading and spelling, and a little writing were all that was taught. The next winter there was a teacher more communicative and better fitted for his place, and under him some progress was made in arithmetic, and I made a tolerable acquisition in the first four rules, according to Dilworth's Schoolmaster's Assistant, of which the teacher and one of the eldest boys had each a copy. The two following winters, 1794 and 1795, I mastered all the rules and examples in the first part of Dilworth; that is, through the various chapters of Rule of Three, Practice, Fellowship, Interest, etc. etc., to Geometrical Progression and Permutation.

"In our district, the books were of rather a miscellaneous character, such as had been in families perhaps half a century or more. My belief is that Webster's Spelling Book was not in general use before 1790 or 1791. The Bible was read by the first class in the morning, always, and generally in the afternoon before the closing exercise, which was always a lesson in spelling, and this was performed by all the pupils who were sufficiently advanced to pronounce distinctly words of more than one syllable. It was the custom for all such pupils to stand together as one class, and with *one voice* to read a column or two of the tables for spelling. The master gave the signal to begin, and all united to read, letter by letter, pronouncing each syllable by itself, and adding it to the preceding one till the word was complete. Thus, a-d *ad*, m-i *mi*, *admi*, r-a *ra*, *admira*, t-i-o-n *shun*, *admiration.* This mode of reading was exceedingly exciting, and, in my humble judgment, exceedingly useful; as it required and taught deliberate and distinct articulation, and inspired the youngest with a desire

* This was the last time I went to a *summer* school.

to equal the older ones. It is true the voices would not all be in perfect unison; but after a little practice they began to assimilate. I have heard a class of thirty or more read column after column in this manner, with scarcely a perceptible variation from the proper pitch of voice. When the lesson had been thus read, the books were closed, and the words given out for spelling. If one was misspelt, it passed on to the next, and the next pupil in order, and so on till it was spelt correctly. Then the pupil who had spelt correctly went up in the class *above* the one who had misspelt. It was also a practice, when one was absent from this exercise in spelling, that he should stand at the foot of the class when he returned. Another of our customs was to choose sides to spell once or twice a week. The words to be spelt went from side to side; and at the conclusion, the side which *beat* (spelt the most words) were permitted to leave the schoolroom, preceding the other side, who had to sweep the room and build the fires the next morning. These customs prevalent sixty and seventy years ago excited emulation, and emulation produced improvement. A revival of them, I have no doubt, would be advantageous in the common schools, especially where pupils are required to spell words given out indiscriminately from a reading book or dictionary. There was not, to my knowledge, any *reading book* proper, except the Bible, till Webster's Third Book, so called, came out about 1793 or 1794. A new edition of his spelling book furnished some new matter for reading—selections from the New Testament, a chapter of Proverbs, and a set of Tables, etc.; but none of these operated to the exclusion of the Bible.

"In the family in which I lived there were three or four old spelling books, which I presume had been used in schools before the period of my remembrance. One of these was a book of less than a hundred pages, printed in London, I think in 1690. The words were arranged in tables according to syllables. The terminations tion, sion, cial, tial, etc., were all divided and printed as two distinct syllables. (And I believe this mode of printing is still continued in England. It was in the time of Lindley Murray, as may be seen in his spelling book, printed about forty years ago.) This spelling book contained a numeration table which from a singular feature, early attracted my attention. Every figure was 9, and the whole formed a curious triangle. Thus:

9
99
999 and so on to
the last, 999,999,999

"Another spelling book in our farmer's library was by Daniel Fenning, printed in London. It contained a short treatise on grammar, on which I sometimes exercised my memory, but understood not one of its principles. We had also a Dilworth, containing certain fables—such as Jupiter and the Frogs, the Romish Priest and the Jester, Hercules and the Wagoner, etc., etc. Another still we had, the author of which I never knew, as several pages had been lost from the beginning. It had a page of proverbs, one of which—'a cat may look upon a king'—occasioned me much thoughtful exercise. It also had an appropriate collection of couplets for writing-copies, of which the only one I recollect was this:

"'X things a penman should have near at hand—
Paper, pounce, pen, ink, knife, hone, rule, plummet, wax, sand.'

But that which rendered the book so memorable as never to be forgotten, was the astonishing, if not terrific, word of fourteen syllables — 'Ho-no-ri-fi-ca-bi-li-tu-di-ni-tu-ti-bus-que'—asserted to be the longest word in the English language.

"In the winter of 1793–4, we had for a teacher Erastus Ripley, who was an under-graduate of Yale College. I mention his name, because I cannot look back upon the time when I had the advantage of his instruction without a feeling of reverence for the man and respect for the teacher. I learned more from him than all the schoolmasters I had been under. He took more pains to instruct us in reading than all his predecessors within my knowledge. He opened the school every morning with prayer—which had not been practised in our district. He was preparing for the ministry, and was afterwards settled at Canterbury, I think. He was highly esteemed by all the people of the district, and gave such an *impetus* to the ambition of the pupils, that a subscription was made to employ him an extra month after the usual term of the school had expired.

"Mr. Ripley was succeeded in the winter of 1794–5 by a young man from Lebanon by the name of Tisdale, under whom my school days were finished; and here I may bring this long and, I fear, very uninteresting letter to a close. Hoping this may serve the purpose for which you suggested the writing of it, and wishing you all the success you can desire in the noble cause in which you are engaged,

"I am, very respectfully
"And truly yours,
"JOSEPH T. BUCKINGHAM."

LETTER FROM REV. ELIPHALET NOTT, D.D., DATED JAN., 1861.

"When I was a boy, seventy-five or eighty years ago, in good old Puritan Connecticut, it was *felt* as a practical maxim 'that to spare the rod was to spoil the child;' and on this maxim the pedagogue acted in the school-room, and applied it for every offence, real or imaginary; and for having been whipped at school by the relentless master, the unfortunate tyro was often whipped at home by his no less relentless father; so that between the two relentless executors of justice among the Puritan fathers, few children, I believe, were spoiled by the withholding of this orthodox discipline. For myself, I can say (and I do not think I was wayward beyond the average of district school-boys) that, in addition to warnings, and admonitions daily, if I was not whipped more than three times a week, I considered myself for the time peculiarly fortunate.

"Being of a contemplative and forbearing disposition, this discipline of the rod became peculiarly irksome to me, and, as I thought, unjustifiable; and I formed a resolution, if I lived to be a man, I would not be like other men in regard to their treatment of children.

"Through the mercy of God I did live to be a man, and when at the age of eighteen I became installed as master of a district school in the eastern part of Franklin, Connecticut—a school where rebellious spirits had previously asserted their rights, and been subdued or driven from the school by the use of the rod—nothing daunted, I made up my mind to substitute in my school moral motives in the place of the rod; and I frankly told my assembled pupils so, and that if they would have the generosity to second my efforts, they would secure to themselves and furnish me and their parents the happiness which is the heaven-appointed reward of well-doing.

"The school responded to my appeal, and thereafter, though we played and gambolled together as equals in play-hours, and on Saturday afternoons, which were also devoted to play, the moment we entered the school-room, a subordination and application to study was observable, that became matter of remark and admiration among the inhabitants of the district, the fame of which success extended to other districts, and even to adjoining towns, so that the examination and exhibition with which the school closed the ensuing spring, called together clergymen and other officials from places quite remote.

"This success brought me to the knowledge of the trustees of the Plainfield Academy, one of the most important, if not at the time the most important academy in the state, and I was by a unanimous vote appointed principal of said academy—an institution in which several hundred children of both sexes were in the same building successfully taught and governed, for years, without the use of the rod, it being at that time the prevailing usage, both in district schools and academies, for the two sexes to be taught in the same room, and subjected to the same form of government.

"This successful experiment in the use of moral suasion, and other kindred and kindly influences, in place of the rod, led to other and kindred experiments, until, whether for the better or the worse, the rod at length came to occupy a very subordinate place in the system of school education.

"In those days, education in common schools was not so diffusive as at the present day; but quite as thorough, if not more so. The same remark may be applied to the higher schools or academies—the whole field of natural science being at that time, for the most part, unexplored; but mathematics and classics were zealously taught. In evidence of this, though inferior in attainments to some of my classmates, I published successfully myself an almanac when about twenty-one years of age.

"As the rod in those days was the principal instrument in common school education, so when I was afterward called to Union College, fines, suspensions, and expulsions were the principal instruments of collegiate government. The faculty sat in their robes as a court, caused offenders to be brought before them, examined witnesses, heard defences, and pronounced sentences with the solemnity of other courts of justice; and though Union College had on its catalogue but a very diminutive number of students, the sitting of the faculty as a court occupied no inconsiderable part of the time of its president and professors.

"Soon after I became connected with the college as its president, a case of discipline occurred which led to the trial and issued in the expulsion of a student belonging to a very respectable family in the city of Albany. According to the charter of Union College, the sentence of the faculty is not final. An appeal can be taken to the board of trustees, and in the case in question an appeal was taken, and, after keeping college in confusion for months, by the different hearings of the case, the board reversed the decision of the faculty, and restored the young man. On the event of this restoration, I informed them that they should never, during my administration, have occasion to review another case of discipline by the faculty; and during the fifty-six years which have since passed away, I have kept my word; and though we have been less successful in our system of parental government than could be wished, we have had no rebellions, and it is conceded, I believe generally, that quite as large a proportion of our young men have succeeded in after life as of any other collegiate institution in the Union."

RECOLLECTIONS OF PETER PARLEY.

The following picture of the District School as it was a few years later, in the town of Ridgefield,* one of the most advanced agricultural communities of Connecticut, is from the pen of Peter Parley, in his "*Recollections of a Lifetime.*"

"About three fourths of a mile from my father's house, on the winding road to Lower Salem, which bore the name of West Lane, was the school-house where I took my first lessons, and received the foundations of my very slender education. I have since been sometimes asked where I graduated: my reply has always been, 'At West Lane.' Generally speaking, this has ended the inquiry, whether because my interlocutors have confounded this venerable institution with 'Lane Seminary,' or have not thought it worth while to risk an exposure of their ignorance as to the college in which I was educated, I am unable to say.

"The site of the school-house was a triangular piece of land, measuring perhaps a rood in extent, and lying, according to the custom of those days, at the meeting of four roads. The ground hereabouts—as everywhere else in Ridgefield—was exceedingly stony, and in making the pathway the stones had been thrown out right and left, and there remained in heaps on either side, from generation to generation. All round was bleak and desolate. Loose, squat stone walls, with innumerable breaches, inclosed adjacent fields. A few tufts of elder, with here and there a patch of briers and pokeweed, flourished in the gravelly soil. Not a tree, however, remained, save an aged chestnut, at the western angle of the space. This certainly had not been spared for shade or ornament, but probably because it would have cost too much labor to cut it down, for it was of ample girth. At all events it was the oasis in our desert during summer; and in autumn, as the burrs disclosed its fruit, it resembled a besieged city. The boys, like so many catapults, hurled at it stones and sticks, until every nut had capitulated.

"Two houses only were at hand: one, surrounded by an ample barn, a teeming orchard, and an enormous wood-pile, belonged to Granther Baldwin; the other was the property of 'Old Chich-es-ter,' an uncouth, unsocial being, whom everybody for some reason or other seemed to despise and shun. His house was of stone and of one story. He had a cow, which every year had a calf. He had a wife—filthy, uncombed, and vaguely reported to have been brought from the old country. This is about the whole history of the man, so far as it is written in the authentic traditions of the parish. His

* "Nearly all the inhabitants of Ridgefield were farmers, with the few mechanics that were necessary to carry on society in a somewhat primeval state. Even the persons not professionally devoted to agriculture, had each his farm, or at least his garden and home lot, with his pigs, poultry, and cattle. The population might have been 1200, comprising 200 families. All could read and write, but in point of fact, beyond the Almanac and Watts' Psalms and Hymns, their literary acquirements had little scope. There were, I think, four newspapers, all weekly, published in the state: one at Hartford, one at New London, one at New Haven, and one at Litchfield. There were, however, not more than three subscribers to all these in our village. We had, however, a public library of some 200 volumes, and what was of equal consequence—the town was on the road which was then the great thoroughfare, connecting Boston with New York, and hence it had means of intelligence from travellers constantly passing through the place, which kept it up with the march of events."

premises, an acre in extent, consisted of a tongue of land between two of the converging roads. No boy, that I ever heard of, ventured to cast a stone or to make an incursion into this territory, though it lay close to the school-house. I have often, in passing, peeped timidly over the walls, and caught glimpses of a stout man with a drab coat, drab breeches, and drab gaiters, glazed with ancient grease and long abrasion, prowling about the house; but never did I discover him outside of his own dominion. I know it was darkly intimated that he had been a tory, and was tarred and feathered in the revolutionary war, but as to the rest he was a perfect myth. Granther Baldwin was a character no less marked, but I must reserve his picture for a subsequent letter.

"The school-house itself consisted of rough, unpainted clapboards, upon a wooden frame. It was plastered within, and contained two apartments—a little entry, taken out of a corner for a wardrobe, and the school-room proper. The chimney was of stone, and pointed with mortar, which, by the way, had been dug into a honeycomb by uneasy and enterprising penknives. The fireplace was six feet wide and four feet deep. The flue was so ample and so perpendicular, that the rain, sleet, and snow fell direct to the hearth. In winter, the battle for life with green fizzling fuel, which was brought in sled lengths and cut up by the scholars, was a stern one. Not unfrequently, the wood, gushing with sap as it was, chanced to be out, and as there was no living without fire, the thermometer being ten or twenty degrees below zero, the school was dismissed, whereat all the scholars rejoiced aloud, not having the fear of the schoolmaster before their eyes.

"It was the custom at this place to have a woman's school in the summer months, and this was attended only by young children. It was, in fact, what we now call a primary or infant school. In winter, a man was employed as teacher, and then the girls and boys of the neighborhood, up to the age of eighteen, or even twenty, were among the pupils. It was not uncommon, at this season, to have forty scholars crowded into this little building.

"I was about six years old when I first went to school. My teacher was Aunt Delight, that is, Delight Benedict, a maiden lady of fifty, short and bent, of sallow complexion and solemn aspect. I remember the first day with perfect distinctness. I went alone—for I was familiar with the road, it being that which passed by our old house. I carried a little basket, with bread and butter within, for my dinner, the same being covered over with a white cloth. When I had proceeded about half way, I lifted the cover, and debated whether I would not eat my dinner then. I believe it was a sense of duty only that prevented my doing so, for in those happy days I always had a keen appetite. Bread and butter were then infinitely superior to *paté de foie gras* now; but still, thanks to my training, I had also a conscience. As my mother had given me the food for dinner, I did not think it right to convert it into lunch, even though I was strongly tempted.

"I think we had seventeen scholars—boys and girls—mostly of my own age. Among them were some of my after companions. I have since met several of them—one at Savannah, and two at Mobile, respectably established, and with families around them. Some remain, and are now among the gray old men of the town; the names of others I have seen inscribed on the tombstones of their native village. And the rest—where are they?

"The school being organized, we were all seated upon benches, made of what were called *slabs*—that is, boards having the exterior or rounded part of the log on one side: as they were useless for other purposes, these were converted into school-benches, the rounded part down. They had each four supports, consisting of straddling wooden legs, set into auger-holes. Our own legs swayed in the air, for they were too short to touch the floor. Oh, what an awe fell over me, when we were all seated and silence reigned around!

"The children were called up, one by one, to Aunt Delight, who sat on a low chair, and required each, as a preliminary, to make his manners, consisting of a small sudden nod or jerk of the head. She then placed the spelling-book—which was Dilworth's—before the pupil, and with a buck-handled penknife pointed, one by one, to the letters of the alphabet, saying, 'What's that?' If the child knew his letters the 'What's that?' very soon ran on thus:

"'What's that?'

"'A.'

"''Stha-a-t?'

"'B.'

"'Sna-a-a-t?'
"'C.'
"'Sna-a-a-t?'
"'D.'
"'Sna-a-a-t?'
"'E.' &c.

"I looked upon these operations with intense curiosity and no small respect, until my own turn came. I went up to the school-mistress with some emotion, and when she said, rather spitefully, as I thought, 'Make your obeisance!' my little intellects all fled away, and I did nothing. Having waited a second, gazing at me with indignation, she laid her hand on the top of my head, and gave it a jerk which made my teeth clash. I believe I bit my tongue a little; at all events, my sense of dignity was offended, and when she pointed to A, and asked what it was, it swam before me dim and hazy, and as big as a full moon. She repeated the question, but I was doggedly silent. Again, a third time, she said, 'What's that?' I replied: 'Why don't you tell me what it is? I didn't come here to learn you your letters!' I have not the slightest remembrance of this, for my brains were all a-wool-gathering; but as Aunt Delight affirmed it to be a fact, and it passed into tradition, I put it in. I may have told this story some years ago in one of my books, imputing it to a fictitious hero, yet this is its true origin, according to my recollection.

"What immediately followed I do not clearly remember, but one result is distinctly traced in my memory. In the evening of this eventful day, the school-mistress paid my parents a visit, and recounted to their astonished ears this, my awful contempt of authority. My father, after hearing the story, got up and went away; but my mother, who was a careful disciplinarian, told me not to do so again! I always had a suspicion that both of them smiled on one side of their faces, even while they seemed to sympathize with the old petticoat and penknife pedagogue, on the other; still I do not affirm it, for I am bound to say, of both my parents, that I never knew them, even in trifles, say one thing while they meant another.

"I believe I achieved the alphabet that summer, but my after progress, for a long time, I do not remember. Two years later I went to the winter-school at the same place, kept by Lewis Olmstead—a man who had a call for plowing, mowing, carting manure, etc., in summer, and for teaching school in the winter, with a talent for music at all seasons, wherefore he became chorister upon occasion, when, peradventure, Deacon Hawley could not officiate. He was a celebrity in ciphering, and 'Squire Seymour declared that he was the greatest 'arithmeticker' in Fairfield county. All I remember of his person is his hand, which seemed to me as big as Goliah's, judging by the claps of thunder it made in my ears on one or two occasions.

"The next step of my progress which is marked in my memory, is the spelling of words of two syllables. I did not go very regularly to school, but by the time I was ten years old I had learned to write, and had made a little progress in arithmetic. There was not a grammar, a geography, or a history of any kind in the school. Reading, writing, and arithmetic were the only things taught, and these very indifferently—not wholly from the stupidity of the teacher, but because he had forty scholars, and the standards of the age required no more than he performed. I did as well as the other scholars, certainly no better. I had excellent health and joyous spirits; in leaping, running, and wrestling, I had but one superior of my age, and that was Stephen Olmstead, a snug-built fellow, smaller than myself, and who, despite our rivalry, was my chosen friend and companion. I seemed to live for play: alas! how the world has changed since I have discovered that we live to agonize over study, work, care, ambition, disappointment, and then ——?

"As I shall not have occasion again, formally, to introduce this seminary into my narrative, I may as well close my account of it now. After I had left my native town for some twenty years, I returned and paid it a visit. Among the monuments that stood high in my memory was the West Lane school-house. Unconsciously carrying with me the measures of childhood, I had supposed it to be at least thirty feet square; how had it dwindled when I came to estimate it by the new standards I had formed! It was in all things the same, yet wholly changed to me. What I had deemed a respectable edifice, as it now stood before me was only a weather-beaten little shed, which, upon being measured, I found to be less than twenty feet square. It happened to be a warm, summer day, and I ventured to enter the place. I found a girl, some eighteen years old, keeping 'a ma'am school' for about twenty scholars, some of whom were studying Parley's Geography. The mistress was the daughter of one of my schoolmates, and some of the boys and girls were grandchildren of the little brood which gathered under the wing of Aunt Delight, when I was an a-b-c-darian. None of them, not even the school-mistress, had ever heard of me. The name of my father, as having ministered unto the people of Ridgefield in some bygone age, was faintly traced in their recollection. As to Peter Parley, whose Geography they were learning—they supposed him some decrepit old gentleman hobbling about on a crutch, a long way off, for whom, nevertheless, they had a certain affection, inasmuch as he had made geography into a story-book. The frontispiece-picture of the old fellow, with his gouty foot in a chair, threatening the boys that if they touched his tender toe, he would tell them no more stories, secured their respect, and placed him among the saints in the calendar of their young hearts. Well, thought I, if this goes on I may yet rival Mother Goose!

"At the age of ten years I was sent to the up-town school, the leading seminary of the village, for at this period it had not arrived at the honor of an academy, the institution being then, and many years after, under the charge of Master Stebbins. He was a man with a conciliating stoop in the shoulders, a long body, short legs, and a swaying walk. He was, at this period, some fifty years old, his hair being thin and silvery, and always falling in well-combed rolls over his coat-collar. His eye was blue, and his dress invariably of the same color. Breeches and knee-buckles, blue-mixed stockings, and shoes with bright buckles, seemed as much a part of the man as his head and shoulders. On the whole, his appearance was that of the middle-class gentleman of the olden time, and he was in fact what he seemed.

"This seminary of learning for the rising aristocracy of Ridgefield was a wooden edifice, thirty by twenty feet, covered with brown clapboards, and, except an entry, consisted of a single room. Around and against the walls ran a continuous line of seats, fronted by a continuous writing-desk. Beneath, were depositories for books and writing materials. The centre was occupied by slab seats, similar to those of West Lane. The larger scholars were ranged on the outer sides, at the desks; the smaller fry of a-b-c-darians were seated in the centre. The master was enshrined on the east side of the room, contrary, be it remembered, to the law of the French savans, which places dominion invariably in the west. Regular as the sun, Master Stebbins was in his seat at nine o'clock, and the performances of the school began.

"According to the Catechism—which, by the way, we learned and recited on Saturday—the chief end of man was to glorify God and keep his commandments: according to the routine of this school, one would have thought it to be reading, writing, and arithmetic, to which we may add spelling. From morning to night, in all weathers, through every season of the year, these exercises were carried on with the energy, patience, and perseverance of a manufactory.

"Master Stebbins respected his calling: his heart was in his work; and so, what he pretended to teach, he taught well. When I entered the school, I found that a huge stride had been achieved in the march of mind since I had left West Lane. Webster's Spelling Book had taken the place of Dilworth, which was a great improvement. The drill in spelling was very thorough, and applied every day to the whole school. I imagine that the exercises might have been amusing to a stranger, especially as one scholar would sometimes go off in a voice as grum as that of a bull-frog, while another would follow in tones as fine and piping as a peet-weet. The blunders, too, were often ineffably ludicrous; even we children would sometimes have tittered, had not such an enormity been certain to have brought out the birch. As to rewards and punishments, the system was this: whoever missed went down; so that perfection mounted to the top. Here was the beginning of the up and down of life.

"Reading was performed in classes, which generally plodded on without a hint from the master. Nevertheless, when Zeek Sanford—who was said to have a streak of lightning in him—in his haste to be smart, read the 37th verse of the 2d chapter of the Acts—'Now when they heard this, they were *pickled* in their heart'—the birch stick on Master Stebbins's table seemed to quiver and peel at the little end, as if to give warning of the wrath to come. When Orry Keeler—Orry was a girl, you know, and not a boy—drawled out in spelling: k—o—n, *kon*, s—h—u—n—t—s, *shunts*, konshunts—the bristles in the master's eyebrows fidgeted like Aunt Delight's knitting-needles. Occasionally, when the reading was insupportably bad, he took a book and read himself, as an example.

"We were taught arithmetic in Daboll, then a new book, and which, being adapted to our measures of length, weight, and currency, was a prodigious leap over the head of poor old Dilworth, whose rules and examples were modelled upon English customs. In consequence of the general use of Dilworth in our schools, for perhaps a century—pounds, shillings, and pence were classical, and dollars and cents vulgar, for several succeeding generations. 'I would not give a penny for it,' was genteel; 'I would not give a cent for it,' was plebeian. We have not yet got over this: we sometimes say *red cent* in familiar parlance, but it can hardly be put in print without offence.

"Master Stebbins was a great man with a slate and pencil, and I have an idea that we were a generation after his own heart. We certainly achieved wonders according to our own conceptions, some of us going even beyond the Rule of Three, and making forays into the mysterious region of Vulgar Fractions. Several daring geniuses actually entered and took possession.

"But after all, penmanship was Master Stebbins's great accomplishment. He had no magniloquent system; no pompous lessons upon single lines and bifid lines, and the like. The revelations of inspired copybook makers had not then been vouchsafed to man. He could not cut an American eagle with a single flourish of a goose-quill. He was guided by good taste and native instinct, and wrote a smooth round hand, like copper-plate. His lessons from A to &, all written by himself, consisted of pithy proverbs and useful moral lessons. On every page of our writing-books he wrote the first line himself. The effect was what might have been expected—with such models, patiently enforced, nearly all became good writers.

"Beyond these simple elements, the Uptown school made few pretensions. When I was there, two Webster's Grammars and one or two Dwight's Geographies were in use. The latter was without maps or illustrations, and was in fact little more than an expanded table of contents, taken from Morse's Universal Geography—the mammoth monument of American learning and genius of that age and generation. The grammar was a clever book; but I have an idea that neither Master Stebbins nor his pupils ever fathomed its depths. They floundered about in it, as if in a quagmire, and after some time came out pretty nearly where they went in, though perhaps a little obfuscated by the dim and dusky atmosphere of these labyrinths.

"The fact undoubtedly is, that the art of teaching, as now understood, beyond the simplest elements, was neither known nor deemed necessary in our country schools in their day of small things. Repetition, drilling, line upon line, and precept upon precept, with here and there a little of the birch—constituted the entire system.

"Let me here repeat an anecdote, which I have indeed told before, but which I had from the lips of its hero, G . . . H . . ., a clergyman of some note thirty years ago, and which well illustrates this part of my story. At a village school, not many miles from Ridgefield, he was put into Webster's Grammar. Here he read, '*A noun is the name of a thing—as horse, hair, justice.*' Now in his innocence, he read it thus: '*A noun is the name of a thing—as horse-hair justice.*'

"'What then,' said he, ruminating deeply, 'is a noun? But first I must find out what a horse-hair justice is.'

"Upon this he meditated for some days, but still he was as far as ever from the solution. Now his father was a man of authority in those parts, and moreover he was a justice of the peace. Withal, he was of respectable ancestry, and so there had descended to him a somewhat stately high-backed settee, covered with horse-hair. One day, as the youth came from school, pondering upon the great grammatical problem, he entered the front door of the house, and there he saw before him, his father, officiating in his legal capacity, and seated upon the old horse-hair settee. 'I have found it!' said the boy to himself, as greatly delighted as was Archimedes when he exclaimed *Eureka*—'my father is a horse-hair justice, and therefore a noun!'

"Nevertheless, it must be admitted that the world got on remarkably well in spite of this narrowness of the country schools. The elements of an English education were pretty well taught throughout the village seminaries of Connecticut, and I may add, of New England. The teachers were heartily devoted to their profession: they respected their calling, and were respected and encouraged by the community. They had this merit, that while they attempted but little, that, at least, was thoroughly performed.

"As to the country at large, it was a day of quiet, though earnest action: Franklin's spirit was the great 'schoolmaster abroad'—teaching industry, perseverance, frugality, and thrift, as the end and aim of ambition. The education of youth was suited to what was expected of them. With the simple lessons of the country schools, they moved the world immediately around them. Though I can recollect only a single case—that already alluded to of Ezekiel Sanford—in which one of Master Stebbins's scholars attained any degree of literary distinction, still, quite a number of them, with no school learning beyond what he gave them, rose to a certain degree of eminence. His three sons obtained situations in New York as accountants, and became distinguished in their career. At one period there were three graduates of his school, who were cashiers of banks in that city. My mind adverts now with great satisfaction to several names among the wealthy, honorable, and still active merchants of the great metropolis, who were my fellow-students of the Up-town school, and who there began and completed their education."

To the advantages, such as they were, of the district school, Mr. Goodrich adds an account of his experience on the farm, and his juvenile sports, as well as his early attempts at *whittling* and other mechanical arts, and adds the following reflections:—

"Now all these things may seem trifles, yet in a review of my life, I deem them of some significance. This homely familiarity with the more mechanical arts was a material part of my education; this communion with nature gave me instructive and important lessons from nature's open book of knowledge. My technical education, as will be seen hereafter, was extremely narrow and irregular. This defect was at last partially supplied by the commonplace incidents I have mentioned. The teaching, or rather the training of the senses, in the country—ear and eye, foot and hand, by running, leaping, climbing over hill and mountain, by occasional labor in the garden and on the farm, and by the use of tools—and all this in youth, is sowing seed which is repaid largely and readily to the hand of after cultivation, however unskilful it may be. This is not so much because of the amount of knowledge available in after-life, which is thus obtained—though this is not to be despised—as it is that healthful, vigorous, manly habits and associations—physical, moral, and intellectual—are thus established and developed.

"It is a riddle to many people that the emigrants from the country into the city, in all ages, outstrip the natives, and become their masters. The reason is obvious: country education and country life are practical, and invigorating to body and mind, and hence those who are thus qualified triumph in the race of life. It has always been, it will always be so; the rustic Goths and Vandals will march in and conquer Rome, in the future, as they have done in the past. I say this, by no means insisting that my own life furnishes any very striking proof of the truth of my remarks; still, I may say that but for the country training and experience I have alluded to, and which served as a foothold for subsequent progress, I should have lingered in my career far behind the humble advances I have actually made.

"Let me illustrate and verify my meaning by specific examples. In my youth I became familiar with every bird common to the country: I knew his call, his song, his hue, his food, his habits; in short, his natural history. I could detect him by his flight, as far as the eye could reach. I knew all the quadrupeds—wild as well as tame. I was acquainted with almost every tree, shrub, bush, and flower, indigenous to the country; not botanically, but according to popular ideas. I recognized them instantly, wherever I saw them; I knew their forms, hues, leaves, blossoms, and fruit. I could tell their characteristics, their uses, the legends and traditions that belonged to them. All this I learned by familiarity with these objects; meeting with them in all my walks and rambles, and taking note of them with the emphasis and vigor of early experience and observation. In after days. I have never had time to make natural history a systematic study; yet my knowledge as to these things has constantly accumulated, and that without special effort. When I have travelled in other countries, the birds, the animals, the vegetation, have interested me as well by their resemblances as their differences, when compared with our own.

In looking over the pages of scientific works on natural history, I have always read with eagerness and intelligence of preparation; indeed, of vivid and pleasing associations. Every idea I had touching these matters was living and sympathetic, and beckoned other ideas to it, and these again originated still others. Thus it is that in the race of a busy life, by means of a homely, hearty start at the beginning, I have, as to these subjects, easily and naturally supplied, in some humble degree, the defects of my irregular education, and that too, not by a process of repulsive toil, but with a relish superior to all the seductions of romance. I am therefore a believer in the benefits accruing from simple country life and simple country habits, as here illustrated, and am, therefore, on all occasions anxious to recommend them to my friends and countrymen. To city people, I would say, educate your children, at least partially, in the country, so as to imbue them with the love of nature, and that knowledge and training which spring from simple rustic sports, exercises, and employments. To country people, I would remark, be not envious of the city, for in the general balance of good and evil, you have your full portion of the first, with a diminished share of the last."

THE HOMESPUN ERA OF COMMON SCHOOLS. BY HORACE BUSHNELL, D.D.

"But the schools—we must not pass by these, if we are to form a truthful and sufficient picture of the homespun days. The schoolmaster did not exactly go round the district to fit out the children's minds with learning, as the shoemaker often did to fit their feet with shoes, or the tailor to measure and cut for their bodies; but, to come as near it as possible, he boarded round, (a custom not yet gone by,) and the wood for the common fire was supplied in a way equally primitive, viz., by a contribution of loads from the several families, according to their several quantities of childhood. The children were all clothed alike in homespun; and the only signs of aristocracy were, that some were clean and some a degree less so, some in fine white and striped linen, some in brown tow crash; and, in particular, as I remember, with a certain feeling of quality I do not like to express, the good fathers of some testified the opinion they had of their children, by bringing fine round loads of hickory wood to warm them, while some others, I regret to say, brought only scanty, scraggy, ill-looking heaps of green oak, white birch, and hemlock. Indeed, about all the bickerings of quality among the children, centered in the quality of the wood pile. There was no complaint, in those days, of the want of ventilation; for the large open fire-place held a considerable fraction of a cord of wood, and the windows took in just enough air to supply the combustion. Besides, the bigger lads were occasionally ventilated, by being sent out to cut wood enough to keep the fire in action. The seats were made of the outer slabs from the saw-mill, supported by slant legs driven into and a proper distance through auger holes, and planed smooth on the top by the rather tardy process of friction. But the spelling went on bravely, and we ciphered away again and again, always till we got through Loss and Gain. The more advanced of us, too, made light work of Lindley Murray, and went on to the parsing, finally, of extracts from Shakspeare and Milton, till some of us began to think we had mastered their tough sentences in a more consequential sense of the term than was exactly true. O, I remember (about the remotest thing I can remember) that low seat, too high, nevertheless, to allow the feet to touch the floor, and that friendly teacher who had the address to start a first feeling of enthusiasm and awaken the first sense of power. He is living still, and whenever I think of him, he rises up to me in the far background of memory, as bright as if he had worn the seven stars in his hair. (I said he is living; yes, he is here to-day, God bless him!) How many others of you that are here assembled, recall these little primitive universities of homespun, where your mind was born, with a similar feeling of reverence and homely satisfaction. Perhaps you remember, too, with a pleasure not less genuine, that you received the classic discipline of the university proper, under a dress of homespun, to be graduated, at the close, in the joint honors of broadcloth and the parchment."

We might add other lights and shades to the picture of school life as it was down to a very recent period in New England and New York, but we must refer our readers to that amusing and instructive volume of Rev. Warren Burton, "The District School as it was." We must pass to the elementary schools of Pennsylvania and the Southern States.

LETTER FROM WILLIAM DARLINGTON, M.D., LL.D.

"At your request, I propose to attempt a brief and hasty sketch of my acquaintance with, and reminiscences of the *Country Schools*, and their condition, some sixty-five or seventy years since, in the south-eastern corner of the state of Pennsylvania; more particularly the school at Birmingham, Chester county, where the limited instruction of my youthful days was chiefly acquired.

"My earliest recollections of the school to which I was sent go back to that trying period of loose government, rusticity, and scarcity experienced in the interval between the War of Independence and the adoption of the Federal Constitution; and if it were given me to wield the pen of *Tom Brown of Rugby*, I might peradventure furnish some graphic details of our rural seminaries of learning in those days of general destitution. But, under present circumstances, I can only offer the imperfect narrative of incidents and observations, as retained in an almost octogenarian memory.

"At the time when I was first sent to school—say in 1787–8—school-houses were rare; and there was little or no organization for their maintenance. The country round, having been recently ravaged by a hostile army, was scantily supplied with teachers, who occasionally obtained schools by going among the principal families of the vicinage, and procuring subscribers for a quarter's tuition of the children on hand. Those who were too young to be serviceable on the farm were allowed to go to school in the summer season; but the larger ones (*expertus loquor*) could only be spared for that purpose during winter. The extent of rural instruction was then considered to be properly limited to what a worthy London alderman designated as the *three R's*, viz., 'Reading, Riting, and Rithmetic.' To cipher beyond the *Rule of Three* was deemed a notable achievement and mere surplusage among the average of country scholars. The business of teaching, at that day, was disdainfully regarded as among the humblest and most unprofitable of callings; and the *teachers*—often low-bred, intemperate adventurers from the old world—were generally about on a *par* with the prevalent estimate of the profession. Whenever a thriftless vagabond was found to be good for nothing else, he would resort to *school-keeping*, and teaching young American ideas how to shoot! It was my good fortune, however, to have a teacher who was a distinguished exception to the sorry rule referred to. JOHN FORSYTHE was a native of the Emerald Isle, born in 1754, received a good English education at home, and while yet a young man, migrated to the county of *Chester*, in the land of PENN, where he became an excellent schoolmaster. When he arrived in our quakerly settlement, he was a gay young Presbyterian, dressed in the fashionable apparel of the world's people; and being withal musical in his taste, was an expert performer on the violin. He soon, however, adopted the views and principles of the 'Friends,' among whom he remained, married one of the society, and was ever recognized as an exemplary and valuable member.

"As the head and master-spirit of the school, at Birmingham meeting-house, established under the auspices of the Quaker society, he taught for a number of years, and always applied himself *con amore* to his arduous duties. He accomplished more in exciting a taste for knowledge and developing young intellects, than any teacher who had theretofore labored in that hopeful vineyard. He effectually routed the lingering old superstitions, prejudices, and benighted notions of preceding generations, and ever took delight in introducing youthful genius to the bright fields of literature and science. The young men of his day, who have since figured in the world, were deeply indebted to John Forsythe for the aid which he afforded them in their studies, as well as for the sound doctrines which he inculcated; and some few of them yet survive to make the grateful acknowledgment.

"When the noble Quaker institution at *West-town* was erected, near the close of the last century, the skill and experience of John Forsythe were put in requisition, until it was fairly inaugurated; after which he retired to his comfortable farm, in East Bradford, where he passed a venerable old age, until his 87th year, in superintending agricultural employments and in manifesting a lively interest in the progress of education among our people. No instructor has labored in this community more faithfully, nor with better effect. None has left a memory more worthy to be kindly cherished.

"The old *school-house* at Birmingham was a one story stone building, erected by men who did not understand the subject; and was badly lighted and ventilated. The *discipline* of that day (adopted from the mother country) was pretty severe. The real *birch* of the botanists not being indigenous in the immediate vicinity of the school, an efficient substitute was found in young apple tree sprouts, as unruly boys were abundantly able to testify.

"The *school books* of my earliest recollection were a cheap English spelling book, the Bible for the reading classes, and when we got to ciphering, the 'Schoolmasters' Assistant.' The 'Spelling Book' and 'Assistant' were by Thomas Dilworth, an English schoolmaster at Wapping. The 'Assistant' was a useful work, but has long since disappeared. The 'counterfeit presentment' of the worthy author faced the title-page, and was familiarly known to every schoolboy of my time. The Spelling Book contained a little elementary grammar, in which the English substantives were declined through all the cases (genitive, dative, etc.) of the Latin. But *grammar* was then an unknown study among us. Dilworth's 'Spelling Book,' however, was soon superseded by a greatly improved one, compiled by John Pierce, a respectable teacher of Delaware county, Pennsylvania. This comprised a tolerable English grammar, for that period, and John Forsythe introduced the study into his school with much zeal and earnestness. Intelligent employers were made to comprehend its advantages, and were pleased with the prospect of a hopeful advance in that direction; but dull boys and illiterate parents could not appreciate the benefit. Great boobies often got permission, at home, to evade the study, but they could not get round John Forsythe in that way. They would come into school with this promised indulgence, and loudly announce, 'Daddy says I needn't *larn grammar;* it's no use:' when the energetic response from the desk was, 'I don't care what daddy says. He knows nothing about it; and I say thou shalt learn it!' and so some general notion of the subject was impressed upon the minds even of the stupid; while many of the brighter youths became excellent grammarians.

"In this *Friendly* seminary we were all required to use the *plain language* in conversation, being assured that it was wrong, both morally and grammatically, to say *you* to one person. Our teacher contrived a method of his own for mending our cacology, even while at our noonday sports. He prepared a small piece of board or shingle, which he termed a *paddle;* and whenever a boy was heard uttering bad grammar, he had to take the paddle, step aside, and refrain from play, until he detected some other unlucky urchin trespassing upon syntax; when he was authorized to transfer the badge of interdiction to the last offender, and resume his amusements. It was really curious to observe how critical we soon became, and how much improvement was effected by this whimsical and simple device.

"Pierce's 'Spelling Book' kept its position in our school for several years, but was at length superseded, in the grammatical department, by a useful little volume, prepared by *John Comly*, of Bucks county, Pennsylvania. *Lindley Murray* and others prepared elaborate grammars, which were successively introduced, as our schools improved or created a demand; and so rapidly have the bookmaking competitors in that department multiplied that their name is now legion, and the respective value of their works is known only to experts in the art of teaching.

"Excellent works in *Reading* and *Elocution* are now so abundant and well known in all our respectable seminaries, that they need not to be here enumerated. One of the best and most popular of those works, some half century or more since, was a volume entitled 'The Art of Speaking,' compiled, I think, by a Mr. Rice, in England.

"But, as we have now reached the age of academies, normal institutes, and schools for the people, I presume you will gladly forego a further extension of this prosy narrative, so little calculated to interest a veteran in the great cause of education. I have ever been a sincere friend and advocate of the blessing; but, unfortunately, my acquaintance with it has been mainly limited to a humbling consciousness of my deficiencies in the ennobling attainment.

"Very respectfully,

"WM. DARLINGTON.

"WEST CHESTER, PA., Dec. 21, 1860."

SCHOOLS IN PHILADELPHIA.

The following picture of the internal economy of one of the best schools of Philadelphia, is taken from Watson's "Annals of Philadelphia and Pennsylvania."

"My facetious friend, Lang Syne, has presented a lively picture of the 'schoolmasters' in those days, when 'preceptors,' and 'principals,' and 'professors' were yet unnamed. What is now known as 'Friends' Academy,' in Fourth street, was at that time occupied by four different masters. The best room down-stairs by Robert Proud, Latin master; the one above him, by William Waring, teacher of astronomy and mathematics; the east room, up-stairs, by Jeremiah Paul, and the one below, 'last not least' in our remembrance, by J. Todd, and severe he was. The State House clock, being at the time visible from the school pavement, gave to the eye full notice when to break off marble and plug top, hastily collect the 'stakes,' and bundle in, pell-mell, to the school-room, where, until the arrival of the 'master of scholars,' John Todd, they were busily employed, every one in finding his place, under the control for the time of a short Irishman, usher, named Jimmy M'Cue. On the entrance of the master, all shuffling of the feet, 'scrouging,' hitting of elbows, and whispering disputes, were hastily adjusted, leaving a silence which might be felt, 'not a mouse stirring.' He, Todd, dressed after the plainest manner of Friends, but of the richest material, with looped cocked hat, was at all times remarkably clean and nice in his person, a man of about sixty years, square built, and well sustained by bone and muscle.

"After an hour, maybe, of quiet time, every thing going smoothly on—no sound, but from the master's voice, while hearing the one standing near him, a dead calm, when suddenly a brisk slap on the ear or face, for something or for nothing, gave 'dreadful note' that an eruption of the lava was now about to take place. Next thing to be seen was 'strap in full play over the head and shoulders of Pilgarlic.' The passion of the master 'growing by what it fed on,' and wanting elbow room, the chair would be quickly thrust on one side, when, with sudden gripe, he was to be seen dragging his struggling suppliant to the flogging ground, in the centre of the room; having placed his left foot upon the end of a bench, he then, with a patent jerk, peculiar to himself, would have the boy completely horsed across his knee, with his left elbow on the back of his neck, to keep him securely on. In the hurry of the moment he would bring his long pen with him, griped between his strong teeth (visible the while), causing both ends to descend to a parallel with his chin, and adding much to the terror of the scene. His face would assume a deep claret color—his little bob of hair would disengage itself, and stand out, each 'particular hair' as it were, 'up in arms and eager for the fray.' Having his victim thus completely at command, and all useless drapery drawn up to a bunch above the waistband, and the rotundity and the nankeen in the closest affinity possible for them to be, then once more to the 'staring crew' would be exhibited the dexterity of master and strap. By long practice he had arrived at such perfection in the exercise, that, moving in quick time, the fifteen inches of bridle rein (*alias* strap) would be seen after every cut, elevated to a perpendicular above his head; from whence it descended like a flail on the stretched nankeen, leaving 'on the place beneath' a fiery red streak, at every slash. It was customary with him to address the sufferer at intervals, as follows: 'Does it hurt?' 'Oh! yes, master; oh! don't, master.' 'Then I'll make it hurt thee more. I'll make thy flesh creep—thou shan't want a warming pan to-night. Intolerable being! Nothing in nature is able to prevail upon thee but my strap.' He had one boy named George Fudge, who usually wore leather breeches, with which he put strap and its master at defiance. He would never acknowledge pain—he would not 'sing out.' Todd seized him one day, and having gone through the evolutions of strapping (as useless, in effect, as if he had been thrashing a flour-bag), almost breathless with rage, he once more appealed to the feelings of the 'reprobate,' by saying: 'Does it not hurt?' The astonishment of the school and the master was completed, on hearing him sing out, 'No! Hurray for leather crackers!' He was thrown off immediately, sprawling on the floor, with the benediction as follows: 'Intolerable being! Get out of my school. Nothing in nature is able to prevail upon thee—not even my strap!'

"'Twas not 'his love of learning was in fault,' so much as the old British system of introducing learning and discipline into the brains of boys and soldiers by dint of punishment. The system of flogging on all occasions in schools, for something or for nothing, being protected by law, gives free play to the passions of the master, which he, for one, exercised with great severity.

The writer has, at this moment, in his memory, a schoolmaster *then* of this city, who, a few years ago, went deliberately out of his school to purchase a cow-skin, with which, on his return, he extinguished his bitter revenge on a boy who had offended him. The age of chivalry preferred ignorance in its sons, to having them subjected to the fear of a pedagogue—believing that a boy who had quailed under the eye of the schoolmaster, would never face the enemy with boldness on the field of battle; which it must be allowed is 'a swing of the pendulum' too far the other way. A good writer says: 'We do not *harden* the wax to receive the impression—wherefore, the teacher seems himself most in need of *correction*—for he, unfit to teach, is making them unfit to be taught!'

"I have been told by an aged gentleman, that in the days of his boyhood, sixty-five years ago, when boys and girls were together, it was a common practice to make the boys strip off their jackets, and loose their trowsers' band, preparatory to hoisting them upon a boy's back so as to get his whipping, with only the linen between the flesh and the strap. The girls too—we pity them—were obliged to take off their stays to receive their floggings with equal sensibility. He named one distinguished lady, *since*, who was so treated among others, in his school. All the teachers then were from England and Ireland, and brought with them the rigorous principles which had before been whipped into themselves at home."

Robert Coram, in a pamphlet devoted in part to a "Plan for the General Establishment of Schools throughout the United States," printed in Wilmington, Delaware, in 1791, characterizes the state of education as follows: "The country schools, through most of the United States, whether we consider the buildings, the teachers, or the regulations, are in every respect completely despicable, wretched, and contemptible. The buildings are in general sorry hovels, neither wind-tight nor water-tight; a few stools serving in the double capacity of bench and desk, and the old leaves of copy books making a miserable substitute for glass windows. The teachers are generally foreigners, shamefully deficient in every qualification necessary to convey instruction to youth, and not seldom addicted to gross vices. Absolute in his own opinion, and proud of introducing what he calls his European method, one calls the first letter of the alphabet, *aw*. The school is modified upon this plan, and the children who are advanced are beat and cuffed to forget the former mode they have been taught, which irritates their minds and retards their progress. The quarter being finished, the children lie idle until another master offers, few remaining in one place more than a quarter. When the next schoolmaster is introduced, he calls the first letter *a*, as in mat; the school undergoes another reform, and is equally vexed and retarded. At his removal a third is introduced, who calls the first letter *hay*. All these blockheads are equally absolute in their own notions, and will by no means suffer the children to pronounce the letter as they were first taught; but every three months the school goes through a reform—error succeeds error, and dunce the second reigns like dunce the first. I will venture to pronounce, that however seaport towns, from local circumstances, may have good schools, the country schools will remain in their present state of despicable wretchedness, unless incorporated with government. * * * The necessity of a reformation in the country schools is too obvious to be insisted on; and the first step to such a reformation will be by turning private schools into public ones. The schools should be public, for several reasons—1st. Because, as has been before said, every citizen has an equal right to subsistence, and ought to have an equal opportunity of acquiring knowledge. 2d. Because public schools are easiest maintained, as the burthen falls upon all the citizens. The man who is too squeamish or lazy to get married, contributes to the support of public schools, as well as the man who is burthened with a large family. But private schools are supported only by heads of families, and by those only while they are interested; for as soon as the children are grown up, their support is withdrawn; which makes the employment so precarious, that men of ability and merit will not submit to the trifling salaries allowed in most country schools, and which, by their partial support, cannot afford a better."

SCHOOL HOLIDAY IN GEORGIA.

We have not been very successful in gathering the printed testimony of the dead, or the vivid reminiscences of the living, respecting the internal economy of schools, public or family, in any of the Southern states prior to 1800. The following graphic sketch of "the turn out" of the schoolmaster, from Judge Longstreet's "Georgia Scenes," is said to be "literally true:"

"In the good old days of *fescues*, *abisselfas* and *anpersants*,* terms which used to be familiar in this country during the Revolutionary war, and which lingered in some of our country schools for a few years afterward, I visited my friend Captain Griffen, who resided about seven miles to the eastward of Wrightsborough, then in Richmond, but now in Columbia county. I reached the captain's hospitable home on Easter, and was received by him and his good lady with a *Georgia welcome* of 1790.

"The day was consumed in the interchange of news between the captain and myself (though, I confess, it might have been better employed), and the night found us seated round a temporary fire, which the captain's sons had kindled up for the purpose of dyeing eggs. It was a common custom of those days with boys to dye and peck eggs on Easter Sunday, and for a few days afterward. They were colored according to the fancy of the dyer; some yellow, some green, some purple, and some with a variety of colors, borrowed from a piece of calico. They were not unfrequently beautified with a taste and skill which would have extorted a compliment from Hezekiah Niles, if he had seen them a year ago, in the hands of the '*young operatives*,' in some of the northern manufactories. No sooner was the work of dyeing finished, than our 'young operatives' sallied forth to stake the whole proceeds of their '*domestic industry*' upon a peck. Egg was struck against egg, point to point, and the egg that was broken was given up as lost to the owner of the one which came whole from the shock.

"While the boys were busily employed in the manner just mentioned, the captain's youngest son, George, gave us an anecdote highly descriptive of the Yankee and Georgia character, even in their buddings, and at this early date. 'What you think, pa,' said he, 'Zeph Pettibone went and got his uncle Zach to turn him a wooden egg; and he won a whole hatful o' eggs from all us boys 'fore we found it out; but, when we found it out, maybe John Brown didn't smoke him for it, and took away all his eggs, and give 'em back to us boys; and you think he didn't go then and git a guinea egg, and win most as many more, and John Brown would o' give it to him agin if all we boys hadn't said we thought it was fair. I never see such a boy as that Zeph Pettibone in all my life. He don't mind whipping no more 'an nothing at all, if he can win eggs.'

"This anecdote, however, only fell in by accident, for there was an all-absorbing subject which occupied the minds of the boys during the whole evening, of which I could occasionally catch distant hints, in under tones and whispers, but of which I could make nothing, until they were afterward explained by the captain himself. Such as 'I'll be bound Pete Jones and Bill Smith stretches him.' 'By Jockey, soon as they seize him, you'll see me down upon him like a duck upon a June-bug.' 'By the time he touches the ground, he'll think he's got into a hornet's nest,' etc.

"'The boys,' said the captain, as they retired, 'are going to turn out the schoolmaster to-morrow, and you can perceive they think of nothing else. We must go over to the schoolhouse and witness the contest, in order to prevent injury to preceptor or pupils; for, though the master is always, upon such occasions, glad to be turned out, and only struggles long enough to present his patrons a fair apology for giving the children a holiday, which he desires as much as they do, the boys always conceive a holiday gained by a 'turn out' as the sole achievement of their valor; and in their zeal to distinguish themselves upon such memorable occasions, they sometimes become too rough, provoke the master to wrath, and a very serious conflict ensues. To prevent these consequences, to bear witness that the master was *forced* to yield before he would withhold a day of his promised labor from his

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* The *fescue* was a sharpened wire or other instrument used by the preceptor to point out the letters to the children.

Abisselfa is a contraction of the words "a by itself, a." It was usual, when either of the vowels constituted a syllable of a word, to pronounce it, and denote its independent character by the words just mentioned, thus: "a by itself, *a*, c-o-r-n corn, *acorn*;" "e by itself, *e*, v-i-l, *evil*," etc.

The character which stands for the word "*and*" (&) was probably pronounced with the same accompaniment, but in terms borrowed from the Latin language, thus: "& *per se*" (by itself) *and*. Hence, "anpersant."

employers, and to act as a mediator between him and the boys in settling the articles of peace, I always attend; and you must accompany me to-morrow.' I cheerfully promised to do so.

"The captain and I rose before the sun, but the boys had risen and were off to the school-house before the dawn. After an early breakfast, hurried by Mrs. G. for our accommodation, my host and myself took up our line of march toward the school-house. We reached it about half an hour before the master arrived, but not before the boys had completed its fortifications. It was a simple log pen, about twenty feet square, with a doorway cut out of the logs, to which was fitted a rude door, made of clapboards, and swung on wooden hinges. The roof was covered with clapboards also, and retained in their places by heavy logs placed on them. The chimney was built of logs, diminishing in size from the ground to the top, and overspread inside and out with red clay mortar. The classic hut occupied a lovely spot, overshadowed by majestic hickories, towering poplars, and strong-armed oaks. The little plain on which it stood was terminated, at the distance of about fifty paces from its door, by the brow of a hill, which descended rather abruptly to a noble spring that gushed joyously forth among the roots of a stately beech at its foot.

"The boys had strongly fortified the school-house, of which they had taken possession. The door was barricaded with logs, which I should have supposed would have defied the combined powers of the whole school. The chimney, too, was nearly filled with logs of goodly size; and these were the only passways to the interior. I concluded, if a *turn out* was all that was necessary to decide the contest in favor of the boys, they had already gained the victory. They had, however, not as much confidence in their outworks as I had, and therefore had armed themselves with long sticks, not for the purpose of using them upon the master if the battle should come to close quarters, for this was considered unlawful warfare, but for the purpose of guarding their *works* from his approaches, which it was considered perfectly lawful to protect by all manner of jabs and punches through the cracks. From the early assembling of the girls, it was very obvious that they had been let into the conspiracy, though they took no part in the active operations. They would, however, occasionally drop a word of encouragement to the boys, such as 'I wouldn't turn out the master; but if I did turn him out, I'd die before I'd give up.'

"At length Mr. Michael St. John, the schoolmaster made his appearance. Though some of the girls had met him a quarter of a mile from the school-house, and told him all that had happened, he gave signs of sudden astonishment and indignation when he advanced to the door, and was assailed by a whole platoon of sticks from the cracks: 'Why, what does all this mean?' said he, as he approached the captain and myself, with a countenance of two or three varying expressions.

"'Why,' said the captain, 'the boys have turned you out, because you have refused to give them an Easter holiday.'

"'Oh,' returned Michael, 'that's it, is it? Well, I'll see whether their parents are to pay me for letting their children play when they please.' So saying, he advanced to the school-house, and demanded, in a lofty tone, of its inmates, an unconditional surrender.

"'Well, give us a holiday, then,' said twenty little urchins within, 'and we'll let you in.'

"'Open the door of the *academy*'—(Michael would allow nobody to call it a school-house)—'Open the door of the academy this instant,' said Michael, 'or I'll break it down.'

"'Break it down,' said Pete Jones and Bill Smith, 'and we'll break you down.'

"During this colloquy I took a peep into the fortress, to see how the garrison were affected by the parley. The little ones were obviously panic-struck at the first words of command; but their fears were all chased away by the bold determined reply of Pete Jones and Bill Smith, and they raised a whoop of defiance.

"Michael now walked round the academy three times, examining all its weak points with great care. He then paused, reflected for a moment, and wheeled off suddenly toward the woods, as though a bright thought had just struck him. He passed twenty things which I supposed he might be in quest of, such as huge stones, fence rails, portable logs, and the like, without bestowing the least attention upon them. He went to one old log, searched it thoroughly, then to another, then to a hollow stump, peeped into it with great care, then to a hollow log, into which he looked with equal caution, and so on.

"'What is he after?' inquired I.

"'I'm sure I don't know,' said the captain, 'but the boys do. Don't you notice the breathless silence which prevails in the school-house, and the intense anxiety with which they are eyeing him through the cracks?'

"At this moment Michael had reached a little excavation at the root of a dogwood, and was in the act of putting his hand into it, when a voice from the garrison exclaimed, with most touching pathos, 'Lo'd o' messy, he's found my eggs! boys, let's give up.'

"'I won't give up,' was the reply from many voices at once.

"'Rot your cowardly skin, Zeph Pettibone, you wouldn't give a wooden egg for all the holydays in the world.'

"If these replies did not reconcile Zephaniah to his apprehended loss, it at least silenced his complaints. In the mean time Michael was employed in relieving Zeph's storehouse of its provisions; and, truly, its contents told well for Zeph's skill in egg-pecking. However, Michael took out the eggs with great care, and brought them within a few paces of the schoolhouse, and laid them down with equal care in full view of the besieged. He revisited the places which he had searched, and to which he seemed to have been led by intuition; for from nearly all of them did he draw eggs, in greater or less numbers. These he treated as he had done Zeph's, keeping each pile separate. Having arranged the eggs in double files before the door, he marched between them with an air of triumph, and once more demanded a surrender, under pain of an entire destruction of the garrison's provisions.

"'Break 'em just as quick as you please,' said George Griffin; 'our mothers 'll give us a plenty more, won't they, pa?'

"'I can answer for yours, my son,' said the captain; 'she would rather give up every egg upon the farm than to see you play the coward or traitor to save your property.'

"Michael, finding that he could make no impression upon the fears or the avarice of the boys, determined to carry their fortifications by storm. Accordingly he procured a heavy fence-rail, and commenced the assault upon the door. It soon came to pieces, and the upper logs fell out, leaving a space of about three feet at the top. Michael boldly entered the breach, when, by the articles of war, sticks were thrown aside as no longer lawful weapons. He was resolutely met on the half-demolished rampart by Peter Jones and William Smith, supported by James Griffin. These were the three largest boys in the school; the first about sixteen years of age, the second about fifteen, and the third just eleven. Twice was Michael repulsed by these young champions; but the third effort carried him fairly into the fortress. Hostilities now ceased for a while, and the captain and I, having levelled the remaining logs at the door, followed Michael into the house. A large three inch plank (if it deserve that name, for it was wrought from the half of a tree's trunk entirely with the axe), attached to the logs by means of wooden pins, served the whole school for a writing desk. At a convenient distance below it, and on a line with it, stretched a smooth log, resting upon the logs of the house, which answered for the writers' seat. Michael took his seat upon the desk, placed his feet on the seat, and was sitting very composedly, when with a simultaneous movement, Pete and Bill seized each a leg, and marched off with it in quick time. The consequence is obvious; Michael's head first took the desk, then the seat, and finally the ground (for the house was not floored), with three sonorous thumps of most doleful portent. No sooner did he touch the ground than he was completely buried with boys. The three elder laid themselves across his head, neck and breast, the rest arranging themselves *ad libitum*. Michael's equanimity was considerably disturbed by the first thump, became restive with the second, and took flight with the third. His first effort was to disengage his legs, for without them he could not rise, and to lie in his present position was extremely inconvenient and undignified. Accordingly he drew up his right, and kicked at random. This movement laid out about six in various directions upon the floor. Two rose crying: 'Ding his old red-headed skin,' said one of them, 'to go and kick me right in my sore belly, where I fell down and raked it, running after that fellow that cried "school butter."'*

* "I have never been able to satisfy myself clearly as to the literal meaning of these terms. They were

" 'Drot his old snaggle-tooth picture,' said the other, 'to go and hurt my sore toe, where I knocked the nail off going to the spring to fetch a gourd of *warter* for him, and not for myself n'other.'

" 'Hut!' said Captain Griffin, 'young Washingtons mind these trifles! At him again.'

"The name of Washington cured their wounds and dried up their tears in an instant, and they legged him *de novo.* The left leg treated six more as unceremoniously as the right had those just mentioned; but the talismanic name had just fallen upon their ears before the kick, so they were invulnerable. They therefore returned to the attack without loss of time. The struggle seemed to wax hotter and hotter for some time after Michael came to the ground, and he threw the children about in all directions and postures, giving some of them thrusts which would have placed the *ruffle-shirted* little darlings of the present day under the discipline of paregoric and opodeldoc for a week; but these hardy sons of the south seemed not to feel them. As Michael's head grew easy, his limbs, by a natural sympathy, became more quiet, and he offered one day's holiday as the price. The boys demanded a week; but here the captain interposed, and after the common but often unjust custom of arbitrators, split the difference. In this instance the terms were equitable enough, and were immediately acceded to by both parties. Michael rose in a good humor, and the boys were of course. Loud was their talking of their deeds of valor as they retired. One little fellow about seven years old, and about three feet and a half high, jumped up, cracked his feet together, and exclaimed, 'By jingo, Pete Jones, Bill Smith and *me* can hold any *Sinjin* [St. John] that ever trod Georgy grit.' "

considered an unpardonable insult to a country school, and always justified an attack by the whole fraternity upon the person who used them in their hearing. I have known the scholars pursue a traveller two miles to be revenged of the insult. Probably they are a corruption of 'The school's better.' '*Better*' was the term commonly used of old to denote a *superior*, as it sometimes is in our day: 'Wait till your betters are served,' for example. I conjecture, therefore, the expression just alluded to was one of challenge, contempt, and defiance, by which the person who used it avowed himself the *superior* in all respects of the whole school, from the preceptor down. If any one can give a better account of it, I shall be pleased to receive it."

AN OLD FIELD SCHOOL, OR ACADEMY, IN VIRGINIA.

The experience of one of that class of teachers, who found temporary occupation in teaching the children of one or more families of planters in Virginia and other southern states, will be found in the "Travels of Four Years and a Half in the United States (in 1798, 1799, 1800, 1801 and 1802), by John Davis." Mr. Davis was an Englishman of more than ordinary education and of social address, and while in this country numbered among his friends such men as Aaron Burr, President Jefferson, and other men of high political standing. He was a private tutor in New York, South Carolina and Virginia, and his graphic sketches of men and manners show some of the deficiencies in the means of education which even wealthy planters in the southern states experienced. With letters of introduction from President Jefferson he proceeds to the plantation of a Mr. Ball, and is engaged to teach his and his neighbors' children:

"The following day every farmer came from the neighborhood to the house, who had any children to send to my Academy, for such they did me the honor to term the log-hut in which I was to teach. Each man brought his son, or his daughter, and rejoiced that the day was arrived when their little ones could light their tapers at the torch of knowledge! I was confounded at the encomiums they heaped upon a man whom they had never seen before, and was at a loss what construction to put upon their speech. No price was too great for the services I was to render their children; and they all expressed an eagerness to exchange perishable coin for lasting knowledge. If I would continue with them seven years! only seven years! they would erect for me a brick seminary on a hill not far off; but for the present I was to occupy a log-house, which, however homely, would soon vie with the sublime college of William and Mary, and consign to oblivion the renowned academy in the vicinity of Fauquier Court-House. I thought Englishmen sanguine; but these Virginians were infatuated.

"I now opened what some called an academy,* and others an Old Field School;

* "It is worth the while to describe the academy I occupied on Mr. Ball's plantation. It had one room and a half. It stood on blocks about two feet

and, however it may be thought that content was never felt within the walls of a seminary, I, for my part, experienced an exemption from care, and was not such a fool as to measure the happiness of my condition by what others thought of it.

"It was pleasurable to behold my pupils enter the school over which I presided; for they were not composed only of truant boys, but some of the fairest damsels in the country. Two sisters generally rode on one horse to the school-door, and I was not so great a pedagogue as to refuse them my assistance to dismount from their steeds. A running-footman of the negro tribe, who followed with their food in a basket, took care of the beast; and after being saluted by the young ladies with the courtesies of the morning, I proceeded to instruct them, with gentle exhortations to diligence of study.

"Common books were only designed for common minds. The unconnected lessons of Scot, the tasteless selections of Bingham, the florid harangues of Noah Webster, and the somniferous compilation of Alexander, were either thrown aside, or suffered to gather dust on the shelf; while the charming essays of Goldsmith, and his not less delectable Novel, together with the impressive work of Defoe, and the mild productions of Addison, conspired to enchant the fancy, and kindle a love of reading. The thoughts of these writers became engrafted on the minds, and the combinations of their diction on the language of the pupils.

"Of the boys I cannot speak in very encomiastic terms; but they were perhaps like all other school-boys, that is, more disposed to play truant than enlighten their minds. The most important knowledge to an American, after that of himself, is the geography of his country. I, therefore, put into the hands of my boys a proper book, and initiated them by an attentive reading of the discoveries of the Genoese; I was even so minute as to impress on their minds the man who first descried land on board the ship of Columbus. That man was Roderic Triana, and on my exercising the memory of a boy by asking him the name, he very gravely made answer, Roderic Random.

"Among my male students was a New Jersey gentleman of thirty, whose object was to be initiated in the language of Cicero and Virgil. He had before studied the Latin grammar at an academy school (I use his own words) in his native state; but the academy school being burnt down, his grammar, alas! was lost in the conflagration, and he had neglected the pursuit of literature since the destruction of his book. When I asked him if he did not think it was some Goth who had set fire to his academy school, he made answer, 'So, it is like enough.'

"Mr. Dye did not study Latin to refine his taste, direct his judgment, or enlarge his imagination; but merely that he might be enabled to teach it when he opened school, which was his serious design. He had been bred a carpenter, but he panted for the honors of literature."

Mr. Davis accounts for his fidelity in teaching more hours than he was required to do by his contract, by his interest in the lessons of one of his female pupils:

"Hence I frequently protracted the studies of the children till one, or half past one o'clock; a practice that did not fail to call forth the exclamations both of the white and the black people. Upon my word, Mr. Ball would say, this gentleman is diligent; and Aunt Patty the negro cook would remark, 'He good cool-mossa that; he not like old Hodgkinson and old Harris, who let the boys out before twelve. He deserve good wages!"

"Having sent the young ladies to the family mansion, I told the boys to break up, and in a few minutes they who had even breathed with circumspection, now gave loose to the most riotous merriment, and betook themselves to the woods, followed by all the dogs on the plantation."

"There was a carpenter on the plantation, whom Mr. Ball had hired by the year.

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and a half above the ground, where there was free access to the hogs, the dogs, and the poultry. It had no ceiling, nor was the roof lathed or plastered, but covered with shingles. Hence, when it rained, like the nephew of old Elwes, I moved my bed (for I slept in my academy) to the most comfortable corner. It had one window, but no glass, nor shutter. In the night, to remedy this, the mulatto wench who waited on me, contrived very ingeniously to place a square board against the window with one hand, and fix the rail of a broken down fence against it with the other. In the morning, when I returned from breakfasting in the 'great big house,' (my scholars being collected,) I gave the rail a forcible kick with my foot, and down tumbled the board with an awful roar. 'Is not my window,' said I to Virginia, 'of a very curious construction?' 'Indeed, indeed, sir,' replied my fair disciple, 'I think it is a mighty noisy one.'"

He had tools of all kinds, and the recreation of Mr. Dye, after the labor of study, was to get under the shade of an oak, and make tables, or benches, or stools for the academy. So true is the assertion of Horace, that the cask will always retain the flavor of the liquor with which it is first impregnated.

"'Well, Mr. Dye, what are you doing?'

"'I am making a table for the academy school.'

"'What wood is that?'

"'It is white oak, sir.'

"'What, then you are skilled in trees, you can tell oak from hickory, and ash from fir?'

"'Like enough, sir. (A broad grin.) I ought to know those things; I served my time to it.'

"'*Carpenter.*—I find, sir, Mr. Dye has done with his old trade; he is above employing his hands; he wants work for the brain. Well! larning is a fine thing; there's nothing like larning. I have a son only five years old, that, with proper larning, I should not despair of seeing a member of Congress. He is a boy of genus; he could play on the Jews-harp from only seeing Sambo tune it once.'

"'*Mr. Dye.*—I guess that's Billy; he is a right clever child.'

"'*Carpenter.*—How long, sir, will it take you to learn Mr. Dye Latin?'

"'*Schoolmaster.*—How long, sir, would it take me to ride from Mr. Ball's plantation to the plantation of Mr. Wormley Carter?'

"'*Carpenter.*—Why that, sir, I suppose, would depend upon your horse.'

"'*Schoolmaster.*—Well, then, sir, you solve your own interrogation. But here comes Dick. What has he got in his hand?'

"'*Mr. Dye.*—A mole like enough. Who are you bringing that to, Dick?'

"'*Dick.*—Not to you. You never gave me the taste of a dram since I first know'd you. Worse luck to me; you New Jersey men are close shavers; I believe you would skin a louse. This is a mole. I have brought it for the gentleman who came from beyond sea. He never refuses Dick a dram; I would walk through the wilderness of Kentucky to serve him. Lord! how quiet he keeps his school. It is not now as it was; the boys don't go clack, clack, clack, like 'Squire Pendleton's mill upon Catharpin Run!'

"'*Schoolmaster.*—You have brought that mole, Dick, for me.'

"'*Dick.*—Yes, master, but first let me tell you the history of it. This mole was once a man; see, master (Dick exhibits the mole), it has got hands and feet just like you and me. It was once a man, but so proud, so lofty, so puffed-up, that God, to punish his insolence, condemned him to crawl under the earth.'

"'*Schoolmaster.*—A good fable, and not unhappily moralized. Did you ever hear or read of this before, Mr. Dye?'

"'*Mr. Dye.*—Nay (a broad grin), I am right certain it does not belong to Æsop. I am certain sure Dick did not find it there.'

"'*Dick.*—Find it where? I would not wrong a man of the value of a grain of corn. I came across the mole as I was hoeing the potato-patch. Master, shall I take it to the school-house? If you are fond of birds, I know now for a mocking-bird's nest; I am only afeared those young rogues, the school-boys, will find out the tree. They play the mischief with every thing, they be full of devilment. I saw Jack Lockhart throw a stone at the old bird, as she was returning to feed her young; and if I had not coaxed him away to look at my young puppies, he would have found out the nest.'

"I had been three months invested in the first executive office of pedagogue, when a cunning old fox of a New Jersey planter (a Mr. Lee) discovered that his eldest boy wrote a better hand than I. Fame is swift-footed; *vires acquirit eundo;* the discovery spread far and wide; and whithersoever I went, I was an object for the hand of scorn to point his slow unmoving finger at, as a schoolmaster that could not write. Virginia gave me for the persecutions I underwent a world of sighs, her swelling heavens rose and fell with indignation at old Lee and his abettors. But the boys caught spirit from the discovery. I could perceive a mutiny breaking out among them; and had I not in time broke down a few branches from an apple tree before my door, it is probable they would have displayed their gratitude for my instructions by throwing me out of my school-window. But by arguing with one over the shoulders, and another over the back, I maintained with dignity the first executive office of pedagogue.

"I revenged myself amply on old Lee. It was the custom of his son (a lengthy fellow of about twenty) to come to the academy with a couple of huge mastiffs at his heels. Attached to their master (*par nobile* *fratrum*) they entered without ceremony Pohoke Academy, bringing with them myriads of fleas, wood-lice, and ticks. Nay, they would often annoy Virginia, by throwing themselves at her feet, and inflaming the choler of a little lap-dog, which I had bought because of his diminutive size, and which Virginia delighted to nurse for me. I could perceive the eye of Virginia rebuke me for suffering the dogs to annoy her; and there lay more peril in her eye than in the jaws of all the mastiffs in Prince William County.

"'Mr. Lee,' said I, 'this is the third time I have told you not to convert the academy into a kennel, and bring your dogs to school.' Lee was mending his pen 'judgmatically.' He made no reply, but smiled.

"I knew old Dick the negro had a bitch, and that his bitch was proud. I walked down to Dick's log-house. Dick was beating flax.

"'Dick,' said I, 'old Farmer Lee has done me much evil—(I don't like the old man myself, master, said Dick)—and his son, repugnant to my express commands, has brought his father's two plantation dogs to the academy. Revenge is sweet—'

"'Right, master,' said Dick. 'I never felt so happy as when I bit off Cuffey's great toe and swallowed it—

"'Do you, Dick,' said I, 'walk past the school-house with your bitch. Lee's dogs will come out after her. Go round with them to your log-house; and when you have once secured them, hang both of them up by the neck.'

"'Leave it to me, master,' said Dick. 'I'll fix the business for you in a few minutes. I have a few fadoms of rope in my house—that will do it.'

"I returned to the academy. The dogs were stretched at their ease on the floor. 'Oh! I am glad you are come,' exclaimed Virginia; 'those great big dogs have quite scared me.'

"In a few minutes Dick passed the door with his slut. Quick from the floor rose Mr. Lee's two dogs, and followed the female. The rest may be supplied by the imagination of the reader. Dick hung up both the dogs to the branch of a pine-tree; old Lee lost the guards to his plantation; the negroes broke open his barn, pilfered his sacks of Indian corn, rode his horses in the night—and thus was I revenged on Alexander the coppersmith.

"Three months had now elapsed, and I was commanded officially to resign my sovereign authority to Mr. Dye, who was in every respect better qualified to discharge its sacred functions. He understood tare and tret, wrote a copper-plate hand, and, balancing himself upon one leg, could flourish angels and corkscrews. I, therefore, gave up the 'academy school' to Mr. Dye, to the joy of the boys, but the sorrow of Virginia."

Whilst schools were thus poorly equipped and the instruction given was thus defective in its methods and meagre in its extent, it becomes of interest to inquire whence such a measure of general intelligence and so many individual cases of attaining to an eminent position in society. This was the result of no single cause alone, but of a variety in combination.

The first of these that may be named, both in its influence upon childhood and upon manhood, was the necessity of a hard fought battle for existence, but relieved by the assurance that victory would be the reward of persistent exertion. Its results were robustness, patience of toil, resoluteness and perseverance in encountering difficulties, and fertility of resources. The rustic lad,—and making the necessary variations, we include the female sex with the representative male,—the rustic lad who had been trained to help his parents from the moment he had acquired strength to steady his steps, to toil on all the same whether the bright sun cheered him or the chill air benumbed his limbs; whether his tasks were varied, pleasant and light, or, on the contrary, he had learned patience, marching beside the patient ox all the long hours of a long spring day, the animals only alternating with others which served as relays; and had been no stranger to such discipline as picking stones in the stubble whilst the sad heavens distilled a drizzly rain, they condensing all their gloom in his soul, but withheld those large and frequent drops which would have been the signal of his release; and among the least severe of whose lessons in acquiring hardihood had been, in gathering the fruits of autumn, to face its frosts without mittens or shoes; this lad found nothing in the difficulties of the school-room to appall him, and storms and deep drifts rather added zest to his daily walks. No unintelligible jargon of the spelling book, no abstruse section in his reader, was an overmatch for his industry.

True, he did not understand all he studied, but he learned to spell and to read and to commit to memory what was assigned him. And when he took his arithmetic, which contained only definitions, rules and examples, although his teacher vouchsafed him little explanation, he had perseverance enough to ponder every dark process till light broke through. And there were instances of boys who worked for consecutive hours and days at problems confessedly some of the most knotty that could be found, till at last their unaided exertions were rewarded with success, which brought more exquisite joy than ever thrilled the finder of a rare gem. These exceptional cases stimulated the more dull, and most became possessed of at least the rudiments of the science, quite sufficient for practical life, or which under the stimulus of necessity became subsequently enlarged to that extent. In manhood no blind adherence to traditional methods was or could be observed. Emergencies were constantly arising which taxed ingenuity to the utmost in devising the fitting expedients to meet them. It was a daily study to make the narrowest means serve the same ends as the amplest. Hard thought was expended without stint upon labor-saving processes, improvements and inventions. Thus was gained a discipline of mind beyond what the higher college mathematics usually imparts, and ofttimes a readiness in applying mechanical principles, of which many an engineer trained in the schools is utterly devoid, however prompt he may be in the routine to which he is accustomed.

The family training, aside from the inuring of children to patient industry, contributed greatly to their profiting from their school privileges. To do or not to do was not then left so generally to the child's pleasure. He was made to obey before he had experienced the delight of carrying into effect his own will in opposition to that of others; and thus was formed the habit of unquestioning compliance with the requirements of parents. When the child could understand the subject, he was taught that however irksome at times were the tasks imposed upon him, it was only in virtue of the allotment that man was to eat bread by the sweat of his brow, and that only by a cheerful performance of what was within his power could he make a return for the care he was continually receiving. Thus from a sense of religious and filial obligation the rigor of their early discipline was the more easily sustained. Self-control and a certain measure of self-reliance were results of the discipline of infancy even ; and in advancing childhood it was inculcated in the house and in the field, that each must depend upon himself for whatever he was to be and to possess in life. And knowledge, knowledge that was not the mere blind recipient of instruction, intelligent knowledge which perceived relations, and reasoning knowledge which could make the practical application as opportunity served, was set forth as the condition indispensable to render exertion successful. Hence it was a prized privilege to go to school, as well as a pleasant exchange for physical toil for a brief period, an exchange of work at home for another variety of work in the school-room, not of one manner of busy idleness and mischief for another. Also in many cases the home was itself a school, and either that knowledge was there gained which others acquired at school, or study was further pursued under the guidance of parent, or brother or sister, who by some happy gift of Providence had required little tuition. Often also, winter evenings or other hours, when the labor of one pair of hands might be spared, were passed in the social reading of instructive books.

The listening every seventh day to two discourses, wherein were discussed the deepest theories which can be proposed to man, may be named as an additional item in the answer to our inquiry. The clergymen of that day had received the best education that the country afforded, and were daily cultivating intimacy with the profoundest theologians. Thus they had ever thoughts which they had originated or had made their own to present. And these thoughts were inwardly digested by a goodly number of their hearers, and becoming a part of their being, they too

> "reasoned high
> Of Providence, foreknowledge, will and fate,
> Fixed fate, free will, foreknowledge absolute;"

and if they "found no end," they were not "in wandering mazes lost," for, unlike the lost angels, they ruled their discussions by the infallible word of inspiration. It cannot be said that serious thought then bored, or that the sparkle of the unsubstantial poem chiefly drew, or that triviality was the characteristic of the multitude.

The study of one book, and that the Bible, simple enough in parts to meet the understanding of the little child, and of interest enough to absorb his attention, and in other parts of depths which no finite intellect can sound, and everywhere wise above the wisdom of men, and without any alloy of error, was one of the most efficacious means of raising the mass of the people in intelligence, and in educating a few, who made it their constant meditation, to a nicety of discrimination and a profundity of thought truly wonderful. Take as an example one silvery haired man whose memory is cherished with veneration. His school privileges had been less even than the scanty amount of most of his contemporaries, hardly amounting to three winter schools in all. Moreover, weakness of the eyes almost cut him off from reading books and papers throughout his life. But he was able to read daily a few verses, sometimes several chapters, in his large quarto Bible, and when he read aloud, all untaught as he was, he read with a naturalness and gave the sense, so that the hearer marvelled. Comparing scripture with scripture, he had attained to a skill in interpreting which seldom erred. His quickness in detecting a fallacy or in observing a doctrine which harmonized not with the living oracles was surpassed by very few of even the most highly educated of schoolmen. He was exceedingly retiring, but to the few who knew him, his life and his language seemed as correct as the words of that book on which both, with perfect naturalness, without any tinge of formality or quaintness, were modeled. Who will venture to say that this man's education was not incomparably superior to that of him who has delved a whole life in conflicting systems, who has sought to know the thoughts of all reported as great, but who has settled nothing for himself?

The political principles which found their expression in the declaration of independence, and which were a cherished inheritance from the fathers, leading to a general participation in the government of the country, and producing the habit of earnestly debating every question of public concern, had no small share of influence in exciting intensity and energy of mental action. By the fireside, in the field, at the corners of the streets, in the shops and stores, those powers were developed which had further exercise in the town meeting, and carried their possessor to some humble position of trust or authority; and when here trained and shown to be capable of sustaining higher responsibilities, advanced him again, so that he who had forged iron chains, was chosen to fashion the more efficacious restraints of laws; he who had occupied the cobbler's seat, was promoted to the bench of justice; and he who had been wont to rule oxen was thought worthy to govern men.

The newspaper, and the family, and the village library contributed largely to the general intelligence. The weekly paper furnished no small part of the topics of conversation in the family and among neighbors, and, in particular, supplied the pabulum for political discussions. The few books owned or borrowed were carefully read again and again. The small proprietary libraries furnished some of the most valuable histories and the choicest works in belles-lettres. It was not of rare occurrence to find persons who showed familiarity with Rollin, Ferguson, Gibbon, Robertson, and Hume; and sometimes one might even be met, who could give an orderly account of an entire work of these authors; and there were many who could repeat favorite poems, peradventure even the entire *Night Thoughts* of Dr. Young, if that was the chosen *vade mecum.* Even some children of twelve or fifteen years of age,—barefoot boys who had only "noonings" and the time they might gain by manual dexterity in accomplishing their "stents," —had perused several of the voluminous historians named above. How will such lads compare in mental strength and vigor with children who willingly read nothing but the most exciting tales or the most intellectual pap made toothsome?

The observation of men and of nature, pursued to good advantage where no unbending usages restrained free development of character, no wrappings of conventionalities gave a uniform semblance to all, where the woods and the waters and the inhabitants thereof had only begun to recognize the dominion of man, quickened too by the necessity of turning to account every item of knowledge that could be gained, was an ample equivalent for the more comprehensive speculations of mental philosophy and the scientific nomenclatures and descriptions of natural history to be learned from the mouth of the lecturer.

Finally, those defective schools of the past generation did place the key of knowledge in the hands of the inquisitive; which is nearly all that the schools of the present day accomplish, or at least is their most valuable result. With reading, writing, and the elements of arithmetic, and the stimulus of necessity and emulation, and perhaps religious principle added, he who felt any of the inspiration of genius, or who became conscious of a talent that had been improved, might advance with a speedier flight or a slower and more toilsome step up the steep ascent to the temple of knowledge, and sit a crowned king on one of her numberless thrones. Books procured and mastered one at a time, moments of leisure seized and improved, oneness of aim and unfaltering perseverance, wrought the result.

It is a plain inference that school education, as the correlate of the professional teacher's labors, usually receives credit to which it is not entitled. As we have elsewhere remarked, with all the agencies for the education and improvement of teachers, the public schools of Europe, with their institutions of government and society, do not turn out such practical and efficient men as our own common schools, acting in concert with our religious, social and political institutions. A boy educated in a district school of New England, taught for a few months in the winter, by a rough, half-educated, but live teacher, who is earning his way by his winter's work in the school-room out of the profession into something which will pay better, and in the summer by a young female, just out of the eldest class of the winter school, and with no other knowledge of teaching than what she may have gathered by observation of the diverse practices of some ten or twelve instructors who must have taught the school under the intermittent and itinerating system which prevails universally in the country districts of New England—a boy thus taught through his school-life, but subjected at home and abroad to the stirring influences of a free press, of town and school district meetings, of constant intercourse with those who are mingling in the world, and in the affairs of public life, and beyond all these influences, subjected early to the wholesome discipline, both moral and intellectual, of taking care of himself, and the affairs of the house and the farm, will have more capacity for business, and exhibit more intellectual activity and versatility than the best scholar who ever graduated from a Prussian school, but whose school-life, and especially the years which immediately follow, are subjected to the depressing and repressing influences of a despotic government, and to a state of society in which every thing is fixed both by law and the iron rule of custom. But this superiority is not due to the school, but is gained in spite of the school.

Now when the causes which conduced to this superiority are less operative and less general, the improvement of schools becomes doubly important. This can be effected only as the moulders of educational institutions intelligently apprehend their proper aim, or, in other words, the due relation of school education to education in its enlarged sense, and as they succeed in leading teachers to a judicious direction of their efforts, and to the employment of methods adapted to the end in view. Omitting the consideration of the last topic suggested as not embraced in the design of this article, we shall have before us a practical aim, in addition to supplying the criterion for estimating the excellences and the defects of the education of the past and the present, if we consider as well as we may the question,

WHAT IS EDUCATION?

To facilitate the attainment of definiteness and accuracy of the conception, we shall attempt to distinguish the related ideas. And,

1. *Formation of character*, which is the most comprehensive of these related ideas, represents the combined result of human, natural and supernatural agencies in fashioning every lineament of the man in every department of his inner being. The human agency embraces parent, brother, sister, nurse, playmate, teacher, chosen companion, casual acquaintance, in short, all of his kind, contemporaries or predecessors, who have directly or indirectly contributed to the moulding of the man. The natural agency is the external world or physical universe, which in its influence upon persons similarly situated varies with their susceptibility. The supernatural agency comprehends that exercise of the sovereign power of the great First Cause, which places the individual in the special condition and relations that attend him on his introduction into existence and throughout his life, with whatever of direct operations there may be upon the mind, experienced consciously or unconsciously, of divine, angelic or demoniacal origin. The estimate of this last influence will de-

pend upon the theological views entertained. Character is raised to its highest elevation when the prevailing motive in the conduct of life is regard for the perfect will of God; and it is then called *piety*. Education viewed actively is not the correlative of formation of character, neither, viewed as a result, is it identical therewith. However we may employ sensible objects or those only conceived of, it proceeds by human agency alone. Whilst the disorganization of the human constitution has proved beyond the ability of mere education to rectify, on the supposition that perfection of character was attained, education might go on indefinitely. Formation of character gives a certain combination of features or qualities; education presents cultivated susceptibilities and stores of gathered treasures. Strictly, education is always immediate. We may employ another, or assist in preparing him, to educate a third person; but if this is all, we are not ourselves with him educators of that person.

2. *The development of the faculties* is the second related idea. Development is the unfolding of something which had existed only in embryo, by exciting its dormant vital energy or inherent force to activity. The result of the development of the mental faculties is *power*, power, intellectual, moral, and voluntary; power of instigating and power of controlling action. When the moral faculty or conscience controls action in all the relations of a man to his fellow-men, *rectitude* or uprightness is the result. It is the function of education to superintend the development of the faculties, accelerating that of some, circumscribing or restraining that of others, and to regulate them in their exercise. Development, even when regulated by education, must fail to give to man perfection of character, for it neither gives nor takes away, and hence original imperfection must remain, though it may be partially concealed. In an unregulated but stimulated development the proportions of what is fair would be outgrown and obscured by all forms of ugliness.

3. *Training*, of which the third related idea is the conception, is directed specifically to the forming of habits. Thus from the earliest mental training there may proceed the habits of obedience, order, neatness, trust, gentleness, kindness, self-denial, &c.; from corporeal training habits of motion, and physical action in general. Education is not, like training, directed exclusively to the forming of habits. This is rather its preliminary work.

4. *Instruction* is the communication of knowledge which may be of value to the recipient, either in itself or as a means to a remoter end. Education gives the discipline which turns knowledge to account. Instruction calls into exercise a sort of passive activity, a reception of facts and a perception of relations as presented. Education trains the pupil to discover relations, and to make deductions from facts, and thus excites an independent activity. Teachers and books instruct when they convey thoughts and explain processes; they educate in so far as they lead the pupil or reader to think for himself and to institute new processes. Instruct a man, and he will become well informed in regard to the subject of the instruction; educate a man, and his mind will be not only furnished, but also disciplined and cultivated in proportion to its capacity and the extent of the process. Precisely the same process may be instruction in one respect and education in another. Often, however, their methods are essentially different, for instruction may simply labor to facilitate to the utmost the acquisition of knowledge, but education, whilst careful to adapt its requirements to the strength of the learner, introducing its severer methods gradually, and never prematurely assigning the abstruser branches of study, only directs the learner how to encounter the difficulties of his path, and leaves him to take every step for himself, aiming to bring him as soon as possible to the condition where he may dispense with all aid. Thus, although instruction and education are inseparable, there may be much instruction where there is very little education, and very little instruction where there is much education. Instruction is limited to what the teacher does; education is measured by what the pupil is rendered competent to perform.

5. *Tuition*, distinctively regarded, has for its end simply advancement in specific branches of study. It is related to education in its restricted sense as a part to a whole. Also, it is objective only.

Education, in its enlarged sense, is the disciplining, cultivating, and furnishing of the mind of man, as a man, and for the particular position which he is to hold. It is thus general and special; general, so far as it seeks to advance man towards the perfection of his being; special, so far as it is directed to preparation for a particular sphere of activity. Discipline gives trained strength, the ability to exercise developed power at will. Culture brings the mind into the condition, relative to its capacity, to produce what is useful and beautiful and good and true. The furniture of the mind is its general stores. Incidental to the principal objects of education is physical culture. Education regards the body as a casket which must be guarded well, that the contents receive no injury; as a servant to be kept in good condition for the master's benefit.

Education in its restricted sense is that extent of mental discipline, culture and furniture, to be systematically gained under the direction of a teacher, which is requisite to the indefinite improvement of the pupil by himself, or to his independent completion of his preparation for his business in life. It is thus, like education in its enlarged sense, general and special.

This last definition determines the sphere to which the teacher is limited, and which he must occupy as completely as possible. It dictates no uniform course or method. These must be varied to suit the character and circumstances of pupils. It prescribes for each simply the text that is practicable, not every thing which is desirable. Beyond the mere fundamental branches of knowledge it makes the furnishing of the mind a secondary end. It utterly forbids the striving to make every pupil the recipient of all the sciences. In the most extended course of study it marks out the pupil's becoming an adequate self-educator as the limit of the teacher's duties, and the aim for the attainment of which he must strive. It countenances no forcing processes, which generate mere hot-bed developments, and prevent all possibility of the solid growth requisite to convert the tender plant into the majestic tree; and least of all, no measure tending to blunt the sensibilities or sour the disposition. It admits that the most valuable part of education is what is superadded to the labors of the teacher, or goes on independently of him, but it requires of him unceasing watchfulness over his pupils, and consummate wisdom and skill in directing their studies and guiding their efforts. Finally, if it permits time and effort to be devoted chiefly to literary attainments, it implies that all intellectual acquisitions must be made subordinate to moral culture.

We will close this chapter by marking some of the successive steps, agencies, and results, in the development of our present system of public elementary education.

1. As has been already remarked, in the reconstruction of civil society which followed the change from colonies to independent states in confederated and afterward national union, the necessity and wisdom of making some provision for the education of children was generally recognized, and in some instances thoroughly and liberally provided for in the fundamental laws.

The constitution of Massachusetts adopted in 1780 has this provision: "Wisdom and knowledge as well as virtue diffused generally among the body of the people, being necessary for the preservation of their rights and liberties, and as these depend on spreading the opportunities and advantages of education in the various parts of the country, and among the different orders of the people, it shall be the duty of legislatures and magistrates in all future periods of this commonwealth, to cherish the interests of literature and the sciences, and all seminaries, especially the University of Cambridge, public schools, and grammar schools in the towns; to encourage private societies and public institutions, rewards and immunities for the promotion of agriculture, arts, sciences, commerce, trades, manufactures, and a natural history of the country; to countenance and inculcate the principles of humanity and general benevolence, public and private charity, industry and frugality, honesty and punctuality in their dealings; sincerity, good humor, and all social affections and generous sentiments among the people." In the revision of the school laws in 1789, it is provided that "towns of fifty families are required to sustain schools wherein children are taught to read and write, and instructed in the English language, arithmetic, orthography, and decent behavior, for a term equal to one school of six months in each year; every town of one hundred families, twelve months; every town of one hundred and fifty families, eighteen months; and every town of two hundred families twelve months, and in addition thereto sustain a school wherein is taught the Latin, Greek and English languages for twelve months in each year." It is also "made the duty of the president, professors and tutors of the University at Cambridge, preceptors and teachers of academies, and all other instructors of youth, to take diligent care, and to exert their best endeavors to impress on the minds of children and youth committed to their care and instruction the principles of piety, justice and a sacred regard to truth, love to their country, humanity and universal benevolence, sobriety, industry and frugality, chastity, moderation and temperance, and those other virtues which are the ornament of human society, and the basis upon which the republican constitution is structured; and it shall be the duty of such instructors to endeavor to lead those under their care into a particular understanding of the tendency of the before-mentioned virtues to preserve and perfect a republican constitution, and to secure the blessings of liberty as well as to promote their future happiness, and the tendency of the opposite vices to slavery and ruin."

Vermont in the constitution adopted in 1793 ordains "that a competent number of schools shall be maintained in each town for the convenient instruction of youth, and one or more grammar schools to be incorporated and properly supported in each county," and by subsequent legislation imposed the necessary tax for their support.

New Hampshire in 1789 empowers and requires the selectmen of the several towns to assess an annual tax upon the inhabitants for the support of a school or schools for teaching, reading, writing and arithmetic, and in each county town a grammar school for the purpose of teaching the Greek and Latin languages in addition to the other studies.

Connecticut in 1795, in addition to a special tax for the support of common schools, collectable with the other public taxes, appropriated the avails of the sales of three millions of acres of land belonging to the state and situated in Ohio—since known as the Western Reserve—as a perpetual fund for the same object.

New York in 1795 appropriated $50,000 annually for the purpose of encouraging and maintaining common schools in the several cities and towns, which were required to raise by tax for the same purpose a sum equal to one-half the amount received from the state.

Pennsylvania in the constitution adopted in 1790 ordains "that the legislature shall provide by law for the establishment of schools throughout the state in such manner that the poor may be taught gratis;" "and that the arts and sciences shall be promoted in one or more seminaries of learning." The peculiar feature in the constitution and laws of Pennsylvania providing for the free education of the poor instead of common schools, was unfortunately adopted by New Jersey, Delaware, Maryland, and most of the southern states which had not enjoyed from their first beginnings the inestimable advantages of public schools "good enough for the rich and cheap enough for the poor." Owing to the sparseness of their population, their "peculiar institution," and difficulty of establishing good school habits in any community, public schools have never flourished in the southern and south-western states.

Virginia in 1796 passed a general school law, a portion of the preamble of which is as follows: "Whereas, upon a review of the history of mankind, it seemeth that, however favorable a republican government founded on the principles of equal liberty, justice and order may be to human happiness, no real stability or lasting permanency thereof can be rationally hoped for, if the minds of the citizens be not rendered liberal and humane, and be not fully impressed with the importance of those principles from whence these blessings proceed; with a view, therefore, to lay the first foundations of a system of education which may tend to produce those desirable purposes," etc. Georgia, Kentucky and Tennessee passed school laws with aims as generous as those of the above preamble; but the institutions established were for higher learning and the few, and not for the great masses of the community.

Ohio, Indiana, and all of the states formed out of the north-western and Louisiana territories, as they were admitted into the Union, adopted in their organic and early laws provisions for the appropriation of the funds created out of the educational land grants of Congress, before spoken of, to the support of common schools and colleges, on the plan of the eastern states. But it was soon found that it was not sufficient to pass laws, or even appropriate money liberally for the support of schools; those laws must be efficiently and uniformly administered, and the condition of the schools be brought constantly to the attention of the legislature and the people.

2. New York was the first state to create an officer to look after the operations of the school law, and to advise and assist local

school officers in its administration. The appointment by the legislature in 1813 of Gideon Hawley as superintendent of common schools, and his annual reports to the legislature on the working of the system, constitute an important era in the history of public instruction in the United States. Other states created the office, but devolved its administration on some other department already burdened with other and dissimilar duties. In 1826 Massachusetts required returns to be made of the condition of the public schools of each town, and in 1836 instituted a state board of education, with a salaried secretary whose business it was made "to collect information of the actual condition and efficiency of the common schools and other means of popular education, and diffuse as widely as possible throughout every part of the state information of the most approved methods of conducting the education of the young, that they may have the best education that common schools can be made to impart." This example was followed by Connecticut in 1838, and in less than ten years this great interest of public instruction, so far as covered by elementary schools, was recognized as a legitimate department of the government, in all the northern and western states.

Under the able and enthusiastic leadership of Horace Mann, the first secretary of the board of education in Massachusetts, the various plans and suggestions which had been proposed for ten or fifteen years previous, for the improvement of common schools, were matured and applied in the most efficient manner. Conventions of teachers, parents and friends of popular education were held for addresses and discussions, in every state, and in almost every county in every state which had appointed either a single officer, or a board with a paid secretary, to look after this interest. The regular and punctual attendance of all the children of a suitable age at school, the advantages of a gradation of schools, of parental visits to the schools, of an association of the teachers for mutual improvement, and the visiting of each other's schools; the evils arising from an improper location, construction and furniture of school houses, from a diversity of text books in the same study, from a multiplicity of studies in the same school, from the neglect of the young pupils and the primary studies, from a constant change of teachers, from the employment of teachers not properly qualified, from severe and unnatural punishments, from the want of suitable apparatus, from the mechanical processes of teaching reading, arithmetic, and other studies, from the neglect of moral education, these and other subjects were discussed in official reports, in the public press, and in professional school journals. Out of the more enlightened and interested public opinion of the country, in neighborhoods, villages, and cities, have resulted wise legislation, efficient organization, vigorous administration, and liberal appropriations, in respect to the material outfit of schools; and with these, but not as rapidly or as widely, have grown up better school attendance, more philosophical arrangement of studies, and improved methods of instruction and discipline.

3. Since 1840 the most marked improvement in the organization, administration and instruction of public schools, has been made in the larger cities of the several states, sometimes under the general school law of the state, but generally under special legislation. With the exception of Boston and a few of the other large cities of New England, the system of public schools was altogether inadequate to the educational wants of large communities. Expensive private schools were the main reliance for the education of the children of professional and wealthy families, while a large number of those whose means were inadequate, were left without provision for their instruction. The establishment of schools of different grades for children of different ages and studies, and especially of primary schools for young children under female teachers, and of a high school for the older boys and girls in studies heretofore pursued only in expensive private schools, has greatly increased the attendance and elevated the character of the public schools of our cities. By means of evening schools which have been established in many of our cities, the defective education of many young men has been remedied, and their various employments have been converted into more efficient instruments of self-culture.

4. With the improvement of schools in cities and large villages, the establishment of normal schools, teachers' associations, teachers' institutes, and educational journals, and state and local supervision, the country schools throughout the northern and western states are now in a good and hopeful condition.

CHAPTER IV.

ACADEMIES, HIGH SCHOOLS, AND OTHER INSTITUTIONS OF SECONDARY EDUCATION.

The first public schools of the American colonies were the free endowed grammar schools and subscription grammar schools; schools for secondary education. Public primary or elementary common schools were of later date, both in chronological order, and as being a logical result of their predecessors of higher grade.

The first school laws, those of Connecticut and Massachusetts, which were subsequent to the establishment by individuals or towns of the classes of schools they referred to, recognized all three grades of educational institutions, both what are at present termed common or elementary, and also secondary or superior; that is to say, common or neighborhood schools, grammar schools, and colleges.

The class of secondary schools, since the very earliest period of their establishment, has been far less cherished and supported, either by public opinion or by legal provisions, than either of the other two classes. Almost universally, the academy, the endowed school, the grammar school, has been wholly left to the support of those wealthier or more learned classes who have been tacitly assumed to have the only use for them; and where any state assistance has been extended to them, it has usually been in the exceptional form of individual acts of incorporation or individual grants of money or land.

It may be observed that such a co-equal public recognition, if extended to the class of secondary schools, would at once produce a definite and important result, in throwing probably half of what may be termed the present secondary course of study back within the course of the elementary grade of schools, and also in bringing back a large number of what are termed colleges into their appropriate grade of secondary institutions.

The noticeable and important fact is moreover thus brought out, that public opinion in the United States has never, up to the present time, demanded or recognized any universal privilege of education beyond that in the merest rudiments of it.

This neglect has of course caused the existing almost entire deficiency of recorded statistics of schools of this class. Such statistics are not accessible at all, except in the single state of New York, and even there, only from such secondary institutions as are obliged to furnish them as a condition of their receipt of a portion of the literature fund. This remark is not applicable to the grade of schools known as public high schools, for boys or girls, or both, in several of our larger cities; but these schools, few in number and of modern origin, are not so much the outgrowth of popular feelling, as the creations of a few intelligent friends of public education, in advance of any general demand for this class of institutions. Although not recognized generally as part of our systems of public instruction, schools of the former class have increased rapidly, and now exist in almost every village in the land, and their aggregate number in 1850, according to the census of that year, will be seen in the table on page 451.

The progress of this class of schools, in respect to studies, books, and equipment generally, and methods of instruction and discipline, can be readily measured by any one who will look into the best academy or public high school in his neighborhood, and then read the following communications—the first by the Hon. Josiah Quincy, respecting one of the earliest institutions of the class known as academies; and the other two by eminent public men, respecting the public schools, and particularly the Latin school of Boston, as it was prior to or about the beginning of the present century, and at that time pronounced "the best on the American continent."

"Mr. Barnard: *Dear Sir*—You ask briefly the position of Phillips Academy as to studies, text-books, methods, and discipline. That academy was founded in the year 1778, in the midst of the war of the Revolution, by the united contributions of three brothers—Samuel, John, and William Phillips—all of them men of property according to the scale of that day, and all of a liberal spirit toward every object, religious, moral, or educational. But the real author and instigator of that foundation was the only son of the first of the above-named, who was known during the early period of his life by the name of *Samuel Phillips, Junior*. He was, during his whole life, one of the most distinguished, exemplary, and popular men in Massachusetts; active, spirited, influential, and ready, and a leader in every good work;

and he had the control of the hearts of his father and two uncles, and was undoubtedly the influential spirit giving vitality to the plan of that institution. There was only one academy in the state at that time—Dummer Academy at Newbury—which, although it had sent forth many good scholars, was then going to decay; and the beautiful and commanding site in the south parish of Andover which that institution now occupies, was unquestionably one of the causes of the idea of the institution as well as of its locality. Eliphalet Pearson had been educated at Dummer Academy, was distinguished for his scholarship and zeal in the cause of classical learning; Samuel Phillips, jr., had formed an intimacy with him at college, though in different classes, and entertained a high opinion both of his literary attainments and spirit of discipline. Phillips Academy was projected with reference to his becoming its first master; and his aid was joined with that of his friend Phillips in forming the constitution of the academy.

"The time of its foundation was unquestionably most inauspicious to its success, but young Phillips was of a spirit that quailed before no obstacles. It was designed to be a model institution of the kind, and no pains were omitted to secure its success; and notwithstanding the uncertainties of the political aspect of the time and the perpetually increasing depreciation of paper money, it was sustained in great usefulness and prosperity. I was sent to that academy within a month after its opening, in May, 1778, being the seventh admission on its catalogue. I had just then entered upon my seventh year, and was thrust at once into my Latin at a period of life when noun, pronoun, and participle were terms of mysterious meaning which all the explanations of my grammars and my masters for a long time vainly attempted to make me comprehend. But the laws of the school were imperious. They had no regard for my age, and I was for years submitted to the studies and discipline of the seminary, which, though I could repeat the former, through want of comprehension of their meaning, I could not possibly understand. I was sent to the academy two years at least before I ought to have been. But William Phillips was my grandfather; it was deemed desirable that the founders of the academy should show confidence in its advantages; I was, therefore, sent at once, upon its first opening, and I have always regarded the severe discipline to which I was subjected, in consequence of the inadequacy of my years to my studies, as a humble contribution toward the success of the academy.

"The course of studies and text-books I do not believe I can from memory exactly recapitulate; I cannot, however, be far out of the way in stating that 'Cheever's Accidence' was our first book; the second, 'Corderius;' the third, 'Nepos;' then, if I mistake not, came 'Virgil.' There may have been some intermediate author which has escaped my memory, but besides Virgil I have no recollection of any higher author.

"Our grammar was 'Ward's,' in which all the rules and explanations are in Latin, and we were drilled sedulously in writing this language far enough to get into the university. Our studies in Greek were very slight and superficial. Gloucester's Greek Grammar was our guide in that language, and a thorough ability to construe the four Gospels was all required of us to enter the college.

"These are the best answers I can give to your inquiries on the subject of 'studies and text-books,' but I am not confident that my memory serves me with exactness. Our preparation was limited enough, but sufficient for the poverty and distracted state of the period.

"Of 'methods and discipline,' for which you inquire, I can only say that the former was strict and exact, and the latter severe. Pearson was a convert to thorough discipline; monitors kept an account of all of a student's failures, idleness, inattention, whispering, and like deviations from order, and at the end of the week were bestowed substantial rewards for such self-indulgences, distributed upon the head and hand with no lack of strength or fidelity.

"In that day arithmetic was begun at the university. The degree of preparation for college and the amount of the studies within it are not worthy of remembrance when compared with the means of acquirement now presented to the aspiring student.

"Your other inquiries I should be happy to make the subject of reply, but long cessation of familiarity with the objects to which they relate makes me dubious of my power to add any thing important to their history. My knowledge of the common schools of Boston was obtained only during the vacations of the academy, and had chief reference to improvement in my writing. Their advantages were few enough and humble enough; the education of females very slight, and limited to reading, writing, and the earlier branches of arithmetic.

"The interests of schools and of education were, thirty years ago, subjects of my thought and writing; but the lapse of time and the interposition of other objects and new duties deprive me of the power of aiding your researches on these subjects, which are, however, easily and far better satisfied by the active men of the day. Wishing you all success in these wise and noble pursuits,

"I am, very truly,

"Your friend and servant,

"JOSIAH QUINCY."

"BOSTON, Dec. 1st, 1860."

The following "Memorandum of an eminent clergyman, who was educated in the best schools of Boston just before the Revolution," we copy from a volume of the "Massachusetts Common School Journal," vol. xii., pp. 311, 312. The notes are by the editor of the Journal, Wm. B. Fowle:

"At the age of six and a half years, I was sent to Master John Lovell's Latin school. The only requirement was reading well; but, though fully qualified, I was sent away to Master Griffith, a private teacher, to learn to read, write and spell. I learned the English Grammar in Dilworth's Spelling Book by heart. Griffith traced letters with a pencil, and the pupils inked them.

"Entered Lovell's school at seven years. Lovell was a tyrant, and his system one of terror. Trouncing* was common in the school. Dr. Cooper was one of his early scholars, and he told Dr. Jackson, the minister of Brookline, that he had dreams of school till he died. The boys were so afraid they could not study. Sam. Bradford, afterward sheriff, pronounced the *P* in *Ptolemy*, and the younger Lovell rapped him over the head with a heavy ferule.*

"We studied Latin from 8 o'clock till 11, and from 1 till dark. After one or two years, I went to the town school, to Master Holbrook, at the corner of West street, to learn to write; and to Master Proctor, on Pemberton's Hill, in the south-east part of Scollay's Building. My second, third, and fourth year, I wrote there, and did nothing else. The English boys alone were taught to make pens. Griffith was gentle, but his being a private teacher accounts for it.

"The course of study was, grammar; Esop, with a translation; Clarke's Introduction to writing Latin; Eutropius, with a translation; Corderius; Ovid's Metamorphoses; Virgil's Georgics; Æneid; Cæsar; Cicero. In the sixth year I began Greek, and for the first time attempted English composition, by translating Cæsar's Commentaries. The master allowed us to read poetical translations, such as Trappe's and Dryden's Virgil. I was half way through Virgil when I began Greek with Ward's Greek Grammar.

"After Cheever's Latin Accidence, we took Ward's Lily's Latin Grammer. After the Greek Grammar, we read the Greek Testament, and were allowed to use Beza's Latin translation. Then came Homer's Iliad, five or six books, using Clarke's translation with notes, and this was all my Greek education at school. Then we took Horace, and composed Latin verses, using the Gradus ad Parnassum. Daniel Jones was the first Latin scholar in 1771 or 1772,

* "Trouncing was performed by stripping the boy, mounting him on another's back, and whipping him with birch rods, before the whole school. James Lovell, the grandson of John, once related to us the following anecdote, which shows the *utility* of corporal punishment! It seems that a boy had played truant, and Master John had publicly declared that the offender should be trounced. When such a sentence was pronounced, it was understood that the other boys might seize the criminal, and take him to school by force. The culprit was soon seized by one party, and hurried to the master, who inflicted the punishment without delay. On his way home, the culprit met another party, who cried out, 'Ah, John Brown,' or whatever his name was, 'you'll get it when you go to school!' 'No, I shan't,' said the victorious boy, who felt that he had got the start of them, 'No, I shan't, for *I've got it*,' and, as he said this, he slapped his hand upon the part that had paid the penalty, thus, as the poet says, 'suiting the action to the word.'"

* "We saw this done by another Boston teacher, about thirty years ago, and when we remonstrated with him upon the danger of inflicting such a blow, upon such a spot, 'O, the caitiffs,' said he, 'it is good for them!' About the same time, another teacher, who used to strike his pupils upon the hand so that the marks and bruises were visible, was waited upon by a committee of mothers, who lived near the school, and had been annoyed by the outcries of the sufferers. The teacher promised not to strike the boys any more on the *hand*, and the women went away satisfied. But, instead of inflicting blows upon the hand, he inflicted them upon the soles of the feet, and made the punishment more severe."

and he was brother to Thomas Kilby Jones, who was no scholar, though a distinguished merchant afterward.

"I entered college at the age of fourteen years and three months, and was equal in Latin and Greek to the best in the senior class. Xenophon and Sallust were the only books used in college that I had not studied. I went to the private school from 11 to 12 A. M., and to the public from 3 to 5 P. M.

"The last two years of my school life, nobody taught English Grammar or Geography, but Col. Joseph Ward (son of Deacon Joseph Ward, of Newton, West Parish, blacksmith,) who was self-taught, and set up a school in Boston. He became aid to General Ward when the war commenced, and did not teach after the war.

"I never saw a map, except in Cæsar's Commentaries, and did not know what that meant. Our class studied Lowth's English Grammar at college. At Master Proctor's school, reading and writing were taught in the same room, to girls and boys, from 7 to 14 years of age, and the Bible was the only reading book. Dilworth's Spelling Book was used, and the New England Primer. The master set sums in our MSS. but did not go farther than the Rule of Three.

"Master Griffith was a thin man, and wore a wig, as did Masters Lovell and Proctor, but they wore a cap when not in full dress. James Lovell was so beaten by his grandfather John, that James the father rose and said, 'Sir, you have flogged that boy enough.' The boy went off determined to leave school, and go to Master Proctor's; but he met one of Master Proctor's boys, who asked whither he was going, and when informed, warned him not to go, for he would fare worse."

Hon. Edward Everett, in an address at the Annual School Festival in Faneuil Hall in 1852, gives the following account of the educational advantages he enjoyed in early life:—

"It was fifty-two years last April since I began, at the age of nine years, to attend the reading and writing schools in North Bennett street. The reading school was under Master Little, (for 'Young America' had not yet repudiated that title,) and the writing school was kept by Master Tileston. Master Little, in spite of his name, was a giant in stature—six feet four, at least—and somewhat wedded to the past. He struggled earnestly against the change then taking place in the pronunciation of *u*, and insisted on saying *monooment* and *natur*. But I acquired, under his tuition, what was thought in those days a very tolerable knowledge of Lindley Murray's abridgment of English grammar, and at the end of the year could parse almost any sentence in the 'American Preceptor.' Master Tileston was a writing master of the old school. He set the copies himself, and taught that beautiful old Boston handwriting, which, if I do not mistake, has, in the march of innovation, (which is not always the same thing as improvement,) been changed very little for the better. Master Tileston was advanced in years, and had found a qualification for his calling as a writing master, in what might have seemed at first to threaten to be an obstruction. The fingers of his right hand had been contracted and stiffened in early life, by a burn, but were fixed in just the position to hold a pen and a penknife—and nothing else. As they were also considerably indurated, they served as a convenient instrument of discipline. A copy badly written, or a blotted page, was sometimes visited with an infliction which would have done no discredit to the beak of a bald eagle. His long, deep desk was a perfect curiosity-shop of confiscated balls, tops, penknives, marbles and Jews-harps—the accumulation of forty years. I desire, however, to speak of him with gratitude, for he put me on the track of an acquisition which has been extremely useful to me in after life—that of a plain, legible hand. I remained at these schools about sixteen months, and had the good fortune in 1804 to receive the Franklin medal in the English department. After an interval of about a year, during which I attended a private school kept by Mr. Ezekiel Webster, of New Hampshire, and on an occasion of his absence, by his ever memorable brother, Daniel Webster, at that time a student of law in Boston, I went to the Latin school, then slowly emerging from a state of extreme depression. It was kept in School street, where the Horticultural Hall now stands. The standard of scholastic attainment was certainly not higher than that of material comfort in those days. We read pretty much the same books—or of the same class—in Latin and Greek, as are read now, but in a very cursory and superficial manner. There was no attention paid to the philosophy of the languages—to the deduction of words from their radical elements—to the niceties of construction—still less to prosody. I never made a hexameter or pentameter verse, till, years afterward, I had a son at school in London, who occasionally required a little aid in that way. The subsidiary and illustrative branches were wholly unknown in the Latin school in 1805. Such a thing as a school library, a book of reference, a critical edition of a classic, a map, a black-board, an engraving of an ancient building, or a copy of a work of ancient art, such as now adorn the walls of our schools, was as little known as the electric telegraph. If our children, who possess all these appliances and aids to learning, do not greatly excel their parents, they will be much to blame."

CHAPTER V.

COLLEGES.

The colleges of the United States were, at the close of the Revolutionary war, seven in number. They had been founded with the design of providing for the new commonwealths the means of a training for the young men, substantially similar to that afforded by the universities at home. Their course of study was four years in length, and was at first decidedly theological in character, and subsequently more and more secularized. The average age of those entering was somewhat less than now; and they conferred, as at present, degrees in arts in course, and honorary ones in arts, law, and divinity.

With the growth of the United States they have rapidly increased in number, being supported, beyond the receipts for tuition, either by endowments raised for each among the denomination to which it belongs, or by the proceeds of state gifts of lands or money. The number of this class of institutions incorporated with power to confer academic honors, exceeds two hundred. The length of their course of study remains the same, and indeed this is the case in all their essential characteristics. Although there has been a gradual elevation of the standard of acquirements made requisite for entrance, this preliminary examination has not been sufficiently exacting and uniform. As their funds and the number of their students have enlarged, they have shown a tendency, not to increase the length and completeness of their course of study, but rather to multiply the number of studies attempted to be taught, by adding them to the undergraduate course; and in a few instances also to annex special schools in one or another department, such as law, medicine, theology, and the application of science to industrial occupations.

Mr. Everett gives the following picture of college life at Harvard as it was fifty years ago:—

"But short as the time is since I entered college (only half as long as that which has elapsed since the close of the seven years' war), it has made me the witness of wonderful changes, both materially and intellectually, in all that concerns our *Alma Mater*. Let me sketch you the outlines of the picture, fresh to my mind's eye as the image in the *camera*, which the precincts of the college exhibited in 1807. The Common was then uninclosed. It was not so much traversed by roads in all directions; it was at once all road and no road at all,—a waste of mud and of dust, according to the season, without grass, trees, or fences. As to the streets in those days, the 'Appian Way' existed then as now; and I must allow that it bore the same resemblance then as now to the *Regina Viarum*, by which the consuls and proconsuls of Rome went forth to the conquest of Epirus, Macedonia, and the East.

"As to public buildings in the neighborhood of the university, with the exception of the Episcopal church, no one of the churches now standing was then in existence. The old parish church has disappeared, with its square pews, and galleries from which you might almost jump into the pulpit. It occupied a portion of the space between Dane Hall and the old Presidential House. I planted a row of elm and oak trees a few years ago on the spot where it stood, for which, if for nothing else, I hope to be kindly remembered by posterity. The wooden building now used as a gymnasium, and, I believe, for some other purposes, then stood where Lyceum Hall now stands. It was the county court-house; and there I often heard the voice of the venerable Chief Justice Parsons. Graduates' Hall did not exist; but on a part of the site, and behind the beautiful linden trees still flourishing, was an old black wooden house, the residence of the professor of mathematics. A little further to the north, and just at the corner of Church street, which was not then opened, stood what was dignified in the annual college catalogue (which was printed on one side of a sheet of paper, and was a novelty) as 'The College House.' The cellar is still visible. By the students this edifice was disrespectfully called 'Wiswall's Den,' or, for brevity, 'the Den.' I lived in it in my freshman year. Whence the name of 'Wiswall's Den' was derived, I hardly dare say; there was something worse than 'old fogy' about it. There was a dismal tradition that, at some former period, it had been the scene of a murder. A brutal husband had dragged his wife by the hair up and down the stairs, and then killed her. On the anniversary of the murder—and what day that was no one knew—there were sights and sounds—flitting garments draggled in blood, plaintive screams, *stridor ferri tractæque catenæ*—enough to appall the stoutest sophomore. But, for myself, I can truly say, that I got through my freshman year without having seen the ghost of Mr. Wiswall or his lamented lady. I was not, however, sorry when the twelvemonth was up, and I was transferred to the light, airy, well-ventilated room, No. 20 Hollis; being the inner room, ground-floor, north entry of that ancient and respectable edifice."

The tables on pages 451-3 exhibit the number, date of foundation, and statistics of our American colleges in several important particulars.

CHAPTER VI.

PROFESSIONAL, SCIENTIFIC, AND SPECIAL SCHOOLS.

As the body of human knowledge increased in extent, and filled out in detail, it subdivided by a natural process into a greater and greater number of sciences, as did the industrial side of life into a greater and greater number of employments. A subdivision and increase in the number of schools, preparatory to the business of life, naturally accompanied this process.

The colleges of the United States, according to this law of development, were in their early day designed primarily to train future clergymen, and secondarily to train those intending to enter the public service. For a long time college graduates had no means of enjoying further instruction in either of the then recognized learned professions, but by residing near or in the family of some eminent clergyman, lawyer, or physician, acting as his assistant and receiving his instructions. Then, when they considered themselves fit, or an invitation came, they took their place in the ranks of their profession. Gradually the necessity of special opportunities of instruction in the principles, and their diverse and complicated applications, led to the establishment of schools of theology, medicine, and law; and still later, of special courses of instruction, and finally, of special schools for the practical chemist, geologist, civil and military engineer, agriculturist and teacher. This department of education is not yet aided systematically in any state, and is hardly recognized by a majority of the states in their systems of public instruction. Most of this class of institutions have been established by denominational or professional associations, or by the liberality of individuals in advance of or as the inducement to legislative aid.

CHAPTER VII.

THEOLOGICAL SCHOOLS.

The future clergyman, in the American colonies, had already studied theology in his college course. It was probably common for graduates to serve what may be well enough termed an apprenticeship under some eminent clergyman, after leaving college. During the first half of the eighteenth century, the custom grew up of subjecting the candidate for the ministry to examination by a number of ministers, and licensing him to preach as candidate. Dr. Bellamy first introduced at his house at Bethlem, Connecticut, the plan of giving something like a regular course of instruction to students in theology. A little later the practice became quite general, and was confirmed by the gradual elimination of its theological character from the course of study in the colleges.

The first separate theological school in the United States was that at Andover, founded and opened in 1807. The thorough three years' course of study here established soon did away with the comparatively inefficient and superficial apprenticeship scheme, which afforded a professional training of twelve, six, or even only three months.

Of previous departmental or imperfect provisions for specific ministerial training, should be mentioned the academy known as "Log College," of Rev. William Tennent, at

Neshaminy, Bucks county, Pa., opened about 1728; the preparatory school opened by Rev. John Smith in the west of Pennsylvania in 1778, afterward under Rev. J. Anderson, D. D.; William and Mary College, which included a professorship of divinity in 1693; the foundation of the Hollis professorship of divinity at Harvard College in 1721; and that of the Livingston professorship of divinity at Yale College in 1746.

The table, altered into chronological succession from the American Almanac, 1861, gives the growth of this class of special schools.

CHAPTER VIII.

LAW SCHOOLS.

The professional education of colonial lawyers was equally unscientific, with the exception of the few who obtained a legal education at the Middle or Inner Temple in London, those inns of court being the favorite resorts of American students. Law, indeed, was then scarcely considered a liberal science in this country, and the profession was in more than one instance discouraged or actually forbidden by colonial constitutions or laws. Thus, in 1660, Virginia, by her house of burgesses, voted for "the total ejection of mercenary attorneys;" Massachusetts, in 1663, prohibited "usual and common attorneys in any inferior court," from being members of the legislature; and Locke's constitution for Carolina permitted "no one to plead another man's cause." The only professional training between the college course and actual practice was in the office of some practitioner already established, where the aspirant served for an indefinite period as an attorney's clerk, usually learning to draw instruments, and obtaining a desultory knowledge of forms, technics and special pleading, but very seldom pursuing any regulated course of study or systematically mastering his subject.

The first separate institution for legal instruction was the celebrated law school at Litchfield, Connecticut, established by Judge Reeve in 1784, taught by him alone until 1798, then together with Judge Gould until a little before Judge Reeve's death in 1823, and afterward by Judge Gould alone until 1827. Seven hundred and fifty students in all studied law in this school; who, scattered over the whole country, carried with them and instilled into the profession at large the idea of a special and systematic training for the practice of law.

We append a table, altered from the American Almanac for 1861, of the existing law schools or collegiate departments in the United States, in the order of their foundation. It should, however, be observed that some legal studies were included in the original scheme of William and Mary College, founded 1693, and the law course became of some positive value by improvements about 1730. Also, that a law professorship was founded in the College of Philadelphia in 1790; a professor of law appointed at Yale College in 1801; and the Royall Professorship of Law at Harvard, founded in 1815.

CHAPTER IX.

MEDICAL SCHOOLS.

Medical schools are of quite recent date; and the training of the young physician was of a very irregular character during the colonial period. Degrees of Doctor of Medicine were possessed by a very few practising physicians, who had studied at Edinburgh, Leyden, or other European schools. The few eminent physicians who were trained exclusively in the colonies, were to a great extent followers of a natural gift and tendency, which went far to supply their lack of school learning. Young men proposing to become physicians, practised in the offices and under the instruction of established physicians. Down to the middle of the 18th century, it was the frequent practice, in Connecticut, at least, to obtain a formal license from the general court, which was commonly granted on petition of the aspirant, reinforced by testimonials from the freemen of his town, the town officers, or practising physicians. Sometimes the only credentials of the beginner, were the certificate of the physician with whom he had studied. After college courses of medical lectures were established, a license from the faculty was given, which served instead of the subsequent diploma.

The earliest collegiate medical department in the United States was that of the University of Pennsylvania in 1765. Dr. Shippen had lectured on anatomy in 1762.

We add a chronological table, altered from the American Almanac for 1861, of the medical schools of the United States.

CHAPTER X.

MILITARY AND NAVAL SCHOOLS.

The experience of the Revolutionary war occasioned a very general conviction among the officers of the American army, of the necessity for such a provision for the military education of native officers as would relieve the United States from a dependence upon professionally trained soldiers of foreign birth. The idea of a military school of some kind, to be connected with each United States arsenal, was entertained at the close of the war among the officers.

In the spring of 1783, General Washington requested from a number of leading officers, statements of their views on all subjects connected with the peace establishment of the United States army. In reply to this request, Colonel Timothy Pickering, then quartermaster-general, drew up an able and interesting memoir, which contains, it is believed, the first suggestion of a single central government military academy, and he also suggested West Point as a proper location for it.

President Washington's annual address to Congress of December 3, 1793, asks "whether a material feature in the improvement of a system of national defence ought not to be to afford an opportunity for the study of those branches of the military art, which can scarcely ever be attained by practice alone."

An act of Congress of May 9, 1794, authorized a corps of four battalions of artillerists and engineers, to each of which were to be attached eight cadets. This was the first introduction into the military service of the United States of this term, which may be defined to signify a grade of officers between the highest non-commissioned officer, a sergeant, and the lowest commissioned one, an ensign. For the use of this corps and cadets, the secretary of war, Colonel Pickering, was authorized to procure the necessary books and apparatus. The secretary, in 1796, reports that this organization is important, and should be as stationary as practicable, with a view to instruction.

President Washington's last annual speech to Congress, December, 1796, again urged strongly the establishment of a military academy. In April, 1798, the corps of artillerists and engineers was increased by an additional regiment, and the number of cadets enlarged to fifty-six. In July following, four teachers were by Congress authorized to be employed in that regiment for instruction in science and art. Some officers and men were collected at West Point, and a sort of military school opened, which, however, acted with little efficiency, owing to the want of preparatory training, and of organization.

Secretary of War McHenry, in a report on the organization of the army, made during the expectation of a war with France, dated December 24, 1798, lamented the want of engineers and artillerists trained at home. In January, 1800, the same officer laid before the President, who transmitted it to Congress, a plan for establishing a military academy. After referring to the imperfect steps already taken in this direction, he proceeds to suggest that the proposed academy shall consist of a "fundamental school," to instruct in such departments of science as are necessary in common in all the arms of the military force; and three special schools, one of engineers and artillerists, one of cavalry and infantry, and one of the navy. The institution was to be in charge of a director-general, four directors, twelve professors, and nine other instructors. This school, so far as Secretary McHenry recommended its immediate establishment, was to accommodate annual classes of one hundred pupils each, for courses of four and five years.

The Military Academy at West Point, according to Colonel Williams' report in 1808, was first opened in 1801, as a "mathematical school for the few cadets that were then in service," and under a private citizen. In 1802, an act of Congress separated the artillerists and engineers, distributing the cadets of the former class among the twenty companies of that arm, and constituted the engineers the Military Academy, making it consist of seven officers and ten cadets.

The operations of the school continued to be deficient in order and efficiency for some years, still for want of proper and energetic administration, and a well adjusted course of study. In 1812, it was much enlarged, and its organization quite changed. The period from 1817 to 1824, however, during which a thorough course of theoretical and practical studies, properly adapted to the military profession, was for the first time introduced, marks the establishment of the academy as a military and scientific school of high grade and value.

The academy, in 1860, was organized under a superintendent, who is commandant of the post, and a corps of forty-six instructors and officers. Its course of study is of five years, and is intended to train the pupils in military science and art as applicable to all arms of the service. The number of pupils is by law fixed at one from each congressional and territorial representative district, together with ten appointed at large; being at present a total limit of 252.

OTHER MILITARY SCHOOLS.

In 1839, the state of Virginia established in connection with Washington College, at Lexington, Va., the "Virginia Military Institute," intended to instruct young men in tactics and civil engineering. There were in 1858 eleven instructors. The pupils are divided into state cadets and pay cadets; the latter class paying their expenses, and the former supported out of a state appropriation of $6000 a year, and an additional sum of $1,500 from the literary fund.

Two similar schools were established by South Carolina in 1842—the Arsenal Academy at Columbia, and the Citadel Academy at Charleston. These contemplate a similar course, and are aided by a state appropriation, which was in 1859 $30,000. A military academy at Lexington, Kentucky, is aided by the state, and is under a board of nine members, appointed by the state. Louisiana has a military school of the same character. These institutions have been found well adapted to the character of southern pupils, and are flourishing and useful.

Of the various private schools which have or have had an infusion of the military element, one of the most prominent was that of Captain Alden Partridge. Captain Partridge was a native of Norwich, Vt., where he died, aged 70, in 1854. He was a military instructor during nearly fifty years, being principal of the West Point Academy from 1812 to 1816; and afterward conducting a private military school, successively at Norwich, Vt., Middletown, Ct., Portsmouth, Va., and Brandywine Springs, Del., nearly or quite down to the time of his death.

A number of private schools and other institutions in various parts of the country have adopted more or less of a military organization, as a means of securing physical exercise, amusement, and mental and moral discipline. A military drill, for instance, is part of the regular exercises of the University of Nashville, Tennessee; and the pupils of the well-known school of Professor William Russell, of New Haven, Connecticut, are regularly and thoroughly drilled as an infantry company.

THE NAVAL ACADEMY.

The Naval Academy at Annapolis, Maryland (in 1861 removed to Newport, R. I.), was founded in October, 1845, by the efforts of the Hon. George Bancroft, then secretary of the navy. All the efforts which had previously been made on board of our national cruisers, in the navy yards of Boston, New York, and Norfolk, and in the Naval Asylum of Philadelphia, were found to be insufficient for the proper training and education of midshipmen.

During the infancy of the academy, several plans of an experimental character were tried, which led gradually to the adoption of the admirable system of education now in operation. Midshipmen who had made a cruise at sea, were first sent to the academy, for a term of nine months, to prepare for their final examination, which practice was continued until 1847. In that year, a board of officers recommended a course of four years at the academy—viz., two years before and two years after a cruise at sea. This plan went into operation, but it was soon abandoned, owing to the constant demand at sea for midshipmen during the Mexican war, and it was not until 1851 that the present uninterrupted course of four years at the academy was inaugurated.

Candidates for the Naval Academy are appointed upon the recommendation of members of Congress, and each state and territory is entitled to a number of appointments corresponding with its congressional representatives. Candidates are admitted between the 20th of September and the 1st of October of each year, and, if successful in the preliminary examination, are permitted to assume the naval uniform, and, in the capacity of acting midshipmen, begin their career on the school-ship "Constitution." This noble old frigate, lately become an adjunct to the Naval Academy, is the home of the fourth class, during the first year of the course.

The entire corps of acting midshipmen now at the Naval Academy is about two hundred strong, and is divided into four classes, three of which occupy the quarters on shore. During the summer vacation, two of the classes are drafted on board the practice-ship to make a cruise in the Atlantic Ocean, and they return well versed in the duties of an officer and a sailor, and in the rigging and evolutions of a ship. During the course of four years they are subjected to eight severe examinations, and, if successful in all, they receive a midshipman's warrant; then they go to sea for two years, and return once more to the academy for their final examination. Thus, the term of a midshipman's apprenticeship is six years, at the expiration of which he receives the warrant of a passed-midshipman, and is then left to carve out his own destiny.

The academy is governed by a captain in the navy, assisted by an executive officer and several lieutenants, who are charged with the discipline of the establishment and the instruction of the midshipmen in strictly professional branches. The other departments of instruction are intrusted to competent professors, and the academy is supplied with a valuable library and scientific apparatus, which aid materially in the education of the "future hope of the navy."

CHAPTER XI.

NORMAL SCHOOLS AND OTHER INSTITUTIONS AND AGENCIES FOR THE PROFESSIONAL TRAINING OF TEACHERS.

Teaching was not recognized as a science or an art in this country until long after what are termed *par excellence* the learned professions. Indeed, it is not by any means yet admitted to its proper dignity as such; and of special schools of preparation for it, only one can date back more than about forty years, viz., Mr. Hall's, established in 1823.

During the colonial period of the United States, and indeed until within cotemporary memory, teachers were expected to be supplied for many of the more advanced village or district schools, from educational institutions of the higher grades, mainly from the colleges, many of whose students were in the habit of teaching during the winter term. The remaining public schools, in the country at least, were commonly kept by persons who had received no other education than the same class of schools had furnished.

The principal agencies introduced in modern times for the professional training of teachers, setting apart the actual incidental practice already mentioned, by college students and graduates of district schools, and also systematized books on the theory and practice of education,* may be enumerated as 1. Teachers' Associations; 2. Educational Periodicals; 3. Normal Schools; 4. Teachers' Institutes; which agencies respectively first commenced their operations within the United States, in the order named; the two latter, however, in the same year, with an interval of only about four months.

Of Teachers' Associations for professional improvement, the earliest in this country, so far as is known, was the "Middlesex County Association for the Improvement of Common Schools," formed at Middletown, Connecticut, in 1799. The "Incorporated Society of Teachers," in the city of New York, of which Albert Picket was president, and John W. Picket, his brother, corresponding secretary, was incorporated in 1811. The Essex County (Mass.) Teachers' Association was established in August, 1830, by teachers from that county, with a constitution and officers. It is still in existence, and has maintained its series of semi-annual meetings and of lectures unbroken to the present time. The Western College of Teachers, a useful and influential body, was formed in 1831, by the influence of the brothers Picket, Samuel Lewis, and other early friends of education in Ohio and the West.

Far the most prominent and influential, however, of all the existing educational associations in the country, is the American Institute of Instruction. The formation of this body was the ultimate result of a movement which commenced by a meeting of teachers and friends of education at Boston, March 15th to 18th, 1830. This meeting debated and resolved upon a "permanent as-

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* The following is a list of some of the earlier American publications on the principles and methods of education:—

Abbott, J. *The Teacher.*

Alcott, W. A. *History of First District School of Hartford. Word to Primary School Teachers. Confessions of a Schoolmaster. Slate and Blackboard Exercises.*

Beecher, Miss C. E. *Suggestions on Female Education.*

Burton, W. *The District School as it Was.*

Davis, E. *Manual for Teachers.*

Emerson, G. B. *The Schoolmaster.*

Griscom, J. *Monitorial Instruction.*

Hall, S. *Lectures on School Keeping. Lectures to Female Teachers.*

Page, D. P. *Theory and Practice of Teaching.*

Palmer, T. H. *Prize Essay on Teaching.*

Potter, A. *The School.*

Russell, W. *Suggestions on Education. Manual of Mutual Instruction.*

sociation of persons engaged and interested in the business of instruction;" and, in pursuance of its votes, an adjourned meeting was held at Boston in August following, at which its constitution and name were adopted, and its first course of lectures delivered. It was incorporated in 1831 by the legislature of Massachusetts, and has received an annual grant from that state. Its series of annual meetings is still continued, and its accompanying series of annual volumes of lectures has now reached the 31st, and includes a valuable mass of useful theoretical and practical discussions.

During the period of educational interest which produced the American Institute of Instruction, many conventions and meetings of teachers and friends of education assembled in different parts of the country, to consult and debate upon means of improvement for schools and teachers. Among the more earnest and efficient of these may be named the Windham County (Conn.) Convention, which met in 1826; the Hartford Society for the Improvement of Common Schools, formed in 1827, and among whose members were Messrs. Hooker, Gallaudet, W. C. Woodbridge, and others; the Pennsylvania Society for the Promotion of Public Schools, formed in 1828; and the Convention of the Teachers of New York, which met at Utica in 1832. These bodies frequently possessed scarcely more than an annual existence, meeting from year to year in pursuance of a new call. Their efforts, however, and the evident capacities of such organizations for usefulness, led directly to the subsequent formation of that class of educational societies known as "State Teachers' Associations." Of these, the Massachusetts State Teachers' Association, and the Rhode Island Institute of Instruction, were organized in 1845; the Ohio State Teachers' Association in 1847; and others have followed, until at present there are no less than twenty-seven State Teachers' Associations, some of them acting with remarkable efficiency for the professional improvement of teachers. In connection with these state bodies, county associations exist in several states, some of them enjoying state aid, and many of them useful co-laborers in the educational field with the state associations with which they are affiliated.

The first proposition in this country for a periodical to be devoted to education was made by Rev. Samuel Bacon, a native of Sturbridge, Massachusetts, who, in 1812, issued the prospectus of a periodical, to be known as *The Academical Herald and Journal of Education.* Mr. Bacon subsequently resumed this idea, but gave it up again upon the appearance of the first actual American educational periodical, *The Academician.* This was a large octavo, issued semi-monthly, at New York, during the years 1818–19, and edited by Albert Picket and John W. Picket, afterward the well-known early influential members of the "Western College of Teachers."

This field of labor now remained unoccupied until the appearance of the *American Journal of Education*, commenced January 1st, 1825, at Boston, Mr. T. B. Wait publisher, and edited by Professor William Russell. With its continuation, the *American Annals of Education*, this well-known and valuable journal appeared until the end of 1839, completing an entire series of fourteen octavo volumes.

In January, 1836, appeared the first number of the *Common School Assistant*, a quarto monthly, edited by J. Orville Taylor, and which was published at Albany, and afterward at New York, during four years and four volumes, and part of a fifth, ending in 1840. This periodical was energetically and usefully edited, was taken and read throughout the country, and did a good work in its day and generation for the cause of common schools.

Mr. Taylor also did much for the cause of education by publishing a *Common School Almanac*, and by delivering forcible and apt addresses on educational subjects in many states of the Union.

In August, 1838, appeared at Hartford, Connecticut, the first number of the quarto *Connecticut Common School Journal*, edited by Henry Barnard, Secretary of the Board of Commissioners of Common Schools. This periodical was published during four years, ending in consequence of the strange reactionary rally which abolished the board in 1842. It contained the state public educational documents of its day, beside a great quantity of valuable selections and original articles. A second series in octavo form was commenced by Mr. Barnard in 1850, covering substantially the same ground, and continued by him until January, 1854, when he surrendered its care to the Connecticut State Teachers' Association, which still publishes it. The interval between 1843 and 1850 was covered by the publication of the *Jour-*

nal of the Rhode Island Institute of Instruction, embodying the official documents and action of Mr. Barnard in that state as commissioner of public achools.

In August, 1855, Mr. Barnard issued the first number of his *American Journal of Education*, published at Hartford, quarterly, in octavo. The plan contemplated a series of at least ten volumes, of about 800 pages, to constitute an encyclopædia of educational materials of permanent value, illustrative of the history, biography, theory, and practice of all departments of education, both in this country and in other parts of the world, as well as a record of cotemporary educational facts and progress. In the progress of this plan hitherto, the ten volumes already completed have included over 300 cuts on school architecture, more than forty singularly fine portraits of eminent American teachers and educators, a still larger number of memoirs, and over 1600 pages on the comparatively new and most important department of methodology.

The earliest suggestion of institutional provision for the specific professional training of teachers seems to have been that of Elisha Ticknor, in an article in the *Massachusetts Magazine* for June, 1789, for county schools under able masters, to teach English grammar, Latin, Greek, rhetoric, geography, mathematics, etc., "in order to fit young gentlemen for college and school keeping."

The first proposition for a separate and exclusive teachers' seminary was, however, set forth by the late Professor Denison Olmsted, in an oration at receiving his master's degree, at commencement, 1816, on the "State of Education in Connecticut." This was to be a state institution, to train teachers for the state public schools. Professor Olmsted's prosecution of his plan was prevented by his accepting a professorship in North Carolina.

Seven years afterward, in March, 1823, Rev. Samuel Read Hall opened at Concord, Vermont, the first teachers' seminary in the United States; an unpretending little school, planned in consequence of his own observations upon the wants of teachers, intended for the improvement of teachers in and near his own town, and including a model class of juvenile pupils.

During the years 1824–5, Messrs. Thomas H. Gallaudet of Hartford, Connecticut; James G. Carter of Lancaster, Massachusetts; and Walter R. Johnson of Germantown, Pennsylvania, issued various pamphlets and newspaper articles, ably urging the necessity, practicability, and advantages of institutions for the professional training of teachers.

In February, 1826, a committee was appointed by the legislature of Massachusetts to report a plan for an institution to instruct in practical arts and sciences. This committee included in the plan recommended by them a department for the professional training of teachers. This scheme was not, however, carried into operation.

In the next year, 1827, Governor Clinton recommended to the legislature of the state of New York the establishment of a normal school, and an act was passed for that purpose. It was, however, strongly opposed by Hon. John C. Spencer, who succeeded in preventing it from going into operation, and in causing the adoption instead of the plan of teachers' departments in academies.

The earliest instance of a teachers' institute in this country, though not then so named, was the experimental one gathered at Hartford, Connecticut, in October, 1839, by the means and at the expense of the then superintendent of common schools in Connecticut, in order to prove the practicability and usefulness of the plan. The result was entirely satisfactory. A similar class, or "temporary normal school," was successfully conducted during eight weeks by Mr. Stephen R. Sweet, at Kingsboro, Fulton county, New York, commencing on the 6th of September, 1842. J. S. Denman, Esq., school superintendent of Tompkins county, New York, urged a similar class upon the attention of the Tompkins County Teachers' Association in October, 1842, and a teachers' institute, supposed by him to be the first in the state and in the world—and probably the first expressly so called—was opened under his direction in that county in April, 1843, and profitably conducted during two weeks.

Institutes were held in many places in New York during the following five years, under the auspices of school officers and teachers; and at the end of that time, in November, 1847, an act of the legislature made them part of the legal school system, and provided a trifling annual appropriation to aid in holding them in each county.

Under the influence of earnest efforts by teachers and educators during 1846, the legislature of Connecticut, in May, 1847, made an appropriation which enabled the superintendent, Hon. S. P. Beers, to provide for the holding of institutes in each county of the state in the following autumn; and they have since formed part of the state system for training teachers.

Institutes were introduced into Massachusetts in the autumn of 1846, as part of the comprehensive school reform which spread through that state under Horace Mann's secretaryship of the Board of Education. Those of 1846 were held in consequence of Hon. Edmund Dwight's gift of $1000 for the purpose. In the next year the legislature appropriated a sum to continue the plan, and they were thus incorporated into the public school system of the state of Massachusetts.

The economy and efficiency of this agency in training teachers were so great and manifest, that they quickly spread into the other eastern states, and into many of the middle and western ones; and at present may be considered a fixed feature of the American system of special training for teachers. In 1859, it was estimated that upward of 20,000 teachers were assembled under this plan of organization for instruction in their professional duties.

CHAPTER XII.

SCHOOLS OF SCIENCE FOR ENGINEERS, GEOLOGISTS, ETC.

For many years the government school for training army officers, founded in 1802, and known as the United States Military Academy at West Point, stood alone as a seminary for advanced education, in which classical instruction yielded its pre-eminence to mathematical and scientific culture. In 1824, the Rensselaer Polytechnic Institute was founded at Troy, N. Y., and furnished civilians with the means of education in some measure corresponding to but yet much lower than the military school at West Point. More than twenty years afterward, in 1846, the corporation of Yale College established two professorships, which soon formed the nucleus of the Yale Scientific School; and about the same time a gift of $50,000, subsequently increased to double that amount, by Abbott Lawrence, enabled the corporation of Harvard University to establish in 1847 the Lawrence Scientific School. Within a short time Dartmouth College was enabled to go forward in the same direction, by a bequest of $50,000 received from Abiel Chandler, at his decease in 1851, endowing the Chandler Scientific School. As these three institutions naturally form a group by themselves, providing instruction of an advanced character in several different branches of science, a brief sketch will be given of each one; but there are a variety of less advanced schools, and of schools devoted to a single practical object, like the agricultural schools at Lansing, Mich., and Ovid, N. Y., which will be noticed under their appropriate head.

In August, 1846, the corporation of Yale College established two professorships, one of agricultural chemistry, the other of chemistry applied to the arts; to the first of which was appointed John Pitkin Norton; to the latter Benjamin Silliman, Jr. At the same time a committee was appointed to consider the expediency of forming a "Department of Philosophy and the Arts" in connection with the university. In August, 1847, this committee reported that it was expedient to form such a department, for the instruction of other than undergraduate students. Accordingly, the department was organized for the purpose of providing instruction in philosophy, philology, history and natural science, etc. The branches of chemistry and engineering were embraced in one section, under the title of the Yale Scientific School. The professors, before appointed, entered on their duties in the autumn of 1847. In 1852, the corporation established in this department the degree of Bachelor of Philosophy, to be conferred after a two years' connection with the school, and a satisfactory examination in at least three branches of study. In September, 1852, the school suffered a severe loss in the death of its devoted friend, Professor J. P. Norton, who bequeathed to it his collection of books and apparatus. New professorships have from time to time been established, and additional instructors appointed, but the school has lacked until 1860 sufficient accommodations and the pecuniary means necessary for expansion. By the liberality of Joseph E. Sheffield, Esq., of New Haven, it is now provided with a spacious building, especially adapted to its purposes, and a fund of $100,000 for sustaining its courses of instruction. To the latter fund other gentlemen have contributed. This building (first opened in September, 1860) contains, besides the usual lecture rooms, extensive analytical and metallurgical laboratories, and halls for agricultural and technological museums. Opportunity is afforded in the school for pursuing a general scientific course, extending through three years, or special courses in physics, chemistry, industrial mechanics, and engineering, which occupy two years each.

The degree of Bachelor of Philosophy is now conferred on those who have completed either the general course or one of the special courses in the scientific school, and have passed a satisfactory examination. The degree of Civil Engineer is conferred on those who have completed, besides the special course in engineering, a higher course of one year. It is also proposed to confer a higher degree, that of Doctor of Philosophy, on those who in their residence and their scholarship conform to the requirements of the department. In February, 1860, a course of agricultural lectures was given under the patronage of the school. The faculty of the school now consists of the president of the college, a professor of civil engineering, a professor of natural history, a professor of general and applied chemistry, a professor of industrial mechanics and physics, a professor of organic chemistry, a professor of modern languages, a professor of metallurgy, and a professor of analytical and agricultural chemistry, besides certain assistants.

In 1846, the project of a Scientific School, to be connected with Harvard University, was first publicly announced, and the plans laid before Hon. Abbott Lawrence of Boston, a distinguished merchant of wealth and public spirit. In June, 1847, he offered to the college the munificent sum of $50,000, "for the purpose of teaching the practical sciences." This gift was to be applied for the erection of suitable buildings, and the purchase of apparatus, the residue to form a fund for the support of professors.

On this foundation the school was commenced the same year; Professor Horsford, already connected with the university, filling the chair of chemistry; Professor Agassiz, of Switzerland, being called to that of zoölogy and geology, and Lieut. Eustis, of the army, to that of engineering. In 1849, a laboratory, then unsurpassed even in Europe in its conveniences for practical instruction, was erected and furnished; and in 1850 a building was constructed for the temporary accommodation of the departments of zoölogy, geology, and engineering. Besides the professors already mentioned, instruction is given by the college professors in mathematics, physics, botany, comparative anatomy and physiology, and mineralogy. The school is essentially a combination of independent departments, each having exclusive control of its own internal arrangements, and sustaining a complete course of instruction for itself. At the death of Mr. Lawrence, August 18, 1855, the school received by bequest, as a second gift, the sum of $50,000, to increase its facilities for instruction and research. Connection with the school for at least a single year, in attendance on the prescribed course of studies, in one or more departments, and a satisfactory public examination, are essential to taking the degree of Bachelor of Science.

An estate valued at $350,000 was bequeathed to Harvard College in 1842 by Mr. Benjamin Bussey, of Roxbury, Mass. (to be received after the death of certain relatives), one half of which, including his mansion and farm, was to be appropriated to the establishment of an agricultural school under the direction of the college.

The Chandler Scientific School, connected with Dartmouth College, at Hanover, N. H., was established in 1851, in acceptance of a gift of $50,000, bequeathed to the trustees, for this purpose, by Abiel Chandler. He was a wealthy merchant of Boston, Mass., who was born in 1778 in Concord, N. H., and died in Walpole, N. H., March 22d, 1851. By the will of the founder, instruction is to be given in "mechanics and civil engineering, the invention and manufacture of machinery, carpentry, masonry, architecture, and drawing, the investigation of properties and uses of materials employed in the arts, the modern languages, and English literature, together with bookkeeping." The school was opened in 1852, and the course of study occupies four years; for the general course in the fourth year, may be substituted a civil engineering course or a commercial course.

Those completing the regular course of four years, and passing a satisfactory examination, are entitled to the degree of Bachelor of Science.

Resident graduates will be instructed in the following advanced subjects, through an additional course of one or two years: Analytical chemistry, analytical and celestial mechanics, application of mechanics to carpentry and masonry, mechanical agents, geodesy, practical astronomy, the arts of design with reference to the useful arts.

The demand for instruction in chemistry beyond the requirements of the general college course, has led to a modification of the requirements of many of our colleges and universities. Among the schools included in the University of Virginia, is one of chemistry, in which department a systematic course of practical instruction is given in qualitative and quantitative analysis. The laboratory is open, and an instructor gives his personal attention to the students therein, for eight hours daily, five days in the week.

CHAPTER XIII.

SCHOOLS OF AGRICULTURE.

The first plan of an agricultural school or college in the English language, which we have met with, was published in 1651 by "Master Samuel Hartlib," to whom Milton addressed his Tractate on Education, and to whom the Parliament of England gave a pension for his disinterested efforts to advance the agricultural and educational interests of the commonwealth. It was nearly two hundred years before an institution of this character was established by individual enterprise, without the aid of any public grant,in the British dominions.

The Agricultural College of the State of Michigan was established in 1855, in accordance with a provision of the revised constitution of the state, adopted in 1850. The legislature in 1855, and again in 1857, provided for the purchase of land and the endowment and management of the institution. A tract of 676 acres, lying three and a half miles east from Lansing, the state capital, was purchased, and a building with accommodations for 80 pupils was erected and dedicated May 13th, 1857. The faculty includes a president, and professors of mathematics, chemistry, physiology and entomology, natural science, English literature, and farm economy and horticulture. The tuition is free (except a matriculation fee of $5), and the students are required to labor three hours a day on the farm, for which they receive a compensation which is allowed in payment of board. The course of professional instruction embraces two years, and includes—I. Theory and Practice of Agriculture—II. Agricultural Chemistry—III. Civil and Rural Engineering—IV. Botany and Vegetable Physiology—V. Zoölogy and Animal Physiology. There is a preparatory course of one year, designed for candidates who have not pursued elsewhere the preliminary studies required in English language, geography and arithmetic, for entrance.

The State University of Michigan at Ann Arbor provides a scientific course, occupying four years, and embracing mathematics, astronomy, geology, zoölogy, botany, chemistry, mineralogy, philosophy, rhetoric, history and modern languages. The School of Engineering, connected with the institution, receives students who have completed the second and third years of the scientific course, and devotes two years to their instruction in engineering. The only charge to the student, from whatever part of the country he may come, is an admission fee of ten dollars.

The Maryland Agricultural College was established and endowed by the state legislature in 1856. The college farm is about two and a half miles north of Bladensburg, in Prince George's county. The faculty includes a president, and five professors, viz.: one of the science of agriculture, including chemistry, geology, etc.; one of the exact sciences, one of languages, one of philosophy, history, etc., and one of natural history, botany, etc. The student, in connection with his course, is obliged to labor on the farm.

The agricultural college now established near Ovid, Seneca Co., N. Y., took its rise from plans started as early as 1837. Nothing definite was accomplished until, in 1844, a charter for an agricultural college was obtained from the legislature; after further delays, in 1856, the sum of $40,000 was appropriated to the college by the legislature, on condition that a like sum be raised by private subscription. This was speedily accomplished, and a tract of some 400 acres purchased. Preparation is making for the accommodation of a large number of pupils.

The Farmers' High School of Pennsylvania was founded by the agricultural society of the state, with a fund of $10,000, accumulated from its annual exhibitions up to the autumn of 1854. The legislature passed an act of incorporation, and a board of trustees was organized; after various private subscriptions, the legislature appropriated in 1858 the sum of $50,000 to the school, half of which sum being dependent on the raising of a like amount by individual contribution. In 1856, the suitable farm-buildings were erected on lands given to the school.

CHAPTER XIV.

COMMERCIAL SCHOOLS.

"Commercial schools," which supply an education adapted to future business life, and to make up in some measure for previous deficiencies in the studies of youths early devoted to trade, are a class of schools of quite recent date; none of them, it is believed, being of a greater age than fifteen or twenty years. They are naturally established in the larger and busier mercantile cities, and their course of study, of course a comparatively brief and confined one, usually includes but little if any of classics and literature, consisting principally of writing, book-keeping, commercial arithmetic, business proceedings, and sometimes mercantile law. Their existence seems to indicate a deficiency in their department, in the higher public schools, although those schools could not afford a similar course of equal extent and thoroughness. But there is no doubt that a competent course of studies preparatory to commercial life, should form part of the course of the high schools of our cities and large business towns.

CHAPTER XV.

SCHOOLS FOR MECHANICS.

During nearly half a century, many indications may be traced of a more or less distinct feeling of the need of some systematic instruction in mechanic arts, although this feeling has not been so extensive and decided as to result in any permanent institutional provision for the purpose.

The Lyceum movement, in which Josiah Holbrook was so active a laborer, commencing about 1823, was accompanied by the institution of many courses of lectures and classes upon subjects connected with mechanics and trades. The Mechanics' School of New York City, an institution still existing, was originally intended to afford instruction, among other things, in mechanical processes and the application of mechanical principles.

A movement was made in the legislature of Massachusetts, in 1825, for the establishment of a state institution for the professional training of youth intending to follow "mercantile, manufacturing, and mechanical pursuits." Though advocated with some earnestness during several sessions, this plan never reached a practical development.

The "manual labor schools," of which a considerable number were established a few years later, frequently provided for the practice of some mechanical trade, usually carpentry. Such was the case at Lane Seminary and at the Oneida Institute, both founded in 1829, and elsewhere.

Somewhat more extensive was the plan of the Franklin Institute of Philadelphia, which established in 1826 a high school, of which it was a special object to "afford the industrial classes cheap instruction in sciences and arts." This institution flourished under the energetic management of Professor W. R. Johnson, and until superseded by the introduction of the present school system of Philadelphia, with its high school, which has not, however, retained this practical department.

Brief courses of lectures, to apprentices, or to mechanics, were organized at various points, as a consequence of the Lyceum movement. Where these have been maintained as an annual institution, however, their distinctive, practically useful character has invariably disappeared in the merely amusing dissipation which is the only object of the present "lecture system."

There exist at present in Philadelphia and Brooklyn schools known as "Polytechnic Schools;" but this name seems to have been chosen as well adapted to catch the ear, rather than as descriptive of any thing peculiar in their course of study.

Some provision for systematic instruction in the mechanic arts, of a higher grade than the pure realism of the shop, is certainly needed. Departments of this character attached to the higher public schools of our larger towns would unquestionably serve a very useful purpose, and would command a certain number of pupils. At the same time it must be confessed that this number would not immediately be great; a fact readily accounted for by the two considerations, that the peculiar conditions of life in the United States strongly disincline the young to apply themselves long or closely to the acquirement of a finished mastery of any occupation, and that it would be extremely difficult to supply instructors qualified to explain and teach the actual practical application to wood, stone, metal, and other materials, of true scientific principles in the most economical way.

CHAPTER XVI.

FINE ARTS.

In modern civilization, culture in fine arts (music, painting, sculpture, architecture) is the attribute and privilege of an advanced stage of social organization. The people of the United States, hitherto intensely occupied in subduing a new country, and in a vigorous and prosperous pursuit of material wealth, have at the present day but just begun those vast accretions of capital, which must form the basis of any culture in fine arts worthy of the name. To none of these arts has great attention been given, and for teaching them nothing like a general public provision has been made.

During the last thirty years, the practice has slowly gained ground among the public schools, both in city and country, of affording the pupils some instruction and training in the rudiments of singing. In a far smaller number of schools, similar rudimentary instruction has been given in drawing; and in one or two secondary schools of the higher city class, pupils have been afforded the means of pursuing that study further, by means of collections of casts and models.

Generally speaking, however, the aspirant after a profound or even competent knowledge of any fine art, has been left to acquire it either by his own unassisted and solitary labor, by the aid of some older practitioner, or by study in foreign schools of art.

The progress of the study of music in our schools, is coincident with the career of the distinguished teacher, Lowell Mason, who was the first to introduce into the school system an efficient mode of teaching singing, about 1830. Of musical schools exclusively, it is believed that there have not been more than two, both of which are in Connecticut. Private schools for girls usually afford their pupils more or less training in executing music upon the piano-forte, but without communicating any scientific knowledge of music.

Within a recent period, several schools have been opened in a few of the larger cities, for instruction in drawing; always having the practical side most prominent, and leading their pupils as rapidly as possible toward the production of salable designs for manufacturing purposes, or of wood engravings for the use of publishers. A superficial practice in drawing, usually by the senseless method of exclusively copying other drawings or engravings, is commonly afforded at private schools for girls. Some small advantages for those desiring more advanced acquirements, are afforded by the various public galleries and collections accessible in some large cities. The painter or sculptor, as well as the architect, must however learn his art from such sources as his individual opportunities allow him to command.

CHAPTER XVII.

FEMALE EDUCATION.

The education of girls is of course not properly a special department any more than that of boys. Still, the history and the present condition of this department of education present many facts which will sufficiently justify its separate treatment, aside from the intrinsic differences which must also characterize it.

Until a comparatively recent period, but trifling provision was made for the education of girls. Down to the close of the Revolution, although girls might attend the public schools, but a small share of time or labor was devoted to them; and their attention was supposed to be more suitably directed to needle-work and housewifery than to intellectual training.

The first school of eminence exclusively for girls was the Moravian Seminary at Bethlehem, Pennsylvania. This was established as early as 1749, but was not opened as a boarding-school until 1785. It enjoyed a national reputation; and its catalogue includes such names as Lansing, Livingston, Bayard, Sumter, and many others from the whole range of states. It was never more flourishing than in 1860.

It has been claimed that President Dwight, in his school at Greenfield, opened in 1783, was the first in the country to admit pupils of both sexes to an entire equality of intellectual training. In any event, both this school and his previous one at Northampton afforded to both boys and girls an education of uncommon value for the period.

When that famous teacher, Caleb Bingham, removed to Boston, in 1784, he did so with the design of opening there a school for girls, who were, singularly enough, at that time excluded from the public schools. Mr. Bingham's enterprise was successful, and was also the means of revolutionizing the unfair school system of the city, and of introducing a plan which, though variously imperfect, at least provided some public instruction for girls.

In 1792, Miss Pierce opened a school for girls at Litchfield, Connecticut, which continued in operation for forty years, and educated large numbers of young ladies from all parts of the country. In the same year, at Philadelphia, was incorporated one of the first, if not the first, female academies in this country.

From about 1797 to 1800, Rev. William Woodbridge, father of the well-known author and educator W. C. Woodbridge, taught a young ladies' school, at first at Norwich, and afterward at Middletown, Conn.

In 1816, Mrs. Emma Willard commenced her endeavors to secure for women the opportunity of acquiring a grade of education corresponding to that which colleges furnish to the other sex. The eminent success and excellence of her celebrated school at Troy are well known; and an important consequence of her labors was, that female seminaries were admitted to receive aid from the literature fund of the state of New York, on the same terms with the academies.

From 1818 to 1830, Rev. Joseph Emerson conducted a young ladies' school of high reputation and efficiency, successively at Byfield and Saugus, Mass., and Wethersfield, Conn. In 1823, George B. Emerson, Esq., opened a young ladies' school at Boston, probably with a more complete and efficient outfit and apparatus than any which had preceded it.

The well-known school of John Kingsbury, Esq., an institution of similar grade and excellence, was opened at Providence, R. I., in 1828.

In 1822, Miss Catherine E. Beecher opened a school for young ladies at Hartford, Conn., which she conducted with eminent success for ten years. She afterward taught for a short period at Cincinnati, but her labors for female education have subsequently consisted in various publications, and in the management of an extended scheme for a system of Christian female education, including a national board, high schools, and normal schools; which has resulted in the establishment of several valuable institutions.

In 1825, at Wilbraham, Mass., was opened the first of the Methodist Conference seminaries; institutions whose plan has substantially followed that of the Wilbraham Seminary, which was drawn up by Rev. Wilbur Fiske, its first principal.

Miss Z. P. Grant and Miss Mary Lyon, both pupils of Rev. Joseph Emerson, were associated in the conduct of an excellent school for young ladies at Ipswich, Mass. The energetic and persevering labors of Miss Lyon, with the purpose of establishing a permanent Protestant school of high grade for young ladies, resulted in the establishment of the celebrated seminary at South Hadley, which was opened in 1837.

The present era in the history of female education in the United States is perhaps most strikingly characterized by the number of large and largely endowed institutions of a high grade, which have been established in various parts of the country. One of them is the Mount Holyoke Female Seminary, at South Hadley, just mentioned. The Packer Collegiate Institute at Brooklyn, N. Y., another of them, had previously existed as the Brooklyn Institute; and received its present name in consequence of the munificent gift of $85,000 by Mrs. Harriet L. Packer of that city. The whole property represents a value of $150,000. A still more magnificent endowment is that of the Vassar Female College at Poughkeepsie, N. Y., for which the vast sum of $408,000 has been given by Matthew Vassar, Esq., of that city.

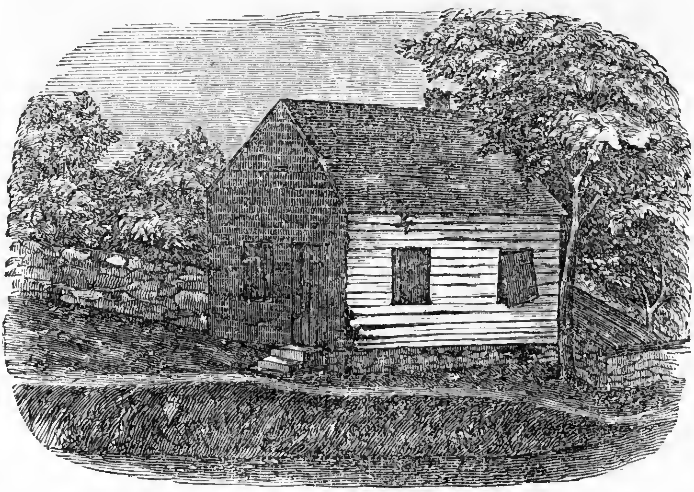
A characteristic of the female education of the present period is the practice of admitting pupils of both sexes to institutions for secondary and superior education; to the high schools of cities, to academies, to the normal schools, and even in one or two institutions of the collegiate grade. Another one is the increasing regard which is paid to the employment of female teachers, and to their thorough preparatory training for that duty, in institutions partly or wholly for that purpose. On the whole, the department of female education is, at present, attracting as much attention, and improving as rapidly, as any other.

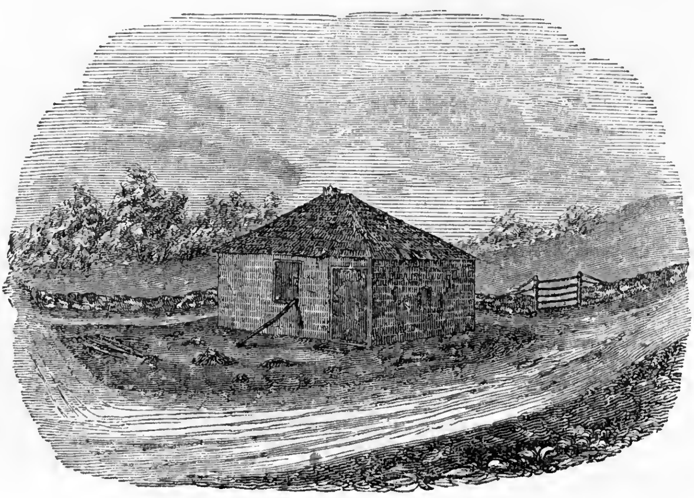
CHAPTER XVIII.

SCHOOL-HOUSES, APPARATUS, AND TEXT-BOOKS.

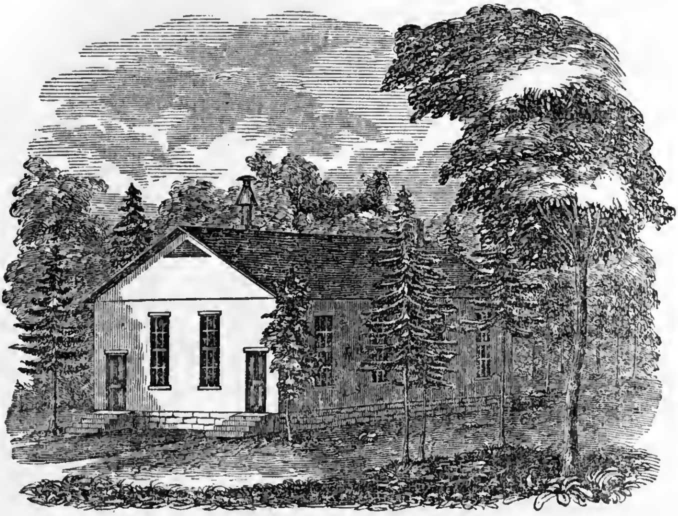
In no department of instruction has the work of improvement been so general, so rapid, or so thorough as in the material outfit of the school. Within a quarter of a century a revolution has been wrought in public opinion and action in respect to the location, construction, ventilation, warming, furniture, and equipment generally, of school-houses, and more than thirty-five millions of dollars have been expended for these objects within this short period.

SCHOOL-HOUSES AS THEY WERE.

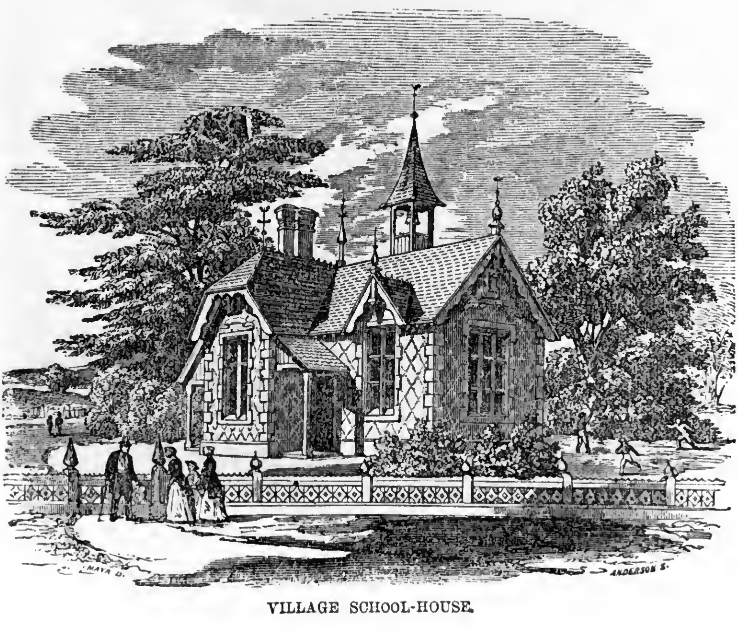




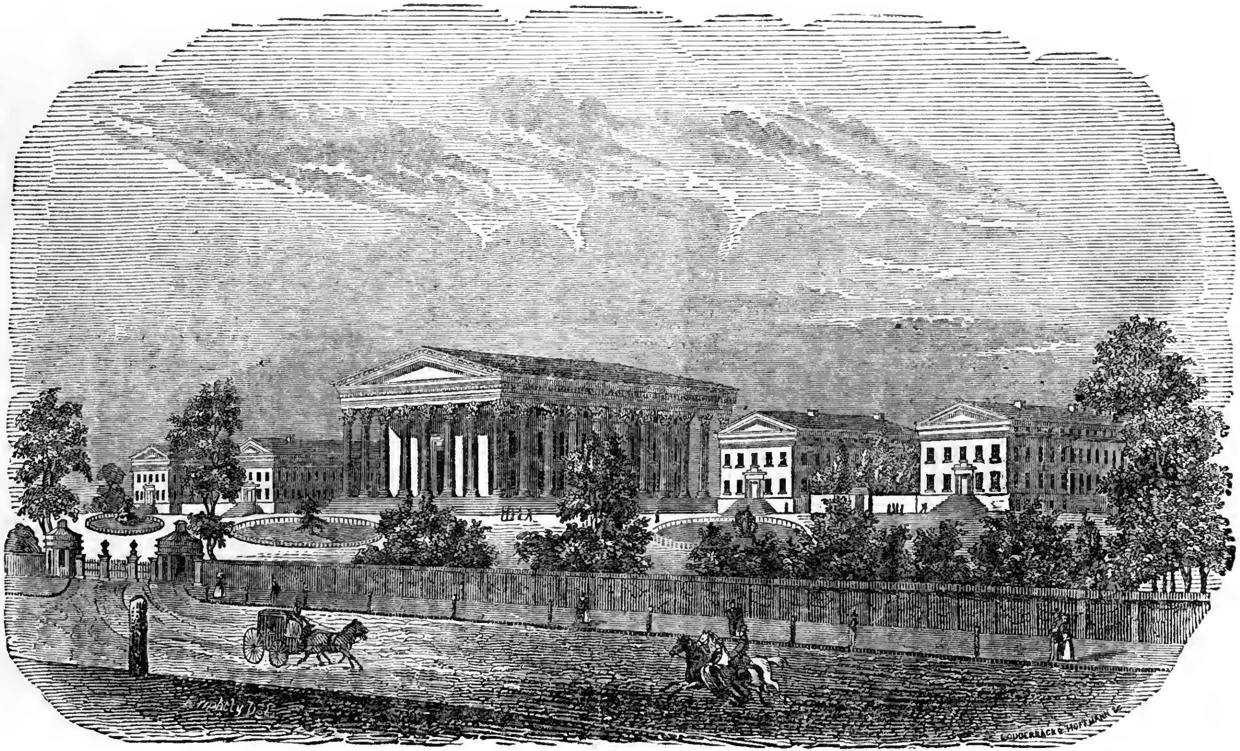
SCHOOL-HOUSES AS THEY ARE.



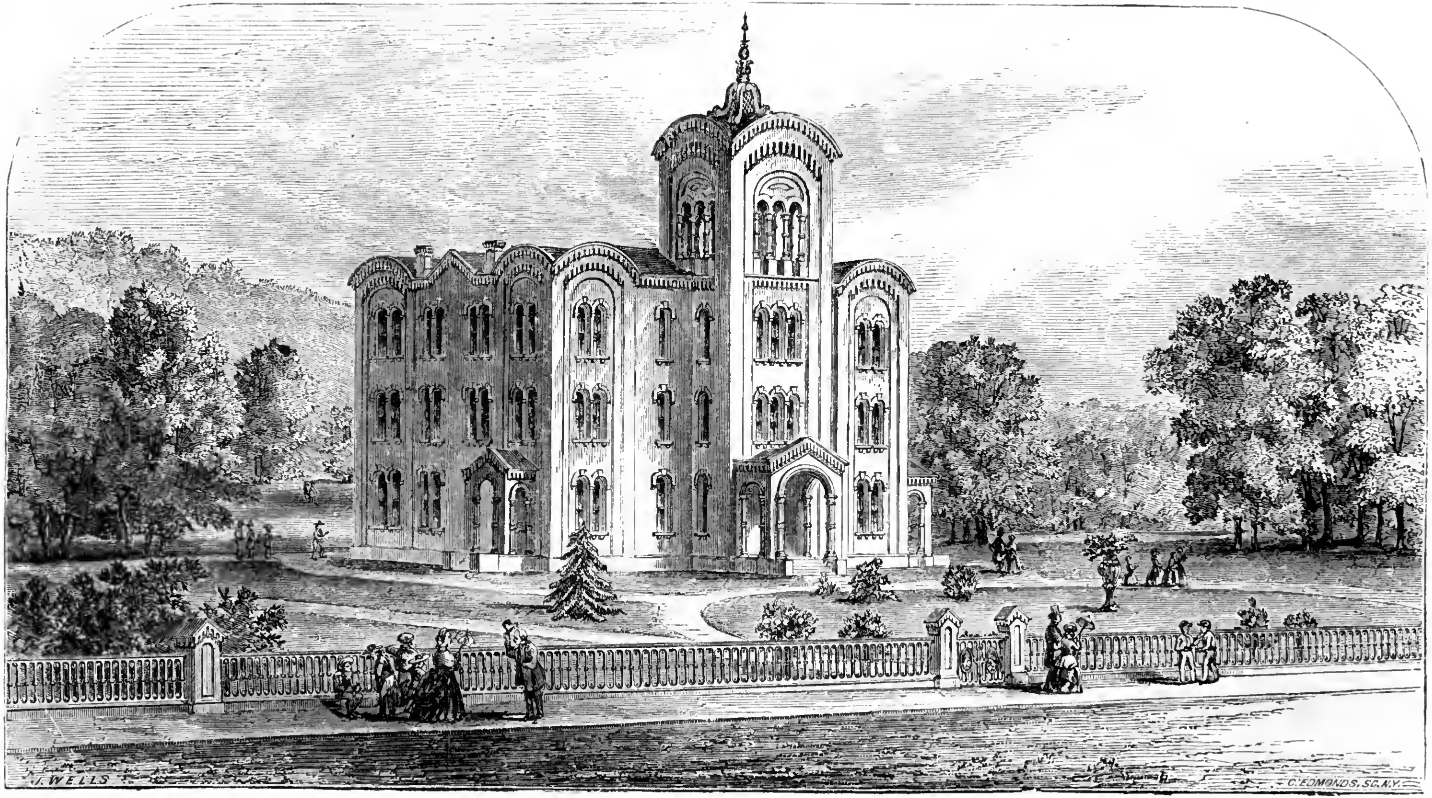
COUNTRY DISTRICT SCHOOL-HOUSE.



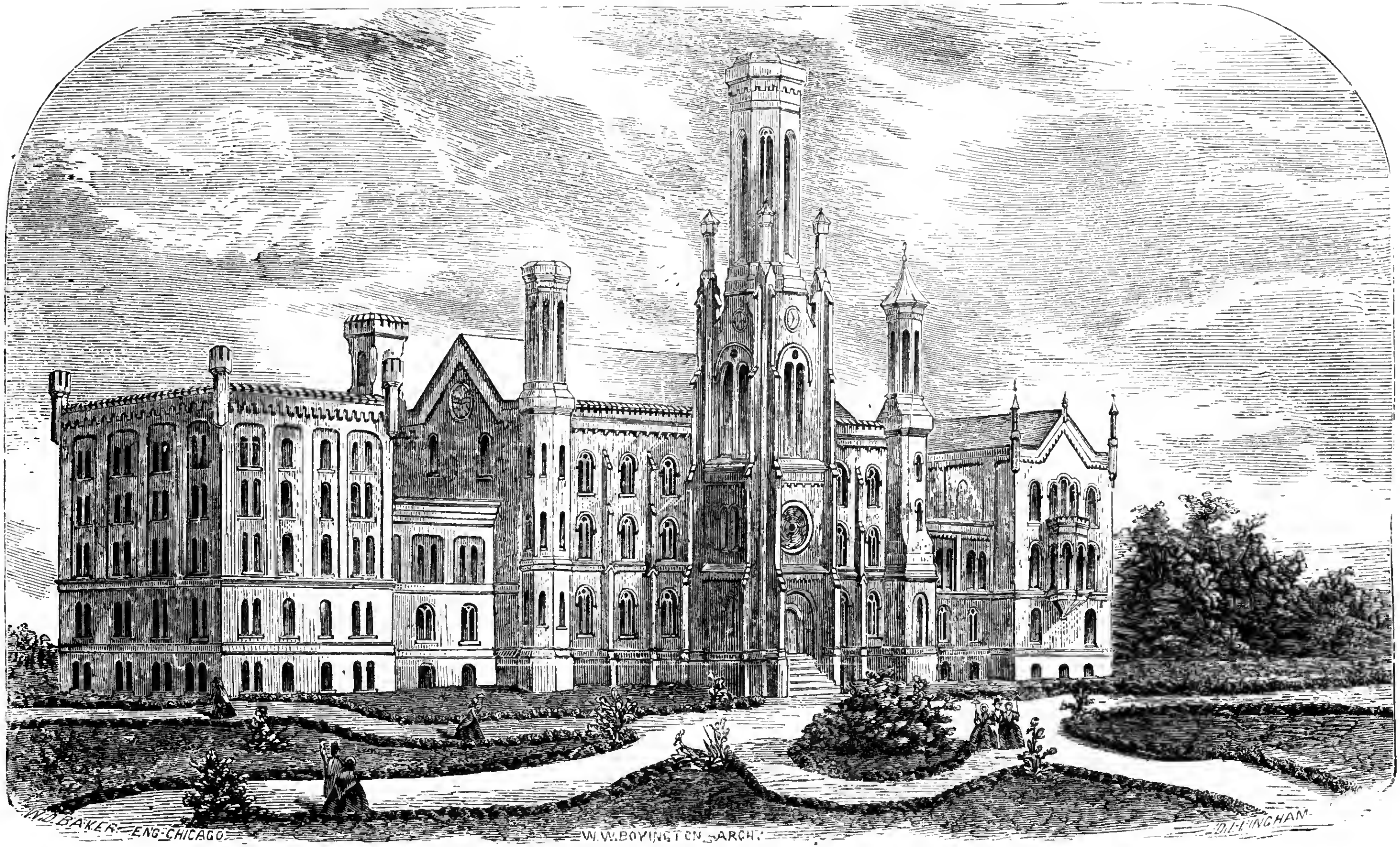
VILLAGE SCHOOL-HOUSE.



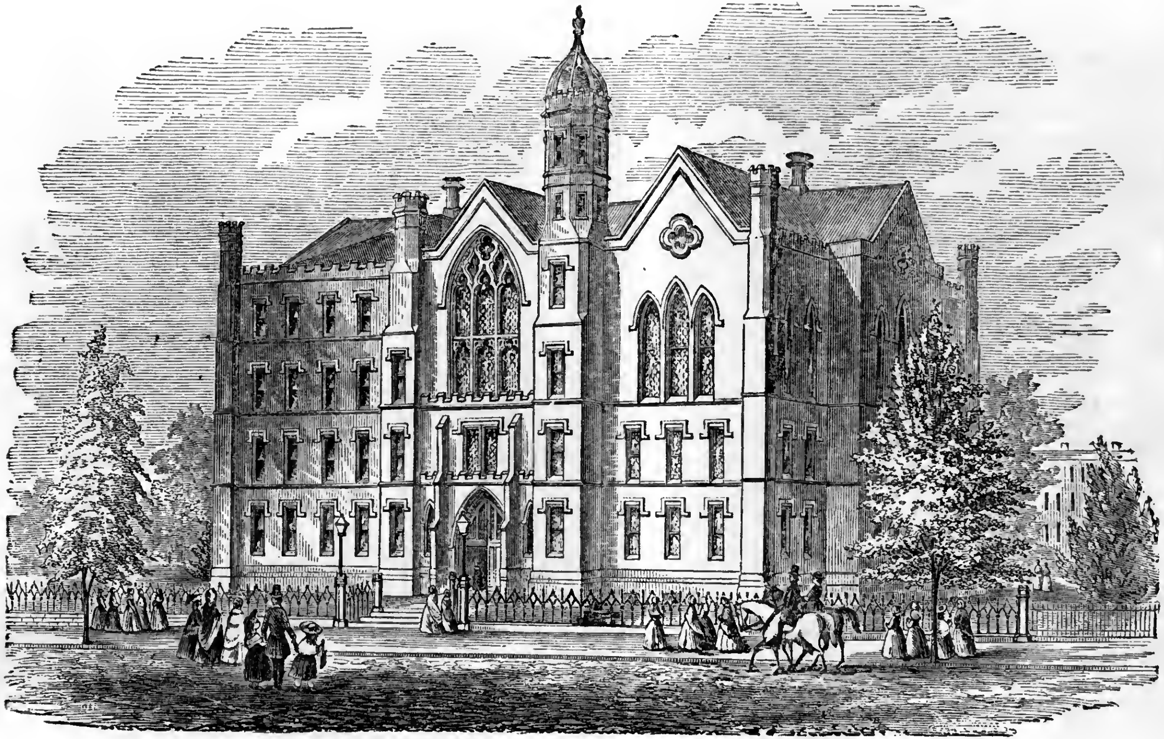
VIEW OF GIRARD COLLEGE.



NORWICH (CONN) FREE ACADEMY.



CHICAGO CITY UNIVERSITY.



PACKER COLLEGIATE INSTITUTE.

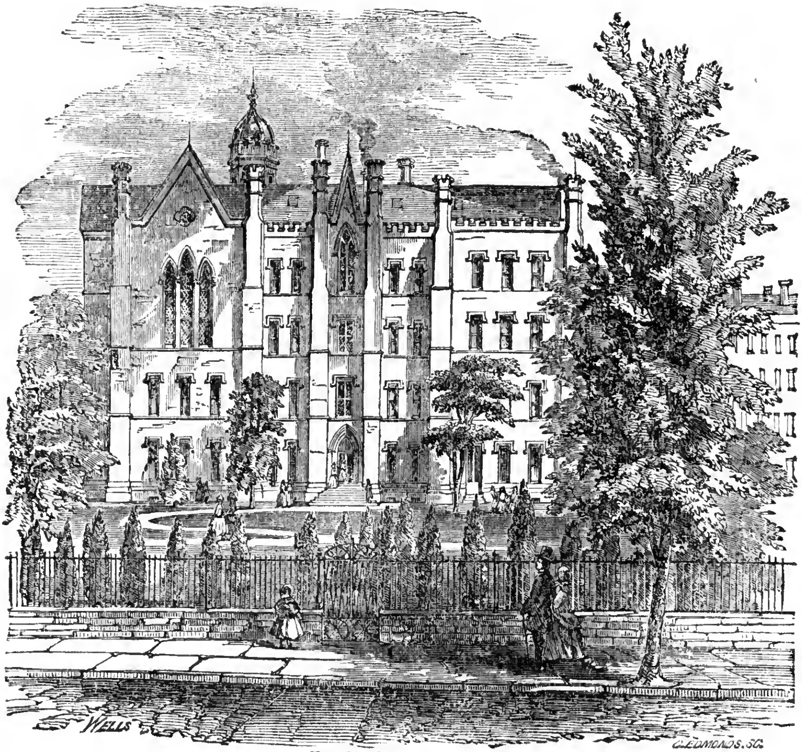


Fig. 2. GARDEN FRONT.

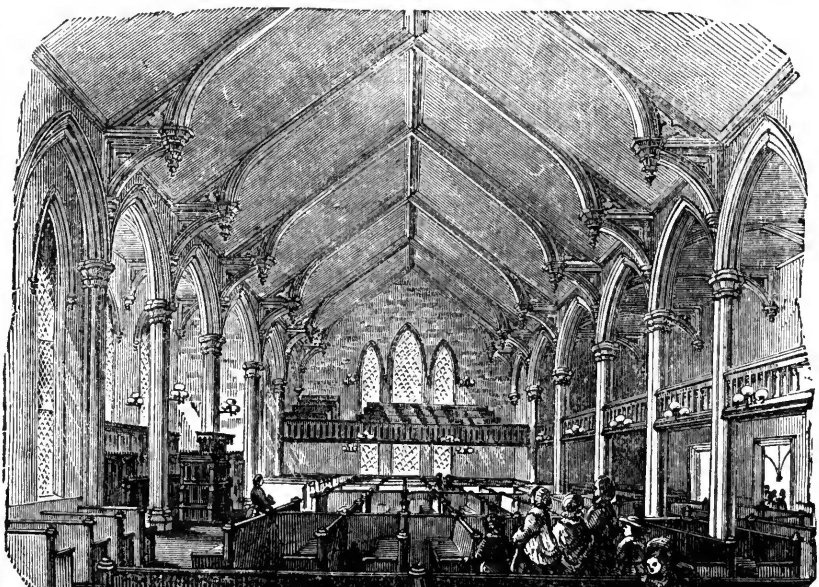


Fig. 3. INTERIOR OF CHAPEL.

SCHOOL-BOOKS.

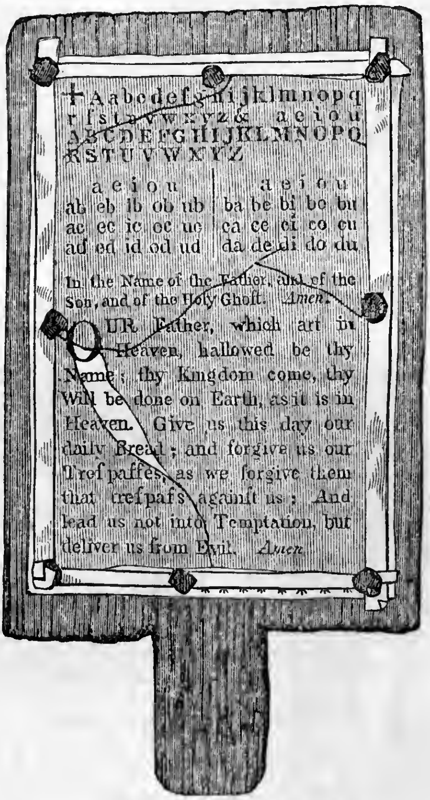
The improvement in the authorship and manufacture of text-books, from the Primer to the Manuals of our colleges and scientific schools, within the last half century is immense. We will refresh the memory of some of our readers by reproducing a few of the tough subjects and illustrations with which they or their fathers were painfully familiar.

The Horn-book.

Few of us have had the satisfaction of learning our letters after the manner described by Prior:—

"To master John the English maid
A Horn-book gives of gingerbread;
And that the child may learn the better,
As he can name, he eats the letter."

To many, even a picture of the old-fashioned Horn-book—the Primer of our ancestors, consisting of a single leaf pasted on a board, and covered in some instances with thin



HORN-BOOK OF THE EIGHTEENTH CENTURY.

transparent horn to preserve it from being torn or soiled—will be new. The following description and the accompanying cut we copy from Barnard's *American Journal of Education*, for March, 1860:—

Shenstone, who was taught to read at a dame school near Halesowen, in Shropshire, in his delightfully quaint poem of the *Schoolmistress*, commemorating his venerable preceptress, thus records the use of the Horn-book:—

"Lo! now with state she utters her command;
Eftsoons the urchins to their tasks repair;
Their books of stature small they take in hand,
Which with pellucid horn secured are
To save from finger wet the letters fair."

Cowper thus describes the Horn-book of his time:—

"Neatly secured from being soiled or torn
Beneath a pane of thin translucent horn,
A book (to please us at a tender age
'Tis called a book, though but a single page),
Presents the prayer the Saviour deigned to teach,
Which children use, and parsons—when they preach."
Tirocinium, or a Review of Schools, 1784.

In "*Specimens of West Country Dialect*," the use of the Horn-book is thus shown:—

"Commether *Billy Chubb*, an breng the hornen book. Gee ma the vester in tha windor, yor *Pal came!*—What! be a sleepid—I'll wâke ye. Now, *Billy*, there's a good bway! Ston still there, and mind what I da zâ to ye, an whaur I da point. Now; criss-cross, girt â, little a—b—c—d. That's right, *Billy;* you'll zoon lorn the criss-cross-lain; you'll zoon auvergit Bobby Jiffry—you'll zoon be a *scholard*. A's a pirty chubby bway—Lord lov'n!"

New England Primer.

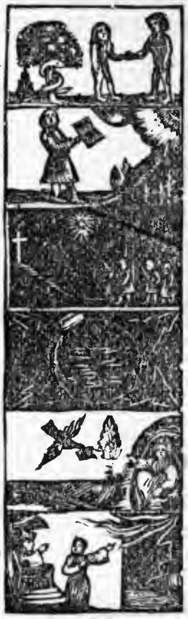
Of the New England Primer we can give no earlier specimen than the edition of 1777, embellished with a portrait of John Hancock, Esq., who was at that time President of the Continental Congress.

The Honorable JOHN HANCOCK, Efq; Prefident of the *American* CONGRESS.

We must not omit the painfully interesting group of John Rogers in the burning faggots, with his wife and nine or ten children—including the one at the breast—a problem which has puzzled many a school-boy's brain:

MR. JOHN ROGERS, minifter of the gofpel in *London*, was the firft martyr in Queen MARY's reign, and was burnt at *Smithfield*, *February* 14, 1554.—His wife with nine small children, and one at her breast following him to the ftake; with which forrowful fight he was not in the leaft daunted, but with wonderful patience died courageoufly for the gofpel of JESUS CHRIST.

We are fortunate in being able to present our readers with an exact transcript of the four pages of the first illustrated alphabet printed in this country. Some of our readers may recognize their old friends of the later editions of the Primer, in which "Young Timothy" and "Zaccheus he" were drawn to nature less severely true. The whole belongs to that department of literature which "he who runs may read, and he who reads will run."



A In ADAM's Fall
We ſinned all.

B Heaven to find,
The Bible Mind.

C Chriſt crucify'd
For ſinners dy'd.

D The Deluge drown'd
The Earth around.

E ELIJAH hid
By Ravens fed.

F The judgment made
FELIX afraid.

N NOAH did view
The old world & new

O Young OBADIAS,
DAVID, JOSIAS
All were pious.

P PETER deny'd
His Lord and cry'd.

Q Queen ESTHER ſues
And ſaves the *Jews*.

R Young pious RUTH,
Left all for Truth.

S Young SAM'L dear
The Lord did fear.

G As runs the Glass,
Our Life doth pass.

H My Book and Heart
Must never part.

I JOB feels the Rod,—
Yet bleſſes GOD.

K Proud Korah's troop
Was ſwallowed up

L LOT fled to *Zoar*,
Saw fiery Shower
On *Sodom* pour.

M MOSES was he
Who *Israel's* Hoſt
Led thro' the Sea.

T Young TIMOTHY
Learnt ſin to fly.

U VASTHI for Pride,
Was ſet aſide.

W Whales in the Sea,
GOD's Voice obey.

X XERXES did die,
And ſo muſt I.

Y While youth do chear
Death may be near.

Z ZACCHEUS he
Did climb the Tree
Our Lord to ſee.

WEBSTER'S SPELLING BOOK.

Few books have done more to give uniformity to the orthography of the language or to fill the memory of successive generations with wholesome truths than Webster's Spelling Book. Who can forget his first introduction to those four-and-twenty characters, standing in stiff upright columns, in their roman and italic dress, beginning with little *a*, and ending with that nondescript "*and per se;*" or his first lesson in combining letters,

ba be bi bo bu by

Or his joy in reaching words of two syllables,

ba ker bri er ci der

Or his exultation in learning to "know his duty" in those "Lessons of Easy Words" beginning,

No man may put off the law of God:

Or the more advanced steps, both in length of words and stubborn morality, in pursuit of

The wick-ed flee

And closing his spelling career with

Om pom pa noo suc
Mich il li mack a nack

And

Ail to be troubled
Ale malt liquor

In this hasty glance at this famous text book, we have designedly passed over the fables commencing with the Rude Boy and ending with Poor Tray, that we might introduce them all unabridged with their unique illustrations.

Of the Boy that ſtole Apples.

AN old man found a rude boy upon one of his trees ſtealing Apples, and deſired him to come down; but the young Sauce-box told him plainly he would not. Won't you? ſaid the old Man, then I will fetch you down; ſo he pulled up ſome tufts of Graſs, and threw at him; but this only made the Youngſter laugh, to think the old Man ſhould pretend to beat him down from the tree with graſs only.

Well, well, ſaid the old Man, if neither words nor graſs will do, I muſt try what virtue there is in Stones; ſo the old Man pelted him heartily with ſtones; which ſoon made the young Chap haſten down from the tree and beg the old Man's pardon.

MORAL.

If good words and gentle means will not reclaim the wicked, they muſt be dealt with in a more ſevere manner.

The Country Maid and her Milk Pail.

WHEN men ſuffer their imagination to amuſe them, with the proſpect of diſtant and uncertain improvements of their condition, they frequently ſuſtain real loſſes, by their inattention to thoſe affairs in which they are immediately concerned.

A country Maid was walking very deliberately with a pail of milk upon her head, when ſhe fell into the following train of reflections: The money for which I ſhall ſell this milk will enable me to increaſe my ſtock of eggs to three hundred. Theſe eggs, allowing for what may prove addle, and what may be deſtroyed by vermin, will produce at leaſt two hundred and fifty chickens. The chickens will be fit to carry to market about Chriſtmas, when poultry always bears a good price; ſo that by May Day I cannot fail of having money enough to purchaſe a new Gown. Green—let me conſider—yes, green becomes my complexion beſt, and green it ſhall be. In this dreſs I will go to the fair, where all the young fellows will ſtrive to have me for a partner; but I ſhall perhaps refuſe every one of them, and with an air of diſdain, toſs from them. Tranſported with this triumphant thought, ſhe could not forbear acting with her head what thus paſſed in her imagination, when down came the pail of milk, and with it all her imaginary happineſs.

The Cat and the Rat.

A CERTAIN Cat had made ſuch unmerciful havoc among the vermin of her neighbourhood, that not a ſingle Rat or Mouſe ventured to appear abroad. Puſs was ſoon convinced, that if affairs remained in their preſent ſituation, ſhe muſt be totally unſupplied with proviſions. After mature deliberation, therefore, ſhe reſolved to have recourſe to ſtratagem. For this purpoſe ſhe ſuſpended herſelf to a hook with her head downwards, pretending to be dead. The Rats and Mice, as they peeped from their holes, obſerving her in this dangling attitude, concluded ſhe was hanging for ſome miſdemeanour; and with great joy immediately ſallied forth in queſt of their prey. Puſs, as ſoon as a ſufficient number were collected together, quitting her hold, dropped into the midſt of them; and very few had the fortune to make good their retreat. This artifice having ſucceeded ſo well, ſhe was encouraged to try the event of a ſecond. Accordingly ſhe whitened her coat all over, by rolling herſelf in a heap of flour, and in this diſguiſe lay concealed in the bottom of a meal tub. This ſtratagem was executed in general with the same effect as the former. But an old experienced Rat, altogether as cunning as his adverſary, was not ſo eaſily enſnared. I don't much like, ſaid he, that white heap yonder: Something whiſpers me there is miſchief concealed under it. 'Tis true it may be meal; but it may likewiſe be ſomething that I ſhould not reliſh quite ſo well. There can be no harm at leaſt in keeping at a proper diſtance; for caution, I am ſure, is the parent of ſafety.

The Fox and the Swallow.

ARISTOTLE informs us, that the following Fable was spoken by Eſop to the Samians, on a debate upon changing their miniſters, who were accuſed of plundering the commonwealth.

A Fox ſwimming acroſs a river, happened to be entangled in ſome weeds that grew near the bank, from which he was unable to extricate himſelf. As he lay thus expoſed to whole ſwarms of flies, which were galling him and ſucking his blood, a ſwallow, obſerving his diſtreſs, kindly offered to drive them away. By no means, ſaid the Fox; for if theſe ſhould be chaſed away, which are already ſufficiently gorged, another more hungry ſwarm would ſucceed, and I ſhould be robbed of every remaining drop of blood in my veins.

The Fox and the Bramble.

A FOX, cloſely purſued by a pack of Dogs, took ſhelter under the covert of a Bramble. He rejoiced in this aſylum; and for a while, was very happy; but ſoon found that if he attempted to ſtir, he was wounded by thorns and prickles on every ſide. However, making a virtue of neceſſity, he forbore to complain; and comforted himſelf with reflecting that no bliſs is perfect; that good and evil are mixed, and flow from the ſame fountain. Theſe Briers, indeed, ſaid he, will tear my ſkin a little, yet they keep off the dogs. For the ſake of the good then let me bear the evil with patience; each bitter has its ſweet; and theſe Brambles, though they wound my fleſh, preſerve my life from danger.

The Partial Judge.

A FARMER came to a neighbouring Lawyer, expreſſing great concern for an accident which he ſaid had juſt happened. One of your Oxen, continued he, has been gored by an unlucky Bull of mine, and I ſhould be glad to know how I am to make you reparation. Thou art a very honeſt fellow, replied the lawyer, and wilt not think it unreaſonable that I expect one of thy Oxen in return. It is no more than juſtice, quoth the Farmer, to be ſure; but what did I ſay? —I miſtake—It is *your* Bull that has killed one of *my* Oxen. Indeed! ſays the Lawyer, that alters the caſe; I muſt inquire into the affair; and if—And *if!* ſaid the Farmer—the buſineſs I find would have been concluded without an *if*, had you been as ready to do juſtice to others, as to exact it from them.

The Bear and the two Friends.

TWO Friends, ſetting out together upon a journey, which led through a dangerous foreſt, mutually promiſed to aſſiſt each other if they ſhould happen to be aſſaulted. They had not proceeded far, before they perceived a Bear making towards them with great rage.

There were no hopes in flight; but one of them, being very active, ſprung up into a tree; upon which the other, throwing himſelf flat on the ground, held his breath and pretended to be dead; remembering to have heard it aſſerted, that this creature will not prey upon a dead carcaſs. The bear came up, and after ſmelling to him ſome time, left him and went on. When he was fairly out of ſight and hearing, the hero from the tree called out—Well, my friend, what ſaid the bear? he ſeemed to whiſper you very cloſely. He did ſo, replied the other, and gave me this good piece of advice, never to aſſociate with a wretch, who in the hour of danger, will deſert his friend.

The Two Dogs.

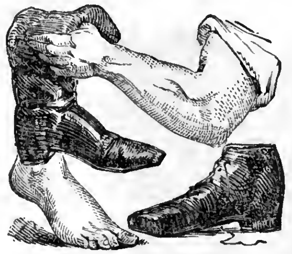
HASTY and inconſiderate connections are generally attended with great diſadvantages; and much of every man's good or ill fortune, depends upon the choice he makes of his friends.

A good-natured Spaniel overtook a ſurly Maſtiff, as he was travelling upon the high road. Tray, although an entire ſtranger to Tiger, very civilly accoſted him; and if it would be no interruption, he ſaid, he ſhould be glad to bear him company on his way. Tiger, who happened not to be altogether in ſo growling a mood as uſual, accepted the propoſal; and they very amicably purſued their journey together. In the midſt of their converſation, they arrived at the next village, where Tiger began to diſplay his malignant diſpoſition, by an unprovoked attack upon every dog he met. The villagers immediately ſallied forth with great indignation, to reſcue their reſpective favourites; and falling upon our two friends, without diſtinction or mercy, poor Tray was moſt cruelly treated, for no other reaſon, but his being found in bad company.

The following cuts, sketched from WILLSON's Series of "School and Family Readers," with the accompanying explanations, show the great degree of advancement made, not only in the artistic beauty of the Illustrations contained in the latest published of our Reading-Books, but, more especially, in the successful attempt to combine *instruction in reading* with *advancement in useful knowledge.*

From the First Reader.

Eye, Nose, Ear, Mouth, Face.

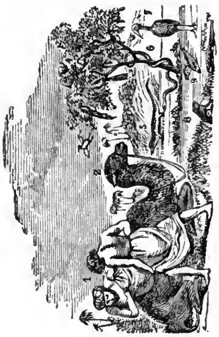


Arm, Hand, Boot, Foot, Shoe.

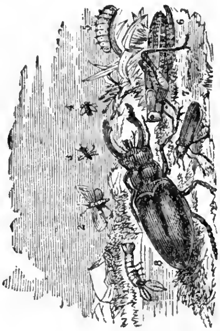
The Eagle's Nest.

The leading principle developed in the SECOND READER (but which also runs throughout the entire Series) is the early cultivation of the *Perceptive Faculties* by lessons drawn from a great variety of objects and scenes which are represented to the eye of the pupil.

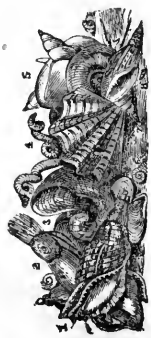
The THIRD READER of the Series, after a brief synopsis of the "Elements of Elocution," is divided into Four Parts:—PART I., "Stories from the Bible," beautifully and bountifully illutsrated.—PART II., "Moral Lessons."—Part III., "First Division of Animal Life," embracing the Mammalia; and PART IV., "Miscellaneous." The following four illustrations give the pupil a general idea of the four great divisions of the Animal Kingdom.



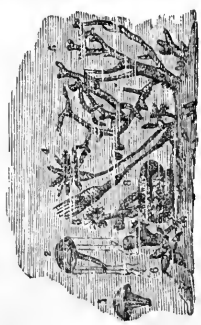
I. Vertebrates.



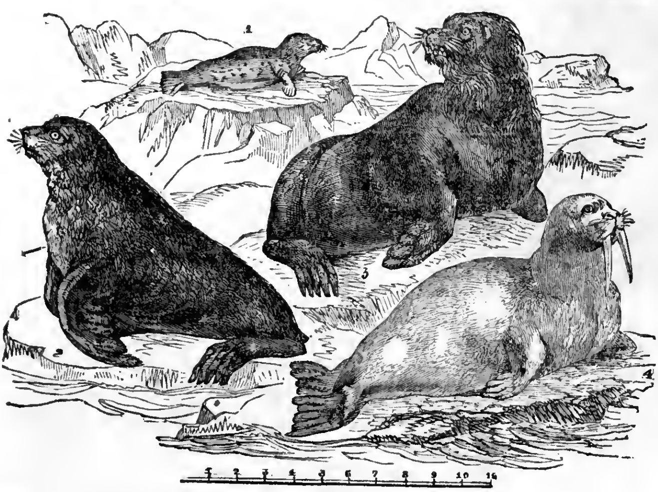
II. Articulates.



III. Mollusks.



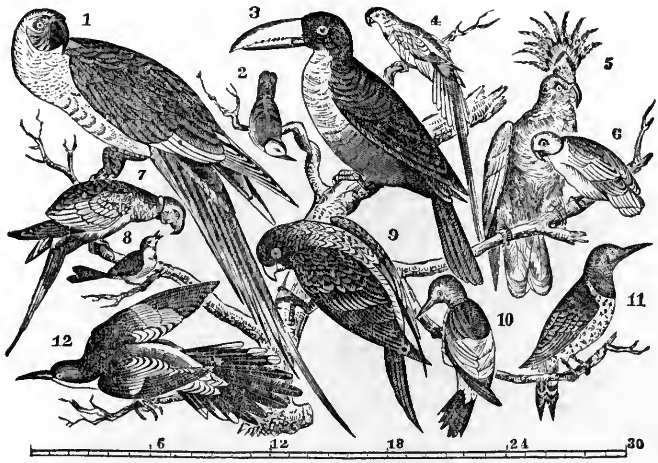
IV. Radiates.

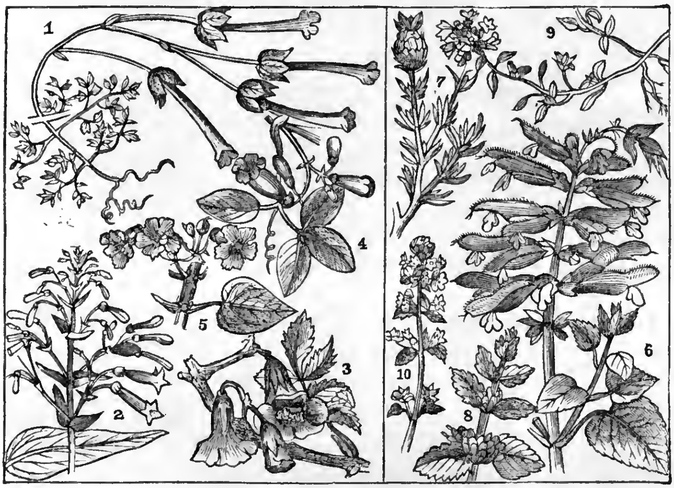


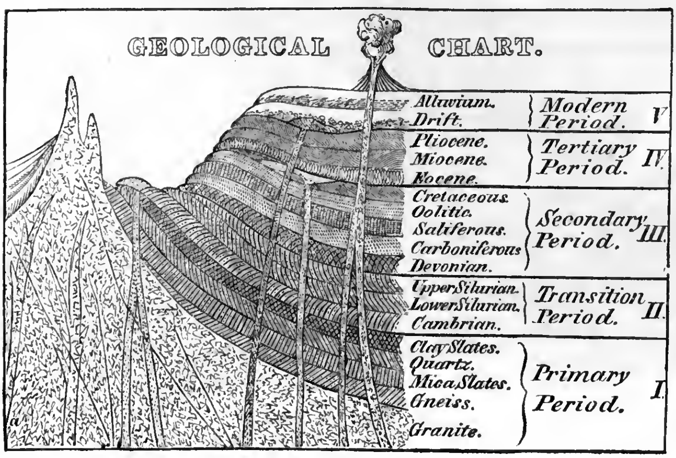
ANIMALS OF THE SEAL KIND.—1. Common Seal, *Phoca vitulina.* 2. Sea-Bear, *Phoca ursina.* 3. Sea-Lion, *Phoca jubata.* 4. Walrus, or Sea-Horse, *Trichechus rosmarus.*

The subject of the *Mammalia*, in the THIRD READER, is illustrated by more than two hundred figures of Animals, many of them in groups, with *Scales of Measurement* showing their comparative sizes, as in the Animals of the Seal kind in the annexed engraving. This we believe to be a new feature, even in zoological works, and it is one that is eminently useful.

An attempt has been made—and, it is believed, successfully—to invest the subject of animal life with a great degree of *interest* for children; to *popularize* it to their capacities; to give all desirable variety to the lessons, as exercises in reading; and to convey as much positive *information* as would be compatible with these requisites for a good Reading-Book. Numerous interesting incidents of animal life, illustrating traits of character, habits, &c., and both poetical and prose selections, effectually relieve the descriptions of that *sameness* of style and matter which is found in most zoological works.







The FOURTH READER, in addition to Miscellaneous Selections, has divisions or "Parts" appropriated to "Human Physiology and Health," "Ornithology, or Birds," "Vegetable Physiology, or Botany," "Natural Philosophy," and "Sacred History," in all which there is great literary variety, well adapted for reading lessons; and, moreover, the beautiful illustrations teach *useful facts*. One of the cuts from "Ornithology," showing the forms, relative sizes, &c., of the "Climbing Birds," is here given.

The FIFTH READER, which is the highest in the Series thus far published, has, in addition to the Miscellaneous Divisions embracing a variety of the best literary selections, the eleven following "Parts."

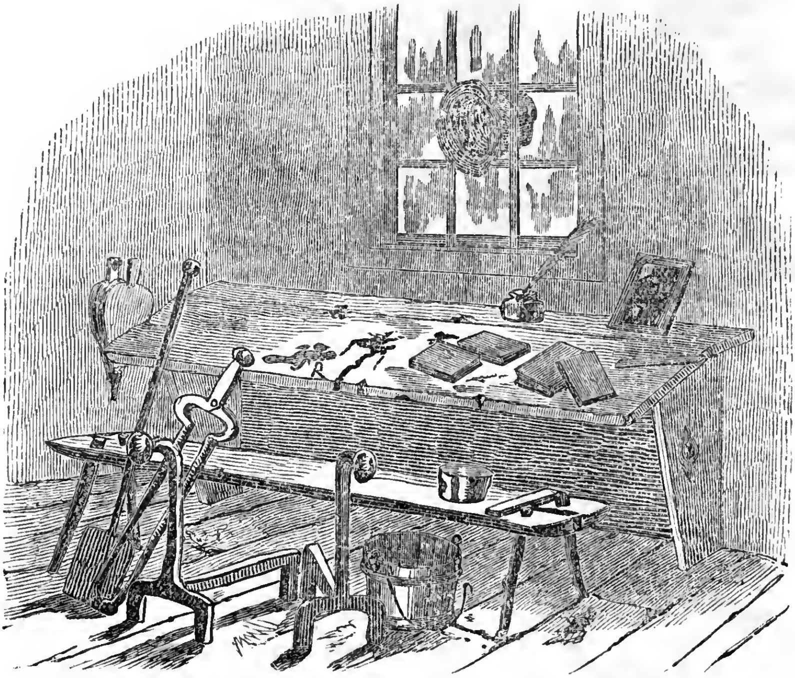
1. "Elocutionary;" 2. "Herpetology, or Reptiles;" 3. "Second Division of Human Physiology and Health;" 4th, "Second Division of Vegetable Physiology, or Botany; 5. "Ichthyology, or Fishes;" 6. "Civil Architecture;" 7. "Second Division of Natural Philosophy; 8. "Physical Geography;" 9. "Chemistry;" 10. "Geology;" 11. "Ancient History." We have room to introduce only one illustration from each of two of these divisions.

The Botanical Illustration here given represents the Trumpet-Flower and Labiate Families; another cut shows the features which specially characterize these families, but for which we have not room here. The Classification of Plants, in accordance with the *Natural System*, is shown chiefly by such interesting illustrations as these, which certainly accomplish far more than pages of description. Moreover, the economical uses of plants are not overlooked, and the entire treatment of the subject is well calculated to cultivate, in early life, a taste for the successful study of Nature. In the department of Ichthyology, 125 species of fish are figured. Physical Geography, Architecture, Geology, &c., have their appropriate illustrations, all teaching useful facts in science, but without the dryness which usually accompanies scientific detail.

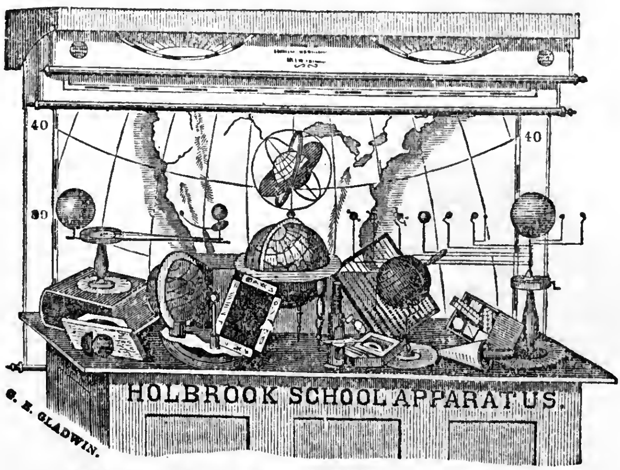
Of the very successful manner in which the above subjects have been made to combine the *literary variety* required in Reading-Books for youth, with *instruction in useful knowledge*, we have not room to speak here; but we commend a critical examination of the books themselves — in their design, plan, and execution—to every one interested in the subject of Educational Progress.

What a contrast between these and our earlier Reading-Books! The simple fact that publishers can now *afford* to illustrate, so elaborately, books designed for use in our *Common Schools*, speaks volumes for the cause of Popular Education.

SCHOOL APPARATUS.



APPARATUS AND EQUIPMENT OF THE DISTRICT SCHOOL AS IT WAS.



SPECIMENS OF APPARATUS OF THE SCHOOL AS IT IS.

CHAPTER XIX.

LIBRARIES.

At the close of the Revolution, there were very few public libraries in the country; hardly any, indeed, away from the colleges and large towns, and even these, few and small as they were, were not generally accessible. The oldest of them all was that of Harvard University, which commenced with the bequest of Harvard's books in 1638, but had been completely destroyed by fire in 1764. Great efforts were made to restore it, and before the commencement of the Revolution about $20,000 and considerable quantities of books had been contributed for that purpose. It could, however, hardly have had more than 10,000 or 12,000 volumes at that period. The only other college libraries then in existence (all of them small, but two or three of them containing many valuable works,) were the library of Yale College, founded in 1700, which had received important additions from Bishop Berkeley and other English gentlemen; the very small library of William and Mary, at Williamsburg, Va., founded, perhaps, two or three years earlier; that of the University of Pennsylvania, founded in 1749, also small, but valuable; that of New Jersey College, at Princeton, founded in 1746; that of King's, now Columbia, College, founded in 1757, and containing at the close of the Revolution not more than 2000 volumes; and the few hundred volumes which had been collected, as nuclei of libraries, in Brown University from and after 1768, Dartmouth College from 1769, and Rutgers College from 1770 to the close of the war. Of proprietary libraries, the oldest and best was the Philadelphia Library Company and Loganian Collection, founded by Benjamin Franklin in 1731, which in 1783 contained about 5000 volumes. The Redwood Library at Newport, R. I., incorporated in 1747, though not a large collection, possessed considerable value to the classical and theological student. The New York Society Library, founded in 1754, had attained to considerable size prior to the war, but suffered much from the vandalism of the British soldiers, its books being carried off by the knapsackful and bartered for grog. In 1795 it had only 5000 volumes. The Charleston Library Society was founded a year or two earlier than the New York Society, and at the commencement of the war had between five and six thousand volumes, aside from the library of Mr. Mackenzie, bequeathed to it about the same time. In 1778, however, this fine collection was almost entirely destroyed by fire, a small portion of the books only being rescued from the flames, and of these many being broken sets. The Providence Athenæum, founded in 1753, the Salem Athenæum in 1760, and the Portland Athenæum in 1765, small collections, but well selected, the special library of the American Philosophical Society at Philadelphia, and a state library of three or four hundred volumes, at Concord, New Hampshire, complete the catalogue of public libraries of any considerable importance at the close of the war of the Revolution.

The period immediately subsequent to the war was not favorable to the multiplication or growth of libraries; for, being among the outgrowths of an opulent and luxurious civilization, we could hardly look for their increase amid the poverty and financial revulsions which continued till nearly the close of the last century. Between 1783 and 1800, ten colleges and one theological seminary were founded, and some of them—as, for instance, Bowdoin, Georgetown, D. C., Williams, Dickinson, Transylvania, and the University of North Carolina—now possess respectable libraries, but they have been mainly accumulated within the last forty years. Of other libraries, we can find no record of even one, of any importance, founded in this period.

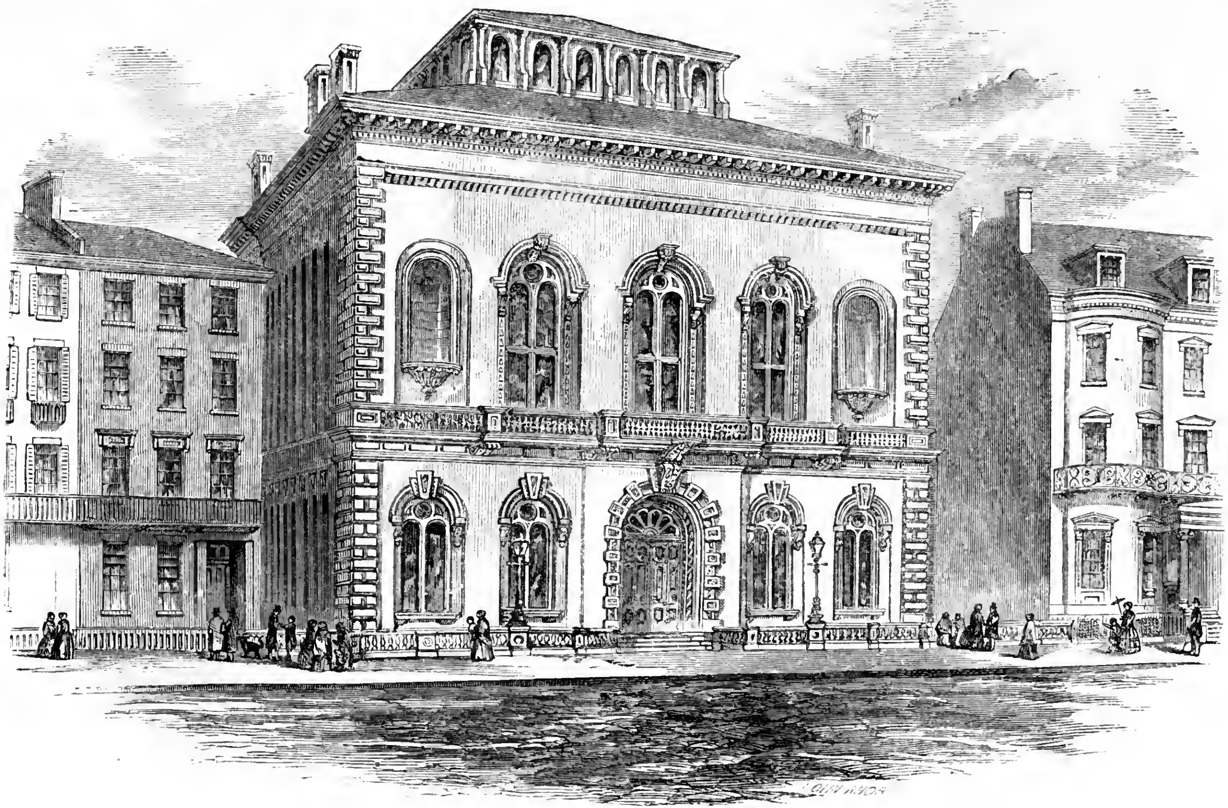
In the period between 1800 and the close of the war of 1812, there were five colleges and two theological seminaries organized, all of which now have libraries of considerable importance. To this period also belong the beginnings of the Boston Athenæum, now the fourth library in the country in the number of its volumes, the first library of Congress, which was destroyed by the British in 1814, the noble collection of the New York Historical Society, and the commencement of the special libraries of the American Antiquarian Society at Worcester, and the American Academy of Natural Sciences at Philadelphia.

The war of 1812 was followed by a period of severe financial distress, and it was not till about 1818 that any considerable efforts were made for the establishment of libraries. Between 1818 and the present time, not only have more than one hundred colleges been organized, each of which has a library of some size, and many of them from 10,000 to 25,000 volumes, but there have also been established more than twenty theological seminaries, with considerable collections of books; most of the state libraries, beginning with the valuable State Library at Albany, of over 50,000 volumes, the Congressional, Astor, Smithsonian, Boston Public Library, and other free libraries; most of the libraries of the learned societies, and the extensive collections of the historical societies, three or four proprietary libraries of some note, all of the subscription libraries, known as mercantile, institute, mechanics', or apprentices' libraries, and those connected with young men's Christian associations and with churches. Within the same period also, and mainly within twenty years past, great numbers of special libraries—scientific, commercial, agricultural, mining, humanitarian, or devoted to the promotion of particular departments of art or literature—have been founded, while in all the states Sunday School libraries, and in many of them school-district, town, and academical libraries have been formed. Prior to 1840, there were many instances in which writers who desired to investigate certain periods of history, or certain sciences or arts, were compelled to visit Europe in order to procure from the great libraries of England or the continent the necessary facts. The necessity for this is now nearly obviated. The great libraries of Cambridge, Boston, New York, Philadelphia, and Washington, though neither of them so complete as they should be, yet together furnish material for the preparation of works in most departments of science, literature, or art, and they are every year becoming more and more full in the topics heretofore deficient.

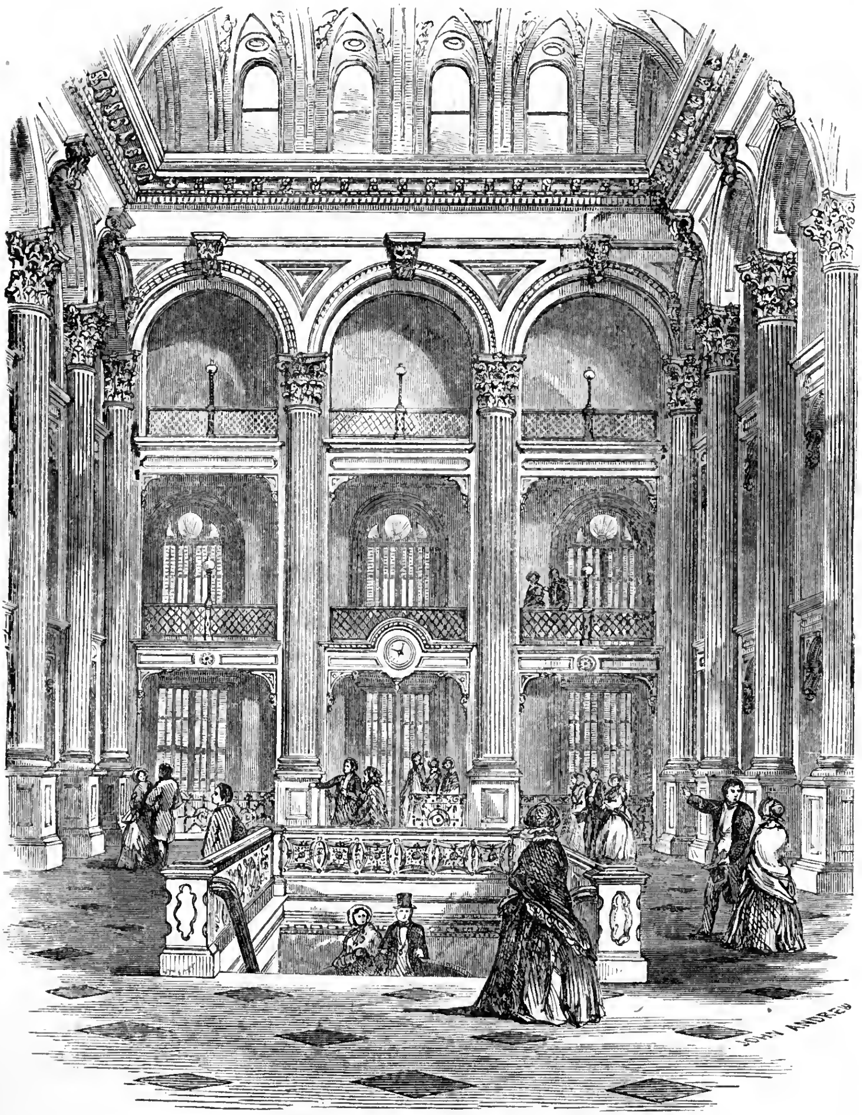
The best free library in this country, and the largest, is the Astor Library of New York. It was founded by the bequest of $400,000 by John Jacob Astor, of which $75,000 was to be appropriated for the building, $120,000 for the first purchase of books, and the remainder invested, and the interest applied to the management and increase of the library. The original building, with its furniture and shelving, opened in 1854, cost about $120,000, the excess over $75,000 being from accrued interest. The $120,000 expended for books purchased about 80,000 volumes. The shelf-room (13,000 feet) being likely to prove insufficient for the wants of the library, William B. Astor, Esq., the son of the founder of the library, purchased a lot adjoining the north side of the library, 80 by 120 feet, and erected an additional building, somewhat larger than the original one, which he presented to the trustees. Mr. Astor has also, at different times, made considerable donations for the purchase of books. The present number of volumes in the library is somewhat more than 120,000, nearly all acquired by purchase. In his long and careful bibliographical preparation for purchasing this library, in his judicious selections, and careful expenditures, Dr. Cogswell, the librarian-in-chief, has established a claim to the gratitude of all scholars.

The library of Harvard University has grown up since 1764, when the original library was destroyed by fire, by numerous donations of books, and, in quite a number of instances, of entire libraries, as well as by donations and bequests of money from friends. These donations and bequests cannot fall much short of $150,000, and it has now a fund of $26,000, the interest of which is applicable to the purchase of books, and the sum of $5000 per year, for five years from 1859, pledged by William Gray, Esq., to be applied to the same purpose. The various collections of books in Gore Hall (the library building) include not only the college library proper, but also the society libraries, and the libraries of the divinity, law, and medical schools. The whole number of volumes is about 125,000, but the library is very miscellaneous in character, and incomplete in certain departments. The considerable sums it now has at command for purchases are applied to make good its deficiencies as far and as fast as possible.

The Boston City Library, a free public library, now ranks third in this country. It was founded in 1848, in accordance with a law of Massachusetts providing for the establishment of town libraries. Hon. Josiah Quincy, jr., then mayor of the city, gave $5000 toward it; Mr. Bigelow gave $1000; Mr. Everett and Mr. Winthrop, large donations of books; Mr. Joshua Bates, of London, $50,000, besides several thousand volumes; Mr. Jonathan Phillips, $10,000; and others, smaller sums. The building, erected at a cost of $363,000 by the city of Boston, is one of the finest library rooms in the world. The present number of volumes is a little more than 100,000, and is increasing at the rate of 8000 volumes per annum. During the present year (1861) also, it will



BOSTON CITY LIBRARY EXTERIOR.



BOSTON CITY LIBRARY. INTERIOR.

receive the fine library bequeathed to it by the late Theodore Parker, consisting of nearly 18,000 volumes.

The Boston Athenæum ranks fourth in the number of its volumes, is peculiarly rich in the transactions of learned societies, and has a considerable portion of General Washington's library. It has now about 75,000 volumes, and has cost for its building and books full $300,000. Though a proprietary library, it is practically free to the public for consultation. It was founded in 1806, but its principal growth has been within the last twenty-five years.

The library of Congress, which was nearly destroyed by fire in 1851, has since been restored and largely increased. The purchases being made under the direction of a committee of the two Houses, comprising their most eminent scholars, are judicious, and the library, which contains about 65,000 volumes, is one of the best for reference and consultation in the country. The library of the House of Representatives, also in the Capitol, contains about 40,000 volumes.

The Philadelphia Library Company and Loganian Collection is another of the proprietary libraries which are accessible to the public for consulting purposes free of charge. Though founded 130 years ago, its growth has been mainly achieved during the present century. In 1800, it contained only 7000 or 8000 volumes, while its present number is about 70,000.

The New York Mercantile Library is the largest of the subscription and lending libraries which are found in most of the considerable towns of the United States. It possesses a fine edifice in Astor Place, which cost nearly $240,000, and the rent of that portion of the building not occupied for library purposes and reading-rooms, will give it, when its debt is liquidated, a considerable annual fund in addition to its receipts for membership. Its reading-room is the largest in the country, though the free reading-room of the Cooper Institute very nearly approaches it. Its library, though intended mainly for popular readers rather than scholars, contains a very considerable collection of valuable works of reference. Its present number of volumes is about 60,000.

The New York State Library at Albany is by far the largest of all the state libraries, and is especially valuable for its fine collection of works on American history and on the natural sciences. It was founded in 1818, but its principal increase has been since 1845, at which time the Warden collection of works on America was purchased and incorporated in the library. The late Dr. T. Romeyn Beck superintended it for many years, and to his judicious purchases it is indebted for much of its value. Its present number of volumes is not far from 55,000.

The library of the Smithsonian Institution at Washington, though not so large as some others, numbering little more than 35,000 volumes, is a very valuable collection. The aim of Dr. Henry, the secretary of the institution, has been to make it particularly full in those departments in which other libraries are deficient. Its books are loaned to eminent scholars at a distance, when needed for the preparation of works of importance. For some years it received a copy of all copyright books in the country.

The American Antiquarian Society at Worcester has an exceedingly valuable collection on American antiquities. Founded in 1812, by the late Isaiah Thomas, who was for twenty years its president, and who gave it about 9000 volumes, it has now about 26,000 volumes, many of them unique in this country.

The New York Historical Society, founded in 1804, has a very valuable library of about 30,000 volumes, mainly confined to American history and literature; a museum of American relics and antiquities; a large picture gallery; and has recently purchased the fine collection of Egyptian antiquities procured by the late Dr. Abbott.

The American Academy of Natural Sciences at Philadelphia has a museum of natural history of nearly 30,000 specimens, and a library of about 27,000 volumes, more complete in natural history than any other, and also containing a very full collection of the revolutionary literature of France, presented them by Mr. William Maclure.

Two other foundations for libraries are deserving of notice: that of George Peabody, Esq., for the Peabody Institute at Baltimore, which contemplates a library in connection with a gallery of the fine arts, a musical conservatory, etc., the entire endowment amounting to $600,000; and that of the late David Watkinson, of Hartford, Connecticut, who left, in 1857, the sum of $100,000 to found a library of reference in connection with the Connecticut Historical Society, and also made that library his residuary legatee.

These are the most remarkable public libraries of the country. There are, according to the latest returns, 3 libraries containing over 100,000 volumes each; 9 containing over 50,000 volumes each; 19 containing 30,000 volumes or more; 26 containing 25,000 volumes or more; 41 containing over 20,000; and 120 containing 10,000 or more.

The total aggregate of volumes in college, state, national, proprietary, subscription, free, and town libraries, is not far from 3,800,000, and is increasing with great rapidity.

There are, besides these, in many of the states, school-district and academic libraries, containing a very large aggregate amount of books. In the state of New York, the number of volumes in the academic libraries reporting to the Board of Regents exceeds 125,000; and the number of volumes in the common-school libraries exceeds 1,500,000. Massachusetts, New Hampshire, Connecticut, Ohio, Michigan, Indiana, Illinois, Wisconsin, and Iowa, also make provision for such libraries, and have large numbers of them. The latest school returns indicate that the number of volumes in this class of libraries is not far from 4,000,000.

Another class of libraries, containing in the aggregate a vast number of volumes, and in many cases works of considerable size and value, are the Sunday School libraries. Few of these contain less than 200 volumes, and many of them have 1000 or more. More than 4000 different works have been published for these libraries within a few years past by the publishing societies and private publishers, and large drafts are also made by the larger schools on English publications and those intended for adults. Estimating the number of these schools at 35,000, or about two thirds the number of churches (an estimate considerably below the truth), and the volumes in each library at 200, we have an aggregate of 7,000,000 volumes collected in these humble libraries.

As might be expected, the rapid growth of public libraries has stimulated gentlemen of wealth and intellectual tastes to collect private libraries of considerable extent, and in many cases devoted to some specialty. Perhaps the largest of these private collections is that of James Lenox, Esq., of New York, which is especially rich in early works and in Bibles.

One of the most singular is that of John Allan, Esq., of the same city, which contains a very considerable collection of books which have been interleaved and illustrated by the collector, with choice engravings of the persons or events described, often to the number of some hundreds in each volume.

There are in the city of New York alone not less than 25 private libraries containing more than 10,000 volumes each, and in Boston a still larger number. Philadelphia has also many very choice private libraries.

Some of these private collections are very complete on American local history. Noticeable among these are the libraries of Peter Force, Esq., of Washington, D. C.; George Brinley, Esq., of Hartford, Connecticut; George W. Greene, of Providence, R. I.; and Messrs. George Bancroft, J. C. Brevoort, W. J. Davis, H. C. Murphy, William Menzies, and J. R. Brodhead, of New York. The library of Hon. Henry Barnard, at Hartford, Connecticut, is more complete on the subject of education than any other in the country; that of W. Parker Foulke, Esq., of Philadelphia, is very full on prisons and prison discipline, and that of S. Austin Allibone, Esq., of the same city, on English literature and criticism; that of David N. Lord, of New York, on ecclesiastical and polemic literature; that of Professor Charles Anthon, of the same city, contains a fine collection of classics and works on classical literature; that of G. W. Pratt, also of New York, on Oriental languages and literature; that of C. L. Bushnell, on numismatics; that of J. A. Stevens, jr., on the literature of the Middle Ages; those of Messrs. W. P. Chapman and R. G. White, on dramatic and especially Shakspearian literature; that of D. W. Fiske, on Scandinavian literature; that of George Folsom, on history and geography; that of R. M. Hunt, on architecture; and those of Archbishop Hughes, Rev. Dr. Forbes, Rev. Dr. Hatfield, and Rev. Dr. Bethune, on theology, ecclesiastical biography, and patristic literature.

There are in connection with many of our benevolent and humane institutions special libraries containing a few hundred or thousand volumes devoted to the particular work of those institutions. Thus, the American Asylum for the Deaf and Dumb, at Hartford, and the New York Institution for the Deaf and Dumb, have each a very considerable collection of works on deaf mute instruction; the American Bible Society has a fine collection of Bibles in all languages; and the American Bible Union, a valuable collection of works on biblical criticism and exegesis, procured for the use of its translators. The collection of books of reference procured for the use of the editors of the New American Cyclopædia is very extensive and complete, surpassing, in these particulars, any library in the country.

The following table gives the name of every considerable public library in the United States, and its number of volumes, according to the latest reports :—

PRINCIPAL PUBLIC LIBRARIES IN THE UNITED STATES, WITH THE NUMBER OF VOLUMES IN EACH IN 1860, AS NEARLY AS CAN BE ASCERTAINED.

I.—LIBRARIES OF COLLEGES, THEOLOGICAL SEMINARIES, ETC.

*Colleges.**

When founded.	Name.	Location.	No. of volumes.
1638,	Harvard College	Cambridge, Mass	125,000
1692,	William and Mary	Williamsburg, Va	53,000
1700,	Yale College	New Haven, Conn	67,000
1746,	College of New Jersey	Princeton, N. J	24,000
1749,	University of Pennsylvania	Philadelphia, Penn	5,100
1757,	Columbia College	New York City, N. Y	20,000
1768,	Brown University	Providence, R. I	37,000
1769,	Dartmouth College	Hanover, N. H	34,000
1770,	Rutgers College	New Brunswick, N. J	12,000
1781,	Washington College	Lexington, Va	6,500
1783,	Dickinson College	Carlisle, Penn	24,000
1784,	St. John's College	Annapolis, Md	8,000
1785,	Charleston College	Charleston, S. C	5,200
1785,	Franklin College	Athens, Ga	18,500
1789,	Hampden Sidney College	Prince Edward's Co., Va	7,200
1789,	University of North Carolina	Chapel Hill, N. C	21,000
1791,	University of Vermont	Burlington, Vt	13,000
1792,	Georgetown College	Georgetown, D. C	36,000
1793,	Williams College	Williamstown, Mass	20,000
1794,	Bowdoin College	Brunswick, Me	27,500
1795,	Union College	Schenectady, N. Y	16,000
1798,	Transylvania University	Lexington, Ky	14,000
1800,	Middlebury College	Middlebury, Vt	14,000
1801,	University of South Carolina	Columbia, S. C	24,000
1802,	Jefferson College	Cannonsburg, Penn	10,000
1804,	Ohio University	Athens, Ohio	5,300
1806,	University of East Tennessee	Knoxville, Tenn	8,500
1806,	University of Nashville	Nashville, Tenn	10,000
1809,	Miami University	Oxford, Ohio	8,500
1812,	Hamilton College	Clinton, N. Y	13,000
1817,	Alleghany College	Meadville, Penn	10,000
1819,	University of Virginia	Charlottesville, Va	30,000
1819,	St. Joseph's College	Bardstown, Ky	9,000
1820,	Waterville College	Waterville, Me	10,000
1821,	Columbian College	Washington, D. C	8,000
1821,	Amherst College	Amherst, Mass	26,000
1823,	Centre College	Danville, Ky	6,000
1825,	Trinity College	Hartford, Conn	14,000
1825,	Hobart Free College	Geneva, N. Y	14,000
1826,	Kenyon College	Gambier, Ohio	14,000
1826,	Western Reserve College	Hudson, Ohio	9,000
1830,	Spring Hill College	Spring Hill (near Mobile), Ala	7,500
1831,	University of Alabama	Tuscaloosa, Ala	12,000
1831,	University of New York	New York, N. Y	5,000
1831,	Wesleyan University	Middletown, Conn	13,000
1832,	Pennsylvania College	Gettysburg, Penn	11,000
1832,	Denison University	Granville, Ohio	5,200
1832,	Randolph-Macon College	Boydon, Va	8,000
1832,	Hanover College	South Hanover, Ind	5,600
1832,	St. Louis University	St. Louis, Mo	22,000
1833,	Wabash College	Crawfordsville, Ind	10,000
1833,	Delaware College	Newark, Del	10,000
1835,	Marietta College	Marietta, Ohio	16,000
1835,	McKendree College	Lebanon, Ill	5,800
1836,	Franklin and Marshall College	Lancaster, Penn	19,000
1837,	University of Michigan	Ann Arbor, Mich	10,000

* Those containing less than 5000 volumes are not noticed.

When founded.	Name.	Location.	No. of volumes.
1837,	Indiana Asbury University	Greencastle, Ind.	10,000
1838,	Wake Forest College	Forestville, N. C.	5,200
1838,	Emory and Henry College	Washington Co., Va.	9,000
1840,	Davidson College	Mecklenburg Co., N. C.	6,000
1840,	St. John's College	Fordham, N. Y.	16,000
1840,	Mercer University	Penfield, Ga.	9,000
1840,	Georgetown College	Georgetown, Ky.	7,000
1842,	St. James's College	Washington Co., Md.	10,000
1842,	Ohio Wesleyan University	Delaware Co., Ohio	10,500
1843,	Holy Cross	Worcester, Mass.	6,500
1845,	Centenary College	Jackson, La.	6,500
1845,	Wittenberg University	Springfield, Ohio	6,500
1846,	Madison University	Hamilton, N. Y.	8,000
1847,	St. Mary's College	Wilmington, Del.	6,000
1848,	Free Academy	New York	15,000
1848,	State Normal School	Albany, N. Y.	8,000
1848,	University of Mississippi	Oxford, Miss.	5,000
1849,	Lawrence University	Appleton, Wis.	15,000
1850,	Rochester University	Rochester, N. Y.	5,500
1854,	Tufts' College	Mildford, Mass.	8,000
1857,	Loyola College	Baltimore, Md.	20,000
	Santa Clara College	Santa Clara, Cal	10,000
	Theological Seminaries.		
1784,	Theological Seminary Reformed Dutch Church	New Brunswick, N. J.	7,000
1791,	St. Mary's Theological Seminary	Baltimore, Md.	10,000
1808,	Andover Theological Seminary	Andover, Mass	21,500
1812,	Princeton Theological Seminary	Princeton, N. J.	11,000
1816,	Divinity School	Cambridge, Mass.	8,700
1816,	Bangor Theological Seminary	Bangor, Me.	10,500
1817,	Episcopal General Theological Seminary	New York	12,000
1820,	Hamilton Theological Seminary	Hamilton, N. Y.	8,000
1821,	Auburn Theological Seminary	Auburn, N. Y.	6,000
1821,	South-Western Theological Seminary	Marysville, Tenn.	6,000
1822,	Episcopal Theological School	Fairfax Co., Va.	7,500
1825,	Newton Theological Institution	Newton, Mass.	5,500
1825,	Wittenberg Theological Seminary	Gettysburg, Penn.	10,000
1825,	German Reformed Theological Seminary	Mercersburg, Penn.	6,000
1827,	Theological Department Kenyon College	Gambier, Ohio	6,500
1828,	Western Theological Seminary	Alleghanytown, Penn.	10,000
1828,	Theological Seminary	Columbia, S. C.	17,500
1829,	Lane Seminary	Cincinnati, Ohio	11,000
1832,	New Albany Theological Seminary	New Albany, Ind.	4,000
1834,	Theological Institute	East Windsor, Conn.	5,000
1836,	Union Theological Seminary	New York	18,000
1844,	Western Theological School	Meadville, Penn.	8,000
1850,	Rochester Theological Seminary	Rochester, N. Y.	6,000
	Medical Schools and Hospitals.		
1755,	Pennsylvania Hospital Library	Philadelphia, Pa.	11,000
1765,	Medical Department Pennsylvania University	" "	5,000
1791,	New York Hospital Library	New York	7,000
1807,	New York College of Physicians and Surgeons	"	1,800
1831,	University Medical School	"	4,500
	Law Schools and Libraries.		
1817,	Dane Law School	Cambridge, Mass.	14,000
1845,	New York State and National Law School	Poughkeepsie, N. Y.	3,000
	New York Law Library	New York	6,500
	Social Law Library	Boston	6,000
1802, } 1841, }	Law Association	Philadelphia	5,000
	II.—STATE LIBRARIES.		
1770,	New Hampshire State Library	Concord	6,500
1816,	Pennsylvania " "	Harrisburg	15,500
1817,	Ohio " "	Columbus	18,500
1818,	New York " "	Albany	55,000
1824,	New Jersey " "	Trenton	9,000
1825,	Indiana " "	Indianapolis	20,000

When founded.	Name.	Location.	No. of volumes.
1826,	Maryland State Library	Annapolis	22,000
1826,	Massachusetts " "	Boston	13,000
1828,	Virginia " "	Richmond	18,000
1829,	Missouri " "	Jefferson City	8,000
1834,	Kentucky " "	Frankfort	10,000
1836,	Maine " "	Augusta	17,000
1836,	Wisconsin " "	Madison	7,500
1848,	Connecticut " "	Hartford	7,500
	Tennessee " "	Nashville	9,000
	Mississippi " "	Jackson	8,000
	Louisiana " "	Baton Rouge	10,000
	North Carolina " "	Raleigh	7,000
	California " "	Sacramento	14,000
	III.—PUBLIC OR ENDOWED LIBRARIES.		
1747,	Redwood Library	Newport, R. I.	4,500
1800, 1815, 1851,	Library of Congress	Washington, D. C.	65,000
	Library of House of Representatives	" "	40,000
	Library of State Department	" "	18,000
	Library of War Department	" "	10,000
	Copyright Library	" "	13,500
	Library of Patent Office	" "	10,000
1839,	Astor Library	New York	120,000
1848, 1852,	City Public Library	Boston	100,000
1849,	Smithsonian Institution	Washington, D. C.	35,000
1838,	National Institute	" "	5,000
1852,	Free Library	New Bedford, Mass.	13,000
1857,	City Library	Springfield	7,000
	Bowditch Library	Boston	3,000
	United States Mint	Philadelphia	2,500
	Graham Institute Library	Brooklyn, N. Y.	10,000
	IV.—LIBRARIES OF LEARNED SOCIEITES.		
1742,	American Philosophical Society	Philadelphia, Penn.	26,000
1812,	American Antiquarian Society	Worcester, Mass.	26.000
1812,	American Academy of Natural Sciences	Philadelphia	27,000
	American Academy of Arts and Sciences	Boston	9,500
	American Oriental Society	New Haven	2,000
	American Geographical and Statistical Society	New York	3,000
	American Natural History Society	Boston	6,500
1824,	Franklin Institute	Philadelphia	6,000
	American Institute	New York	8.000
	New England Genealogical Society	Boston	14,000
	Lyceum of Natural History	New York	3,000
	V.—LIBRARIES OF HISTORICAL SOCIETIES.		
1804,	New York Historical Society	New York	30.000
	Maryland " "	Annapolis	20,000
	Massachusetts " "	Boston	8,000
	Connecticut " "	Hartford	11,000
	Georgia " "	Milledgeville	8,000
	New Jersey " "	Newark	2,500
	Ohio " "	Columbus	2,000
	Wisconsin " "	Madison	4,500
	Chicago " "	Chicago	7,500
	VI.—PROPRIETARY LIBRARIES.		
1731,	Library Company and Loganian Collection	Philadelphia	70,000
1748,	Charleston Library Society	Charleston, S. C.	25,000
1753, 1831, 1836,	Athenæum	Providence, R. I.	23,000
1754,	Society Library	New York	44,000
1760,	Athenæum	Salem, Mass.	14,000
1765,	Athenæum	Portland, Me.	10,000
1806,	Athenæum	Boston, Mass.	75,000

When founded.	Name.	Location.	No. of volumes.
1813,	Athenæum	Philadelphia, Penn	15,000
1817,	Athenæum	Portsmouth, N. H.	9,000
	Library Company	Baltimore, Md	17,500
	Library Society	Boston, Mass	16,000
	VII.—MERCANTILE, INSTITUTE, LYCEUM, ETC., LIBRARIES. Membership and library privileges secured by a small annual, semi-annual, or quarterly subscription.		
1820,	Mercantile Library	New York	60,000
1820,	Mercantile Library	Boston, Mass	22,500
	Apprentices' Library	New York	30,000
1819,	Apprentices' Library	Philadelphia, Pa	18,000
1821,	Mercantile Library	" "	16,000
1835,	Mercantile Library	Cincinnati, O	24,000
1838,	Young Men's Institute	Hartford, Ct	15,500
	Young Men's Institute	New Haven	12,000
	Mercantile Library	Baltimore, Md	16.000
1846,	Mercantile Library	St. Louis, Mo	15,000
	Mercantile Library	Portland, Me	2,500
1858,	Mercantile Library	Brooklyn, N. Y	16,500
	Mercantile Library	San Francisco, Cal	12,000
	Apprentices' Library	Boston, Mass	6,000
	Apprentices' Library	Charleston, S. C	14,000
	Mechanics' Institute	New York	4,000
	Mechanics' Institute	Chicago, Ill	5,000
	Mechanics' Institute	Cincinnati	13,000
1860,	Women's Library	New York	6,000
	VIII.—PUBLIC AND HIGH SCHOOL AND SEMINARY LIBRARIES.		
	High School Library	Providence	2,000
	Public School Library	New Orleans	11,000
1839,	Central High School	Philadelphia	2,000
1853,	Central High School	Cincinnati	14,000
	United States Military Academy	West Point, N. Y	17,500
	United States Naval Academy	Annapolis, Md	8,000
	Spingler Institute	New York	3,000
	Rutgers Institute	" "	3,500
	IX.—MISCELLANEOUS LIBRARIES.		
1817,	American Asylum for Deaf and Dumb	Hartford, Ct	1,800
1818,	New York Institution for Deaf and Dumb	New York	4,500
1815,	American Bible Society	" "	2,000
1850,	American Bible Union	" "	5,000
1838,	American and Foreign Bible Society	" "	1 600
1822,	American Board C. F. Missions	Boston	6,000
	German Society	Philadelphia	12,000
	Orthodox Friends' Library	"	6,000
	Hicksite Friends' Library	"	5,000
	Boston Library	Boston	16,000
	Washington Library	Washington, D. C	13,000
	Southwark Library Company	Philadelphia, Penn	10,000
	Wagner Free Institute	" "	8,000
	American Sunday School Union	" "	7,000
	Maryland Institute	Baltimore	12,000
	Congregational Library Association	Boston	4,500

CHAPTER XX.

LYCEUMS, MECHANICS' INSTITUTES, YOUNG MEN'S INSTITUTES, ART UNIONS, ETC.

THE name of *Lyceum* is one of ancient origin, having been first bestowed on the place where Aristotle gave his instructions, from its connection with the temple of Apollo Lycius. In more modern times it has been applied to schools where the philosophy of Aristotle was taught, and to institutions in which the instruction was given mainly by lectures. In 1786 it was given, in France, to an institution of the nature of a museum, at which daily lectures were delivered by La Harpe. This was discontinued in 1794, in consequence of the French Revolution. During the present century the name has been applied in France to collegiate schools answering very nearly to our colleges or public high schools.

The Conservatory of Arts and Trades at Paris, organized in 1796, by Vaucanson, is an example of the higher class of lyceum in its more extended sense. It has thirteen galleries of materials and machines, and courses of lectures, scientific and practical, which are largely attended during the winter by the working classes.

The origination of the lyceum as a means of mutual instruction in this country is due, in the first instance, to Benjamin Franklin. His "club for mutual improvement" was founded in Philadelphia in 1727, and after forty years' existence became the basis of the American Philosophical Society, one of the highest scientific societies on this continent. There may have been, and probably were, other societies for mutual improvement organized in different towns and cities of the country, during the hundred years that followed the organization of Franklin's club; but there are no records of any such in the possession of the public, previous to 1824, when Timothy Claxton, an English mechanic, succeeded in founding one, or rather in modifying a reading society, which had been in existence for five years, into what was really a lyceum, in the village of Methuen, Mass. Its exercises were weekly, and in the following order: the first week, reading by all the members; the second week, reading by one member selected for the purpose; the third week, an original lecture; the fourth week, discussion. In 1826, Mr. Josiah Holbrook, then of Derby, Conn., communicated to the *American Journal of Education*, then conducted by Mr. William Russell, his views on the subject of "*Associations of Adults for the Purpose of Mutual Education*," in which were contained the germs of the plan of the *Lyceum*, as subsequently developed by him in his lectures and publications. From the first, his views were of wider scope than the organization of a mere local association; they comprehended the establishment of such associations in every town and village, and their union, by representation, in county, state, and national organizations. They contemplated also, not only mutual instruction in the sciences, but the establishment of institutions for the education of youth in science, art, and morals; the collection of libraries, and of cabinets of minerals and other articles of natural or artificial production, to be increased and enlarged by mutual exchanges, by the different associations. Lectures and practical agricultural occupation, the results of which, it was supposed, would materially diminish the cost of instruction, also formed a part of his programme.

The first association formed in accordance with this plan was organized at Millbury, Mass., by Mr. Holbrook himself, in November of the same year, and was called "Millbury Lyceum, No. 1, Branch of the American Lyceum." Other towns soon after organized lyceums, and these were combined a few months later into the Worcester County Lyceum. Not long after, the Windham County, Conn., Lyceum, with its constituent town lyceums, was established; Rev. Samuel J. May, then of Brooklyn, Conn., rendering valuable assistance in the work.

From this time onward to his death in 1854, Mr. Holbrook devoted his whole energies in one way and another to the promotion of these institutions, and to such measures in connection with the cause of education as should promote mutual instruction in children as well as adults. By scientific tracts, by newspapers and other publications, by the manufacture of school apparatus, and by the collection of small cabinets of minerals, to serve as *nuclei* for larger cabinets, by scholars' fairs, by lectures, and long journeys, and by appeals to the members of Congress and of the state legislatures, he succeeded in rousing a powerful and continued interest in the subject of mutual instruction, which, if it did not accomplish all his own plans, at least gave a wonderful impulse to the general intellectual culture of the nation. The lyceums he founded have passed away, at least in their original form, but in their places, and in a great measure as an indirect result of his labors, we have in every considerable town or village debating societies, young men's institutes, mechanics' institutes, library associations—the three latter often with circulating libraries, courses of lectures, and classes for instruction in science, art, and languages, and often with schools attached for the instruction of the children of the members. We have also lecture foundations, either connected with our colleges or professional schools, or independent, in which courses of instruction in physical science, history, literature, or the laws of language, are communicated to popular audiences.

In rendering the scientific lecture a popular institution, our country is greatly indebted to the late John Griscom, LL.D., Prof. B. Silliman, Sr., and Rev. Henry Wilbur. Dr. Griscom delivered his first course of popular lectures on chemistry in New York city in the winter of 1808; they were largely attended, and were continued for a long series of years. Prof. Silliman commenced popular lecturing on the same subject in New Haven about the same time, in connection with his professional courses. He subsequently delivered popular courses of lectures on chemistry and on geology in most of the large cities of the country. Within the last fifteen or twenty years, Prof. Edward Hitchcock, of Amherst College, and several other eminent geologists, have given courses on geology to popular audiences. Prof. Guyot has lectured on physical geography; Messrs. Mann, Barnard, Page and others, on educational topics; Hon. George P. Marsh on language; Professor Lieber and others on commerce, and other prominent scholars on other subjects. The Lowell Institute at Boston, founded by the munificence of the Hon. J. A. Lowell, gives annually free courses of lectures to large audiences on the most important branches of moral, intellectual, and physical science, and from the liberality of its compensation to the lecturers, induces elaborate and conscientious preparation on their part, and the benefit of this preparation inures also to other audiences, to which these lectures are repeated. It has unfortunately been the custom for a few years past of the young men's institutes, mercantile library associations, and other institutions giving courses of lectures through the winter season, to select lecturers who would amuse rather than instruct their audiences, and hence this mode of public instruction has become gradually less and less efficient, and the chief advantages resulting from these institutions have been the use of their circulating libraries, and their classes of instruction and debate. A revolution, however, is now gradually taking place in this respect; lectures on physical science are more frequently incorporated in the courses, and the highest talent is employed in the illustration of these sciences. The lectures of Professors Doremus, Draper, and Silliman, jr., on chemistry; of Mitchel, Youmans, and Loomis on astronomy, and of Agassiz, Henry, and others on geology, have uniformly attracted large audiences, and have led to the study of these sciences.

The Smithsonian Institution, which combines some of the features of the lyceum, in its public lectures, classes, and museum, with its other objects, will be spoken of at length in another place. Its influence in promoting scientific research has been widely felt.

One of the noblest enterprises connected with this class of institutions is the Cooper Union of New York city. The founder with princely liberality has erected an immense building, occupying an entire block, of the most substantial character. A portion of this building is rented, and the proceeds of the rental go to sustain a free reading-room as extensive as any in the country, a picture gallery, a library, schools of design for male and female pupils, and classes for instruction in sciences, the mechanic arts, and languages, all of which have rooms and instruction free, under the most competent teachers. Courses of lectures on scientific subjects for the working classes also form a part of the plan of Mr. Cooper.

Mr. George Peabody has also made a most liberal endowment, amounting in all to about $600,000, for an institution at Baltimore, to include a public library, courses of lectures on science, art, and literature, prizes for scholarship in the high schools, an academy of music, and a gallery of art.

The number of institutions coming under the general head of lyceums in the United States, is very great; throughout the Northern states every city and every considerable town has some organization of the kind, all of them having their courses of lectures, and most of them debates, essays, readings, or classes of instruction. To them is attributable in no inconsiderable degree the very general prevalence of oratorical talent in our country, and that ability for impromptu argument and discussion, the faculty of "thinking on our legs," as an English writer not inaptly terms it. While much of the instruction communicated by lectures must necessarily be superficial, and is often wanting in accuracy, it cannot be denied that they have contributed much to the diffusion of general information and culture.

CHAPTER XXI.

INSTITUTIONS FOR THE INSTRUCTION OF THE DEAF AND DUMB.

THE capacity of the deaf-mute to receive instruction was not generally acknowledged anywhere till the latter part of the last century. Individual instances of education of those laboring under this infirmity had indeed occurred as early as the middle of the 16th century, and perhaps even at a still earlier date, but no considerable attempts had been made to instruct them previous to the efforts of Pereira, Heinicke, De l'Epée, and Braidwood, all of whom taught deaf and dumb pupils, between 1742 and 1760. Of these, Heinicke and De l'Epée alone are deserving of the honor of being reckoned the founders of a great philanthropic movement. The former attempted the instruction of deaf-mutes by teaching them to articulate; the latter by the manual alphabet, and a development of the natural language of signs. De l'Epée's processes were greatly improved by the Abbé Sicard, and Bebian, a pupil of Sicard.

Deaf-mute instruction was not attempted in this country till about the year 1816. In a few instances children of wealthy parents, suffering under this infirmity, had been sent to England for instruction by the Braidwoods, father and sons, who held in their own family the monopoly of deaf-mute teaching, though adopting substantially the processes of Heinicke, and who charged a very high price for the education of each pupil. The father of one of these American pupils, in a work entitled "*Vox oculis subjecta*," published in 1783, lauded in high terms the instruction of the Messrs. Braidwood.

In 1814, Rev. Thomas H. Gallaudet, a young clergyman of Hartford, Conn., became deeply interested in the case of Alice Cogswell, the little daughter of Dr. M. F. Cogswell, a neighbor of his, who had lost her hearing in infancy, and having devoted much thought and investigation to the subject of the number and condition of the deaf-mutes of that state, was desirous of doing something for their education. Dr. Cogswell and other benevolent gentlemen in Hartford furnished the means of sending him to England, to learn the art of teaching deaf-mutes, and he sailed from New York for Liverpool, May 25, 1815. Arrived in England he found the elder Braidwood dead, and the mother, sons, and other relatives, who had now established three schools, unwilling to enlighten him as to their processes, unless he would pay 1500 dollars, remain a year as an assistant in one of their schools, and take the grandson of the first Braidwood, a drunken vagabond, as a partner in the institution to be established in America. Rejecting these terms, as unworthy of the pioneers in a great benevolent enterprise, Mr. Gallaudet had almost determined to return home, when he met the Abbé Sicard in London, and was most cordially invited by him to come to Paris and acquire his methods of teaching, receiving from him the necessary private instructions to enable him to accomplish this object more rapidly. This generous offer was promptly accepted by Mr. Gallaudet, and after three months of close application he returned to America, bringing with him M. Laurent Clerc, an educated deaf-mute, and one of Sicard's most successful teachers. It was now determined to establish a school for deaf-mute instruction, as soon as the necessary funds could be obtained. For this purpose, Messrs. Gallaudet and Clerc travelled extensively through the Eastern and Middle states, everywhere receiving a warm welcome. In the spring of 1817, about $12,000 had been contributed and pledged, to which the Connecticut legislature subsequently added $5000 more.*

The school was opened in rented buildings, April 15, 1817, having been chartered in May, 1816, by the legislature under the name of "The Connecticut Asylum for the Deaf and Dumb." An application was made to Congress for a grant, as it was supposed, in the general ignorance concerning the number of deaf-mutes, that one asylum would be sufficient for the whole country, and that body donated a township of land in Alabama, which, under wise and careful management, has produced a fund of over $300,000, the interest of which is applied to the reduction of the annual expenses of the institution, and enables the directors to furnish board and tuition to their pupils at the low price of $100 per annum. After the reception of this grant, the name of the institution was changed to "The American Asylum for the Deaf and Dumb."

Thomas Braidwood, the grandson of the founder of the first English school for deaf-mutes, to whom we have already referred, had come to Virginia as early as 1811, and had attempted to establish there a school for the deaf and dumb, but his habits were

* This sum was a few years later expended by the Asylum in the education of indigent deaf-mutes natives of Connecticut.

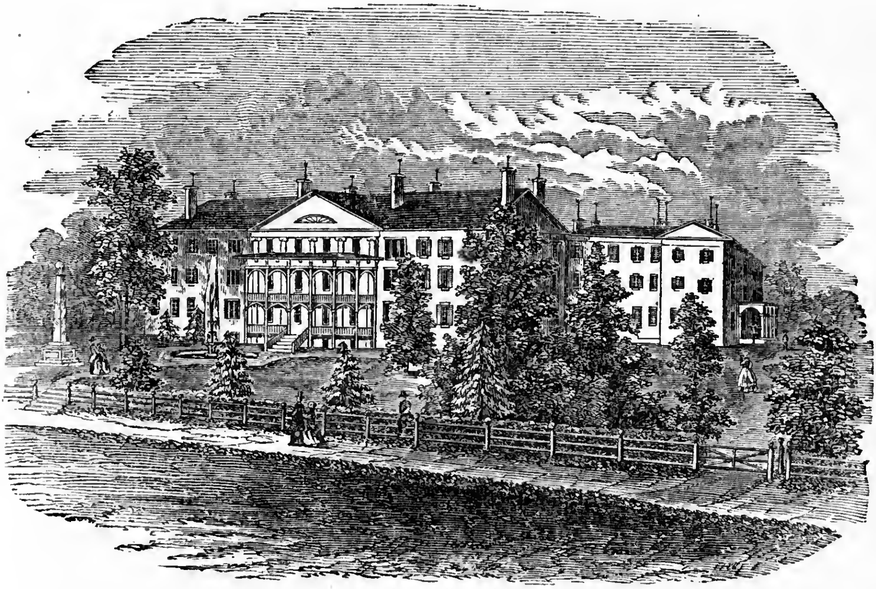
such that all the assistance offered him was of no avail, and after a time he returned to England; Mr. Gallaudet's efforts incited the family to make another trial, but he was so thoroughly a vagabond, that it again proved unsuccessful. M. Gard, a teacher of deaf-mutes at Bordeaux, and himself a deaf-mute, also offered to come to New York, in 1816, and establish an institution there, on the plan of Sicard, but the project fell through.

Meantime, philanthropic persons in New York city were desirous of establishing an institution for the benefit of the deaf-mutes of the city and state, and an act of incorporation for such an institution was passed on the 15th of April, 1817, the same day that the school at Hartford was opened. Among the most active promoters of this enterprise were Dr. Samuel Akerly, Dr. Samuel L. Mitchill, De Witt Clinton, Silvanus Miller, Peter Sharpe, and Rev. James Milnor, D.D.

The course of the American Asylum at Hartford was prosperous from the first. Mr. Gallaudet was a man of genius, and possessed the ability to originate and carry into effect new methods of instruction, and to modify the processes in use in the French schools. In these measures he was efficiently seconded by M. Clerc, and by a corps of young but able teachers whom he had gathered around him, and imbued with his spirit. Prominent among these teachers were Messrs. William C. Woodbridge, Lewis Weld, Harvey P. Peet, Isaac Orr, and William W. Turner

The New York Asylum had adverse fortunes to contend with at first. It was opened in May, 1818. Its first principal was Rev. A. O. Stansbury, who had been for a few months previous the steward of the American Asylum, and was but imperfectly qualified for his duties; the greater part of the pupils were day scholars, and attended irregularly; the assistant teachers were half-educated deaf-mutes; an attempt was made to teach articulation, but it proved a failure. Mr. Loofborrow, who succeeded Mr. Stansbury in 1821, possessed intelligence and energy, but he had few competent assistants, and the state legislature which had made appropriations for the support of deaf-mute pupils, was becoming dissatisfied with the condition of the institution, as compared with those at Hartford and Philadelphia. In 1830, an entire change was effected. The asylum was located on Fiftieth street, where buildings were erected for it; day scholars were no longer admitted; the inefficient teachers were dismissed, and Mr. Harvey P. Peet, then one of the ablest of the teachers in the American Asylum, elected principal. Mr. Peet entered upon his duties in February, 1831, and though at first compelled to perform all classes of duties, his genius, tact, and indefatigable labor soon brought order out of chaos, and enabled him to place the institution in the very first rank. In 1853, the property of the institution on Fiftieth street was sold, the buildings being too small for the accommodation of their pupils, and being subject to encroachment from the rapid increase of population in their vicinity. A new location, comprising 37 acres, was purchased on Washington Heights, about nine miles from the City Hall, and overlooking the Hudson river. On this site a magnificent building has been erected, much the finest and most perfect in its arrangements of any asylum for deaf-mutes in the world. It has cost, including the grounds, nearly $600,000, and will accommodate about 500 pupils. Mr. (now Dr.) Peet is still at the head of it, and his eldest son, Mr. Isaac Lewis Peet, is the efficient vice principal.

The Pennsylvania Institution was founded at Philadelphia in 1820, by David Seixas and Mr. Lewis Weld, one of the teachers at the American Asylum, became its principal in 1822. In 1830, Mr. Gallaudet resigned the charge of the American Asylum, and Mr. Weld was elected his successor, and was followed at Philadelphia by Mr. Abraham B. Hutton, who had been one of the teachers of the institution. This school has enjoyed continuous prosperity. The Kentucky School is located at Danville, and was founded in 1823. Mr. J. A. Jacobs, who is still at its head, was its first, and has been its only principal. He, too, had previously been a teacher at the American Asylum. It has a moderate endowment arising from the sale of lands granted to it by Congress. The Ohio Institution was established in 1829, and has had three principals—Messrs. Hubbell, Cary, and Stone. The first and last were from Hartford, the second from the New York Institution. The Virginia Institution, organized at Staunton, was the first in this country which combined the instruction of deaf-mutes and the blind in one institution. Such a combination is not uncommon in Europe, and five other asylums



AMERICAN ASYLUM FOR DEAF AND DUMB, HARTFORD, CONN.

have followed the example in this country. The best authorities, however, regard the plan as objectionable in many respects.

The other institutions for the instruction of deaf-mutes (there are in all twenty-three) have been organized since 1844. Most of them are state institutions, and though generally well managed, partisan politics have, in some instances, materially impaired their efficiency and usefulness.

Provision has been made, in nearly all the states, for the education of the indigent deaf and dumb, so that no person of suitable age, suffering from this infirmity, need go uninstructed, if they, or their friends, will apply to the state authorities; yet of the nearly 3000 deaf-mutes of school age in the United States, but about 2000 are under instruction. The greatest deficiency, however, is in the new states, and will be remedied in the course of a few years.

The term of instruction varies from six to ten years. Seven years is the usual term in most of the states; but in the American Asylum, the New York Institution, and, we believe, the Pennsylvania Institution, a high class has been established, into which those who give evidence of superior abilities, and desire for higher scholarship, are admitted by examination, and pursue an additional course of three years. The course of study, including this period of three years, embraces the topics of a very thorough English and mathematical education. Other languages than English are not usually taught. From these classes most of the deaf-mute teachers are now drawn.

The intellectual and moral condition of uninstructed deaf-mutes is one of extreme, almost rayless ignorance. Careful inquiry in some thousands of cases has demonstrated that, unless communicated by friends versed to some extent in the language of signs, they have no idea of a Supreme Being, of the origin of the objects of nature, of their own possession of a soul, of death, or a future existence. The mind is almost a blank, and the few thoughts they possess are merely such as concern their food, drink, and rest, and the objects with which they are constantly brought in contact. It is obvious, then, that the mental condition of a child of ten or twelve years of age, deaf from birth, and consequently dumb, is below that of a child of three years who can hear and speak. The child who possesses all its faculties has, before entering school, acquired a very considerable fund of ideas, and the words for their intelligent expression; so that the teacher has comparatively little occasion to communicate ideas to him, except on topics connected with his studies, and these he can clothe in words which the child already understands.

In the case of the deaf-mute, on the other hand ideas, even on many common and simple subjects, must be first communicated to him, and that not in words, for as yet these are entirely incomprehensible, but in the language of pantomime and gesture. He is next to be made to comprehend the laws of construction and connect words, either written, or spelled by the manual alphabet, with the ideas already acquired (a long and painful process,) and then, through the two *media* of words and signs, to be taught the elements of science.

The system of Heinicke and the Braidwoods, a system still, with some modifications, taught in Germany and some other European countries, had for its basis the dogma that ideas could only be expressed or communicated by means of words; and hence with great difficulty and pains, even in the flexible German tongue, the deaf-mute was taught to articulate words, whose meanings he did not understand, and then, as step by step he connected ideas with the simplest of them, these were made the means of conveying to him the meaning of those more abstract and difficult. In this way three or four years were consumed before the pupil was prepared to acquire the facts of science, or the knowledge of his moral obligations.

The plan of De l'Epée, modified by Sicard and Bebian, had little in common with that of Heinicke. Their fundamental principle was, that "words have no natural or necessary connection with the ideas of which they are the signs, and that in the natural language of signs or pantomime, improved and enlarged as it can be, there is a complete substitute for them." No attempt was made at teaching articulation, but words were taught by means of signs, and these once acquired, were made the medium of further instruction by ordinary text-books. In order to teach words more readily, M. Sicard introduced what he denominated *methodical signs*, that is, a peculiar gesture for each word, which the pupil was taught. It is obvious that if the vocabulary of the deaf-mute was to be as large as that of ordinary intelligent speaking persons, the number of these arbitrary signs (for it is to be understood that these differed almost as much from the ordinary signs as the latter from words, the natural signs representing ideas, and the methodical signs single words) must be very great, some thousands at least, and to retain them in memory was a very fatiguing task for both pupil and teacher.

The American system of instruction of deaf-mutes differs materially from both the preceding, and this difference originated partly with Mr. Gallaudet and the teachers trained up under him, and is partly the result of the experience and observation of the eminent teachers who have been, and still are, engaged in deaf-mute instruction.

In establishing the American Asylum, Mr. Gallaudet combined the principle of Heinicke, of the connection of ideas with words, with that of De l'Epée, that the natural language of signs must be elevated to as high a degree of excellence as possible in order to serve as the medium for giving the ideas clearly and explaining them accurately; but he added to these another which had never before been applied to deaf-mute instruction, viz., that the process of learning words might be greatly facilitated by leading the pupils to reflect on their own sensations, ideas, and mental processes. With the earliest lessons he imparted in the names of sensible objects, he was accustomed to endeavor to open communication with them, by means of the sign-language, in regard to the feelings and emotions excited by these objects, and, if possible, to connect them with something in the pupil's past experience. From this, the deaf-mute was naturally led on to think of the feelings and emotions of others, thence, by a natural transition, to the idea of God as a Creator and benefactor, and finally to a knowledge of his law, and the final destiny of man. The result of this has been that pupils in this country (for this plan has been generally adopted in our American institutions) are made acquainted with the simple truths of religion and morality in one year, a period in which, in the European institutions, they have scarcely advanced beyond the knowledge of sounds and the names of sensible objects, qualities, and actions, or the most common phrases. Apart from the high religious importance of this process, it brings moral motives to bear earlier, and renders the government of the pupils easier, while it aids them in the formation of correct habits. The conducting of the daily and weekly devotional exercises in the sign-language was another peculiarity introduced by Mr. Gallaudet.

Methodical signs were used to a considerable extent by Mr. Gallaudet and the earlier instructors of American institutions, but were not regarded as so indispensable by them as by the French teachers. Of late years they are less employed than formerly, and are made to indicate phrases rather than words, while the manual alphabet is regarded as of more value in teaching than it was thirty years ago. An advance has also been made, of great importance, by the introduction, by Mr. I. Lewis Peet, of the New York Institution, of manual and written symbols for those ultimate constituents of the sentence which form so considerable a portion of spoken and written language. By this means written language is taught with much greater facility than formerly. The establishment of high classes has also been an important step in the progress of deaf-mute education, furnishing, as it does, the deaf and dumb the opportunity of attaining to as high intellectual culture as those enjoy who are in the possession of all their faculties.

In 1850, the number of deaf-mutes in the United States was 9803, or one in 2345.

Some of the educated deaf and dumb in this country have attained to considerable distinction. Laurent Clerc, the companion of Gallaudet, belongs by his birth and education rather to France than America, yet he has passed more than forty years in this country, and though now retired in a healthful and happy old age, from active duty, is deservedly esteemed and honored. Thomas Brown, the President of the American Association of Deaf-Mutes, is a vigorous and able writer, as are also John T. Burnett and James Nack. The latter has distinguished himself as a poet of no mean ability, and the former has been a frequent and welcome contributor to several of our ablest reviews. Mrs. Mary Toles Peet, the wife of the accomplished vice principal of the New York Institution, though young, is entitled to a very high rank among the most gifted of our female poets. Colonel David M. Phillips, of New Orleans, in spite of his infirmity, was for many years one of the most accomplished military officers of the South. John Carlin, as an artist, and Albert Newsam, as an engraver, have few superiors in their respective professions. The monument to Mr. Gallaudet, designed by the former and engraved by the latter, is one of the most admirable and appropriate monumental structures. Mr. Levi S. Backus was for several years the able and successful manager of a periodical in central New York.

We present a table of the deaf and dumb institutions of the country, with their statistics to the present year (1860). There is also a deaf-mute institution in California, and one erecting at Faribault, Minnesota.

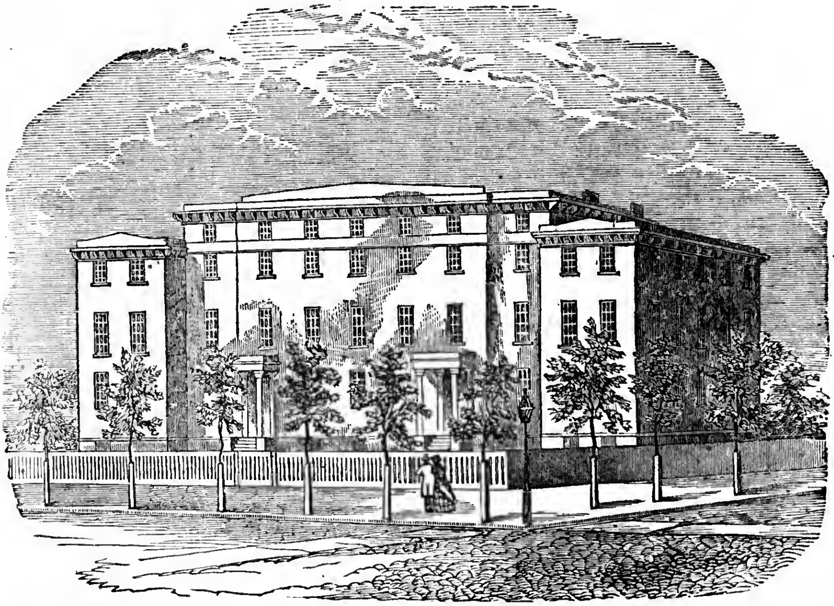
CHAPTER XXII.

INSTITUTIONS FOR THE INSTRUCTION OF THE BLIND.

The instruction of the blind had never been attempted on any considerable scale, in any part of the world, till Valentin Haüy, in 1784, commenced in Paris, France, his school for blind pupils. Individuals who were blind had indeed educated themselves by the assistance of friends; but the great majority of those who suffered from this affliction were left to a life of dependence and depression, and often became beggars. The efforts of Haüy, and his invention of an embossed alphabet, to enable the blind to read, led to the foundation of a school for the blind, supported by the French government, in 1791, and to the organization of similar schools in England, Prussia, Austria, and Russia about the same period. In these schools, reading and music, and some of the simpler mechanic arts, such as knitting, mat-weaving, basket-making, etc., were taught.

The first attempts to establish schools for the blind in this country were made about 1830. Dr. J. D. Fisher, in 1829, obtained an act of incorporation for an institution for the instruction of the blind from the Massachusetts legislature, and in 1831 Dr. Samuel Akerley and Mr. Samuel Wood, a benevolent merchant in New York, in conjunction with some other gentlemen, made an application to the New York legislature for a similar act, which was granted. Soon after this movement was made, Dr. John D. Russ, who had just returned from a mission to Greece, whither he had borne the contributions of American citizens to the suffering Greeks, and who on his way home had visited some of the European blind institutions, identified himself with it, and eventually became the principal of the school for the blind in New York city, which was established in 1832, under the charter already named.

In Boston, Dr. Samuel G. Howe, who had also been actively engaged in the cause of the Greeks, and who, like Dr. Russ, had visited the European institutions for the blind, entered with great zeal upon the work of establishing a school for their instruction,



PENNSYLVANIA ASYLUM FOR THE BLIND.

and made a beginning, we believe, under Dr. Fisher's charter, in 1832. The liberal gift, by Colonel T. H. Perkins, of his valuable mansion house in Pearl street, Boston, to this school, on condition of the raising of $50,000 by the public, soon secured to the institution a liberal endowment.

The year succeeding, an institution for the blind was established in Philadelphia through the efforts of Messrs. Roberts, Vaux, and others, at the head of which was placed an intelligent and philanthropic Prussian, Mr. Julius Friedlander, who had been engaged in teaching the blind at Berlin, under the celebrated Zeuné.

The first efforts of the American instructors of the blind were devoted to the improvement of the alphabet of raised letters, used in printing for the blind, with a view to the preparation of books for them. There were considerable difficulties to be overcome in the accomplishment of this work; the letters must have salient angles; each letter must differ sufficiently from every other to be easily recognized by the touch; yet the size of the letters must be small, or the books printed for the blind would be too cumbrous and expensive. The forms of letters used in Europe did not answer these requirements satisfactorily. Haüy's type, if well embossed, could be read with tolerable facility, but it was much too large, and its size could not be reduced without impairing its legibility; Guillié's was not legible at all; Gall's varied too much from the ordinary form of letter to be desirable, and the other attempts at uniting the requisite qualities failed. Each of the three American superintendents devoted his leisure to the work. Mr. Friedlander devised an alphabet, known in England as the Allston or Sans-serif Alphabet, neat in form and easily read, but somewhat too large. Dr. Russ invented one combining the advantages of Gall's triangular alphabet with the Illyrian letter, and with characters to make it phonetic, but it was somewhat defective in legibility; and Dr. Howe, after repeated trials, constructed what is now known as the Boston letter, which in size, distinctness, and legibility so far surpassed every previous effort, that it has now come into general use in Europe and America. Two other subjects interested these American pioneers in the work of instructing the blind: the recognition by the state legislatures of the right of blind youth to the advantages of an education, and the extension of the course of study so far as to give their pupils a good English education, instructing them, at the same time, in such mechanic arts as might enable them to support themselves after leaving the institution.

At the time of the organization of these schools, the institutions for the blind in Great Britain, and most of those on the continent of Europe, taught nothing but reading and the mechanic arts, except in the case of those who possessed musical talents, who received such instructions in music as would enable them to play upon the piano or organ, and to sing; but the ordinary branches of elementary education were entirely neglected. The American superintendents determined that their pupils should receive a good common-school education, and if possible something beyond this, and they have succeeded. The period of instruction varies in the institutions for the blind in the United States from five to eight years. In the larger and older institutions it is usually eight years, and includes a course of mathematics and belles-lettres as extensive as that in most of the colleges in the country, and a thorough course of musical training, both vocal and instrumental. The languages are not usually taught. There are now twenty-four of these institutions in the United States. The Ohio Institution at Columbus was founded in 1837, and that of Virginia at Staunton in 1839; the others have all been organized since 1842. To all these establishments there are attached work-rooms, in which the pupils are employed in the manufacture of mattresses, mats, baskets, paper boxes, brooms, brushes, or the simpler articles of cabinet work.

To many of the blind, music furnishes not only a recreation but a means of support. Their ear, long trained to the discrimination of sounds, and their touch, rendered delicate by the acquisition of the art of reading, give them peculiar facilities for the attainment of musical skill; and the concentration of their minds upon it, undisturbed by observation of what is passing around them, adds to their advantages. It is not, therefore, remarkable, that many of them should have attained to great eminence in musical science. The Pennsylvania Institution has been specially remarkable for the musical attainments of its pupils. Its weekly concerts are attended by from 1200 to 1500 of the music-loving inhabitants of that city, and the receipts from these concerts furnish a liberal fund to aid the poorer graduates in commencing an independent life. Many of these pupils find speedy and remunerative employment as organists, choir singers, members of orchestras or bands, or piano-teachers and tuners.

The great cost of printing books for the blind has rendered the supply scanty and the number of books small. The American Bible Society has printed an edition of the Scriptures in the Boston letter, and grants are made from time to time to institutions for the blind. The American Tract Society has also printed a few of its smaller books in the same letter. Aside from these, there are not more than fifty works printed for the blind in England and America, except a few in arbitrary characters, which of course are of no general value. Among these fifty is a cyclopedia to be completed in twenty volumes, but of which only eight or nine have yet been issued. Repeated applications have been made to the general government to make an appropriation either of money or lands, to furnish a fund for the establishment of a press for the blind, but the bills reported have always been defeated. Within the past year a "Printing House for the Blind" has been established at Louisville, Kentucky, endowed in part by private benefactions, and in part by appropriations from the several states. Its managers propose to go on in the manufacture of books for the blind, using the Boston letter, and making grants to the blind of each state in a ratio corresponding to the amount contributed by that state.

Owing in part to this paucity of books the educated blind seldom use the books in the raised letter subsequent to their graduation, except the Scriptures, but depend mostly upon the reading aloud of others for their information and instruction.

Writing has always been a difficult and irksome task to the blind; and various devices have been proposed to facilitate this labor, but hardly any of them have proved satisfactory. The plan adopted by the late William H. Prescott of using a frame of wires over the paper, enabled them to write in straight lines, but no corrections could be made, nor could the scribe read what he had written. The use of inks which would leave an elevated surface has been tried, but without much satisfaction; small printing machines have also been used, but are not convenient.

Within a few years past another process has been introduced, which, despite the apparent objections to it, proves far more serviceable and convenient than any other yet devised. By this invention, known as "Braille's system," from its inventor, M. Louis Braille, a French teacher of the blind, they are soon enabled to read and write with great facility, and by the addition of a single character, music can be printed or copied by the blind far more readily than a seeing person can do it in the ordinary way. The plan is based upon a series of fundamental signs, comprising the first ten letters of the alphabet; none of these consist of less than two nor more than four dots. A second series is formed by placing one dot at the left of each fundamental sign; a third by placing two dots under each sign; a fourth by placing one dot under the right of each. These signs designate, besides the alphabet, the double vowels, peculiar compound sounds like *th*, and the marks of punctuation. By prefixing a sign consisting of three dots, the fundamental signs are used as numerals; by prefixing another the last seven represent musical characters, and by a sign peculiar to each octave the necessity of designating the key to each musical sentence is avoided.

The apparatus consists of a board, in a frame like that of a double slate, the surface of which is grooved horizontally and vertically by lines one eighth of an inch apart; on this the paper is fastened by shutting down the upper half of the frame, and the points are made with an awl or bodkin, through a piece of tin perforated with six holes, an eighth of an inch apart. The perforations are made from right to left, in order that the writing when reversed may read from left to right. Books and music are now printed for the blind on this system. Five or six of our larger institutions have adopted it.

Some of the blind institutions in this country have attached to them workshops for the adult blind, especially those who have graduated at these institutions, where certain advantages of shop-rent, machinery, material at wholesale prices, and in some instances board at a reduced rate, or a moderate pension, are allowed, by way of equalizing the difference between them and the working classes who possess all their faculties. In one instance, in Philadelphia, an asylum has been provided for the aged and infirm blind, where, beguiling the weariness of the passing hours by such light toil as they can readily accomplish, they may pass the evening of life in comfort and happiness.

The ratio of the blind to the entire population was, according to the last census, 1 to 2328, which would give not far from 13,000 as the present number in the country. Estimating one fifth of these as of school age, there should be 2600 in the different institutions. The number actually connected with them does not exceed 1300. As most of the states have made provision for supporting poor blind children at these institutions, a provision available on application to the governor or secretary of state, this number should be largely increased.

We have the testimony of some of the most eminent European teachers of the blind, that our larger institutions are superior to any of those in Europe in the thoroughness and extent of their teaching, and in the spirit of self-dependence with which they inspire their pupils. We insert a table giving a view of the present condition of the blind institutions in this country so far as can be ascertained. There is also an institution for the blind incorporated in California.

CHAPTER XXIII.

INSTITUTIONS FOR THE TRAINING OF IDIOTS.

These belong to the class of humanitarian efforts which have become so numerous during the past hundred years, and which have embraced in their scope the infirm, the orphan, the unfortunate, the vicious, and those who, from deprivation of one or more of their faculties, or feebleness of all of them, have become dependent upon others.

An effort is said to have been made by Vincent de Paul, one of the noblest and purest men in the Roman Catholic Church, more than two hundred years ago, to instruct a few adult imbeciles at the priory of St. Lazarus, in Paris, but with very slight success. The attempt was not repeated till 1818, when an idiot child, dumb from idiocy, was admitted as a pupil at the American Asylum for the Deaf and Dumb at Hartford. He was considerably improved during a residence of a year there; but not being properly a deaf-mute, and not being capable of going on with their classes, he was dismissed. He had, however, learned the sign-language sufficiently to be able to communicate his wants by it. Other imbeciles were subsequently, at various times, admitted to that and some other institutions for the blind and for deaf-mutes in this country prior to 1840. Most of these received some benefit from incidental instruction and intercourse with the pupils of these institutions. In Great Britain, as early as 1819, Dr. Richard Poole, of Edinburgh, published an Essay on Education, in which he urged the importance of attempting to educate and improve idiot children, and called for the organization of an institution for imbeciles. Efforts were made in France, from 1824 to 1838, by several eminent men, to instruct a few of these unfortunates, but with comparatively slight success. They were taught to imitate others in a few motions, and to repeat a few words by rote, but, left to themselves, soon relapsed into their previous hopeless condition. In 1838, Dr. Edward Seguin, a friend and pupil of the celebrated surgeon Itard, who had himself long contemplated the possibility of idiot instruction, commenced teaching a few idiot children in Paris. Unlike those who preceded him in this work, he had studied carefully, in all its bearings and relations, the subject of idiocy; and having become satisfied that it was only a prolonged infancy, in which the infantile grace and intelligence having passed away, there remained only the feeble muscular development and mental weakness of that stage of growth, he sought to follow nature in his processes for the development of the enfeebled body and mind. In these efforts he was far more successful than his predecessors. In 1846, he published his treatise on the Treatment of Idiocy, which is still the text-book of all teachers of imbeciles.

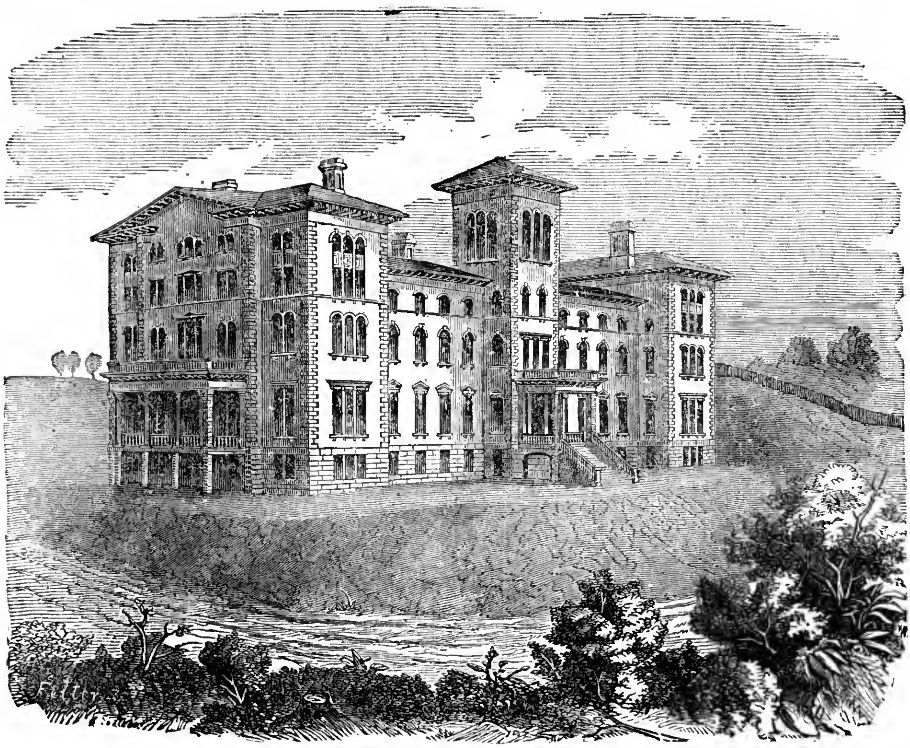
About the same time that Dr. Seguin commenced his school in Paris, a young Swiss physician of Zurich, Dr. Louis Guggenbühl, attempted with success the training of some Cretin* children, on the Abendberg, above Interlachen. The success of these two philanthropists led others in Prussia, Austria, the smaller German states, Sardinia, and England, to establish similar schools for the training of these hitherto neglected children.

The first movements for idiot training in this country were made almost simultaneously in New York and Massachusetts; that in New York having slightly the precedence, though the first schools were organized in Massachusetts. Dr. F. F. Backus of Rochester, elected to the state Senate of New York in the autumn of 1845, had become interested in the accounts of the schools of Seguin and Guggenbühl, and informing himself as fully as possible in regard to them, made a report to the Senate, in the session of 1846, accompanying it with resolutions providing for the establishment of a training school. These passed the two Houses, but were reconsidered and lost in the lower House. During the same winter, on the motion of Judge Byington, in the Massachusetts legislature, a commission was appointed, consisting of the mover, and Dr. S. G. Howe and Gilman Kimball, Esq., to investigate the condition of the idiots and imbeciles of the state. In 1848, as a result of the reports of this commission, the Massachusetts School for Imbecile and Feeble-minded Youth was chartered, but was not organized till October of that year. It is under the general superintendence of Dr. S. G. Howe. Meantime, in July, 1848, Dr. H. B. Wilbur, a young physician of Barre, Mass., had opened a private school for imbecile and backward children in that town. In 1851 an experimental Asylum for Idiots was established at Albany, N. Y., and Dr. Wilbur was appointed its superintendent. Three years later, this gave place to the New York State Asylum for Idiots at Syracuse, for which the state erected a noble edifice, and provided for the training of the indigent imbecile children of the state. In 1852, the Pennsylvania Training School for Idiots and Imbeciles was organized at Germantown, Penn.; but in 1859 it was removed to Media, Penn., where a large and well-provided asylum has been erected for it. It is under the care of Dr. Joseph Parish. In 1857, the Ohio State School for Idiots was established at Columbus, and Dr. R. J. Patterson took charge of it. The original school at Barre passed into the hands of Dr. George Brown when Dr. Wilbur removed to Albany, and still maintains its early efficiency. Besides this, there are two other private schools for imbeciles: one in New York, under the charge of Mr. J. B. Richards, who was formerly connected with the Massachusetts and Pennsylvania institutions, and one in Lakeville, Litchfield county, Conn., under the care of Dr. H. M. Knight, established in 1858.

Several of the other state legislatures have agitated the subject, and will, probably, eventually establish schools.

Of those already in existence, the asylum in Syracuse, of the state institutions, and that at Barre, of the private ones, have been the

* The Cretin is an imbecile whose physical degeneration is greater, though his mental condition is more hopeful, than that of the idiot. The disease, Cretinism, is supposed to be caused by the impregnation of the springs with magnesian salts, and is very common in mountainous districts.



ASYLUM FOR IDIOTS, SYRACUSE.

most successful, and, in the opinion of competent and unprejudiced judges, are superior to any of the European institutions. Dr. Seguin, the founder of the Paris school, has been in this country much of the time for twelve years past, and has rendered efficient service in the introduction of the best methods of instruction.

The processes employed in the training of idiots in our American institutions all grew out of Seguin's fundamental theory, "that idiocy is a prolonged infancy;" and the course pursued by nature in developing the infant into the healthy, robust, intelligent child, is closely followed. In many cases, the muscular system is feeble, and unequally and imperfectly developed; this is carefully invigorated by attention to diet, frequent bathing, and such exercise as shall strengthen the muscles, while subordinating them to the control of the will. The attention is fixed, and taught to distinguish form, size, and color by the presentation of objects of bright colors, and of varied form and bulk. The irregular muscular movements, often the result of habit, are controlled by gymnastic exercises with dumb-bells, ladders, etc., and by military exercises, which exact the attention and careful action of the hands, feet, head, and eye. Numbers are taught by the *object* method, and reading by the *word* system and the use of pictures. As in deaf-mute instruction, the effort is made, at the earliest possible moment, to direct the thoughts inward, to lead the child to watch and express his own feelings and emotions, and then to guide him to observe the emotions of others, and soon to learn something of his Creator, and his own moral nature and destiny. It is remarkable with what facility the simple truths of morality and religion are perceived, even by very weak intellects. Their progress in these is much more rapid than in intellectual studies; yet many of the pupils in the best institutions learn to read passably well, to write a good hand, and generally to spell correctly; become familiar with the principal facts of geography, with the elements of grammar, and arithmetic as far, perhaps, as compound numbers. A few make still greater progress, but these are the exceptions, not the rule.

It is, perhaps, too soon to decide very confidently what will be the results of idiot instruction; but this much is tolerably certain, that a proportion not exceeding one fourth, and these often apparently the worst cases when admitted, will become so far improved as to perform the ordinary duties of life and citizenship nearly as well as the masses generally; another fourth will improve so much as to be capable of working intelligently, under the supervision of others, but not of any considerable independent action—these will, under favorable circumstances, nearly or quite support themselves; another fourth will be greatly improved in their habits, and will require but little attention, though unable to do much toward their own support; while the remainder, though often, perhaps, as promising as any at first, will be little, if at all, improved.

The number of idiots and imbeciles in the country has never been satisfactorily ascertained, and in the nature of the case cannot be, from the reluctance of friends, in many cases, to admit their condition. Careful investigations made in some of the states, and in single counties in others, would indicate that here, as in Europe, the number is but little less than that of the insane, or, in round numbers, one in 600.

CHAPTER XXIV.

INSTITUTIONS FOR THE EDUCATION AND TRAINING OF ORPHANS.

Some of the Roman emperors and many of the bishops and pastors of the early Christian Church interested themselves in the care of orphans, but during the dark ages this as well as other charities was neglected and forgotten, and it was not till the sixteenth century that any attempts were made to establish orphan asylums. During the seventeenth century they became quite numerous both among Protestants and Roman Catholics, and few large towns were without one or more orphan houses. The Moravians in particular were specially tender of the fatherless, and in all their settlements of considerable size established houses for them. In the last years of the seventeenth century, August Hermann Franke established his orphan house at Halle, which still exists, and is one of the largest orphan asylums in the world.

In this country orphan houses were established by the Moravians in Pennsylvania and Georgia, early in the eighteenth century. In 1740 the celebrated George Whitefield laid the foundation of his orphan house at Bethesda, about ten miles from Savannah, Georgia. After many pecuniary difficulties it finally attained to a prosperous condition during his life, and he added to it an academy, and purposed, could a charter have been obtained, to establish a college in connection with it.

The number of orphan asylums established previous to the commencement of the present century was, however, very small. There were no very large cities, and it was only in the large cities that orphans unfriended were so numerous as to require considerable buildings for their shelter and domicile. In New York city the first orphan asylum grew out of the "Society for the Relief of Widows with Small Children," and owes its origin to the zeal and energy of the late Mrs. Joanna Bethune. It was founded in 1806, and at first it was attempted to place the children in families, but their number soon rendered this difficult, and after renting premises for a time they erected an asylum in Bank street, and in 1840 removed to their new edifice on the banks of the Hudson, between Seventy-third and Seventy-fourth streets. It is largely endowed.

Subsequently other institutions for orphans have been established in that city, some of them amply endowed either by legacies, or by the increased value of the property on which they were originally erected, while others are dependent, in part, on annual contributions, or on grants from the city treasury or Board of Education. There are now ten of these institutions in New York city and four in the adjacent city of Brooklyn, aside from the Home for the Friendless and other preventive and reformatory institutions, a large part of whose inmates are orphans; and aside, also, from the Randall's Island Nursery, where the last year about 1200 children —orphans, half orphans, or children of intemperate and criminal parents—were cared for. In all these institutions in the city of New York not less than 4000 children are domiciled.

There are now asylums for orphans in nearly every town of 10,000 inhabitants in the country, and in the larger cities there are usually several. Thus there are nine or ten in Philadelphia, three in Baltimore, and five in Boston. One of the most remarkable of these, both on account of the magnificence of its edifice and the largeness of its endowment, is the Girard College for orphans at Philadelphia. It was founded by the bequest of a tract of land and two millions of dollars by Stephen Girard, a wealthy banker of that city. Mr. Girard left minute directions in his will in regard to the building and management of the charity. It is located on a lot comprising forty-one acres of land, surrounded by a wall ten feet in height. The grounds are laid out as play-grounds, gardens, grass-plots, etc. The buildings are all of marble. The principal one is in the form of a Corinthian temple, 169 feet long, 111 wide, and 97 high, and has a portico of thirty-four marble columns each 55 feet high. One of the smaller buildings is used as a laboratory, bakery, etc. The other four are each 125 feet long, 52 feet wide, and two stories in height. The whole cost of the buildings was $1,930,000. The officers are a president, secretary, two professors, five male and twelve female teachers, a physician, matron, assistant matron, and steward. The college was opened in January, 1848. As many poor white male orphans as the endowment can support are admitted, between the ages of six and ten years, fed, clothed, and educated, and between the ages of fourteen and eighteen bound out to mechanical, agricultural, or commercial occupations. No ecclesiastic, missionary, or minister of any sect whatever, is to hold any connection with the college or be admitted to the premises even as a visitor. The number of pupils on the foundation is a little over 350, and the annual expenditure about $60,000.

This is but one of several munificent foundations for orphans in that city. The Burd Orphan Asylum recently founded there for orphans between four and eight years of age, and primarily those of Episcopal parentage, has an endowment of about half a million dollars.

At Zelienople, Butler county, in western Pennsylvania, a farm school for orphans from Lutheran families, was established in 1854, and is under the charge of a superintendent trained to his work in the Institute of Brothers connected with the Rough House, Dr. Wichern's reformatory at Horn, near Hamburg. This is, so far as we are aware, the first distinct effort in this country to train orphan children distinctively to agricultural or horticultural pursuits.

The ordinary course of instruction in most of these institutions embraces the common branches of English education, and in many of them some mechanical pursuit is taught and practised for four or five hours each day. There is reason to believe that, in many cases, the mode of life and the regularity and formality of the course of training, has too much tendency to render the children *automata*, and unfit them to some extent for the hardships, the frequent changes, and the sudden temptations to which they are exposed after leaving the institutions. Where they are placed in private families while yet quite young, this evil is not so likely to follow as where they are retained, as they are in some asylums, to the age of sixteen.

No estimate, either of the amount permanently invested or of the annual current expenses of these institutions in this country, can be given, nor even any near approximation to an estimate. The permanent investment is to be reckoned by millions, and possibly by tens of millions; the annual expenditure in New York city alone, reaches nearly or quite half a million of dollars.

CHAPTER XXV.

PREVENTIVE AND REFORMATORY INSTITUTIONS.

Although there are occasional indications that individual philanthropists, like the benevolent Cardinal Odescalchi at Rome, and Sir Matthew Hale in England, had clear perceptions of the evil of leaving vagrant and morally endangered children as well as juvenile delinquents, exposed to the temptations to a vicious life, yet apart from a school established partially for them by the former in 1586, there seems to have been no serious movement in their behalf prior to the establishment of the school and home for vagrant and vicious boys at Rome, by Giovanni Borgi, (better known as Tata Giovanni, or Papa John,) in 1786 or 1787, and the organization of the "Philanthropic Society for the Prevention of Crime" at London in 1788. This last, originally established on the family plan, soon became a large establishment, in which a great number of boys were congregated and employed in different branches of manufacture, having also a probationary school of reform for the more vicious and criminal of its inmates. In 1846, the location was changed and the whole system modified. A large farm was purchased at Red Hill, near Reigate, Surrey, agriculture and horticulture substituted for mechanical and manufacturing pursuits, and the family system for the congregated. Since that period the number of family reformatories, as they are called, has greatly increased in Great Britain. On the continent the eminent success of the agricultural and horticultural reformatories of Mettray, Horn, Ruysselede, and many others of more recent origin, has attracted general attention.

In this country the first institution intended for the reformation of vicious and criminal children, was the "New York House of Refuge for Juvenile Delinquents," incorporated in 1824 and opened January 1, 1825. Its founders were John Griscom, Isaac Collins, James W. Gerard, and Hugh Maxwell, all at the time members of a "Society for the Prevention of Pauperism and Crime," which had been formed in 1818. These gentlemen were aided and encouraged by others whose names appear on the list of corporators, and who were through life noteworthy for their hearty participation in works of philanthropy. The institution thus founded has had a steady growth, as the rapid increase of population in the city has been attended by a more than corresponding augmentation of the number of juvenile delinquents. At the end of thirty-six years from its first opening it occupies a tract of between thirty and forty acres on the southern end of Randall's Island, in the East River, and its colossal buildings, erected at an expense of not far from $450,000, furnish ample accommodations for school-rooms, lodging-rooms, dining-rooms, and workshops for 750 children, and actually hold in durance nearly 700.

In 1826 a "House of Reformation," on a similar plan, was established in Boston, and, in 1828, a "House of Refuge" in Philadelphia. Similar institutions have since been organized in New Orleans, Rochester, N. Y., Westboro', Mass., Cincinnati, Providence, Pittsburg, West Meriden, Conn., St. Louis, Baltimore, and perhaps some other cities.

The distinguishing characteristics of these institutions are, that those committed to them have generally been arrested for crime, and have either been sentenced to the House of Refuge, in lieu of a sentence to jail or state prison, or have been sent to these institutions without sentence, in the hope of their reformation. They are supported, directly or indirectly, from the public treasury (the New York house, besides an appropriation of $40 per head from the state comptroller, received last year $8000 from the city treasury, over $5000 from the Board of Education for its schools, and about $7500 from theatre licenses). In most, or all of them, the children are employed in some branch of manufacture, or some mechanic art, for from five to eight hours per day, and receive from three to five hours' instruction in school. In all there is more or less religious and moral instruction imparted, having in view their permanent reformation from evil habits and practices. In all, or nearly all, they are confined at night in cell-like dormitories, into which they are securely locked, and their labor, during the day, is under strict supervision, and is generally farmed out to contractors. High walls and a strict police are mainly relied on to prevent escape, and the attempt to do so, or any act of insubordination, is usually punished with considerable though not perhaps unmerited severity. The managers generally possess and exercise the power of indenturing those children who, after a longer or shorter stay, seem to be reformed, even though the period of their sentence has not been completed. A considerable number who have been sent to the House of Refuge on complaint of their parents are, after a time, delivered to them on application; but a large proportion of these do not do well. Of the others, it is believed that from fifty to seventy-five per cent. reform, at least so far as to become quiet and law-abiding citizens. Of those who do not reform, some, after discharge at the end of their term, are soon recommitted; others are sent to sea, and perhaps amid the hardships of a sailor's life become reformed; others return to the vicious associations from which they were originally taken, and after a few months or years of crime, find their place among the inmates of the county or convict prisons, meet a violent death, or fill a drunkard's grave.

These institutions necessarily combine something of the character of a prison with that of the school, and while their main object is the reformation rather than the punishment of the young offender, they retain so many penal features that they are objects of dread and dislike to many parents and guardians whose children or wards would be materially benefited by their discipline.

This feature of their management has led to the establishment of another class of reformatories which, though sometimes assuming similar names, are essentially different both in the character of their inmates and in the methods adopted for their reformation. These methods are indeed quite diverse in the institutions coming under this general head, and are to some extent the reflection of the differing views of those who have charge of them.

The subjects taken in charge by these reformatories are somewhat younger on the average than those of the houses of refuge; they are for the most part only guilty of vagrancy and the vicious habits of a street life, or at the worst, of petty pilferings and thefts; they have not been, in most instances, tried for any crime against the laws, or if they have, their tender age has justified the magistrate in withholding a sentence.

When admitted to the reformatory, which is usually done on a magistrate's warrant, they undergo a thorough ablution, and are clothed in plain, neat garments having no distinguishing mark, are well fed, and carefully taught and watched over, and the utmost pains are taken to eradicate their evil habits, and to make them feel that their teachers and those who have them in charge are their best friends and seek their good. Their past history is never alluded to, and is generally known only to the superintendent. In these establishments there are no dormitory cells, and severe punishment is seldom found necessary. The labor of the pupils is seldom regarded as a matter of much importance, though in some instances three, four, or five hours a day are spent in some light employment. From these institutions escapes are unfrequent, and in most cases the children form a strong attachment for their teachers. In some instances they are broken up into groups or families of twenty or thirty persons, each having its "house father" and mother, and its "elder brother," if the pupils are boys, and its matron or "mother," and elder sister or aunt, if they are girls. These officers teach them and perform the duties indicated by their titles in such a way as to supply, as far as possible, the place of those natural relations of whose judicious influence they are deprived. One of these reformatories is a ship, and the pupils are taught all the duties required of an able-bodied seaman, and the order and discipline are similar to those of the naval school ships. They are taught, in addition to ordinary common-school studies, navigation, and after a few months' instruction are in demand for the mercantile marine, where they not unfrequently are rapidly promoted.

In most of these institutions the pupils remain in the reformatory a shorter average period than those who are inmates of the houses of refuge. In the New York Juvenile Asylum, one of the most successful of these reformatories, they are usually indentured or discharged in six or twelve months. In the State Industrial School for Girls at Lancaster, Mass., comparatively few remain over a year. These institutions are usually supported by the large cities, though in a few instances they are state institutions. The labor of the children being of but little account, the expense per head per annum is somewhat greater than in the houses of refuge, but the number of reformations is also greater, and may with considerable certainty be estimated at from seventy-five to eighty-five per cent. Among these institutions we may name the "New York Juvenile Asylum," the "State Industrial School for Girls" at Lancaster, Mass., the "Massachusetts School Ship," the "Asylum and Farm School" at Thompson's Island, Boston, the "State Reform School" at Cape Elizabeth, Maine, the "Reform School" at Chicago, and the "State Reform Farm" at Lancaster, Ohio. In the last, which is the first attempt at the introduction of the family or group system for boys in this country, fruit culture is to be the principal employment of the inmates, and the term of residence will be longer than at most of the others.

In our large cities there is still another class of children for whom a preventive education is necessary; they are not criminal, they have not generally acquired vicious habits, but they are *morally endangered.* They are often orphans or half orphans, and frequently homeless; many of them are children of foreign parents of the lower classes, and have had no opportunities of education; some are the offspring of vicious or intemperate parents. The greater part of them obtain a precarious livelihood by begging, sweeping crossings, boot blacking, selling newspapers, statuettes, fruit, or small wares, or organ-grinding. They are all exposed to strong temptations to evil, and have acquired a kind of defiant independence from being driven so early to take care of themselves.

For these children it has been felt that some provision must be made to prevent them from falling into vicious and criminal courses, and becoming depredators upon society, and to give them the opportunity of becoming good and intelligent citizens. The measures necessary to accomplish these results have been the subject of much discussion; and amid the experimenting which has been the result of this discussion, much good and some evil have been done. Industrial schools have been established, mainly for girls, in which reading and the elements of geography and arithmetic, vocal music, and the use of the needle in plain work, are taught; and the furnishing of one or two meals a day and plain clothing when needed, are made the inducements to attendance. For the newsboys and other young vendors of petty wares, a lodging house has been opened in New York city, and evening instruction given, the boys paying six cents each for their lodging. On the Sabbath a free dinner is provided for those who will attend and receive religious instructions; evening schools are also established, where those who are engaged in their little employments during the day, may receive intellectual and moral training.

In the worst quarters of New York and Philadelphia, missions and houses of industry have been founded, in which schools are kept through the week, much after the plan of the industrial schools already described, and where homeless forsaken children, and those whose parents are vicious and degraded, are clothed, boarded, instructed, and made to know the comforts of a home. It is obvious, however, that the greatest kindness which can be done to these children is to remove them from the influence of the temptations to which they have been exposed, and hence, most of these institutions send their children to homes in the country, after more or less preparatory training, as fast as good places can be found for them. In many cases, they are adopted by those in whose charge they are placed, and find in their foster parents more tender affection and care than they have ever known before. In other cases, they meet with less sympathy and love, and return to the great city and its temptations again.

In 1853, a "Children's Aid Society" was organized in New York city, mainly through the efforts of Mr. Charles L. Brace, one of whose principal objects is the location of this class of children in good homes at the West and elsewhere. Several of these societies have since been formed in other large cities. The original society at New York has the oversight of industrial schools, boys' meetings, the newsboys' lodging house, etc., and gathers from all quarters these morally endangered children, and sends them into the country in companies of forty or fifty; its agents having secured situations for them. About 800 are thus sent out annually.

Still another class of organizations intended for the benefit of these hapless children, though devoting its attention mainly to two classes of them, the very young children, infants and children under ten years, and girls of thirteen years and over, who are homeless and out of employment, are the Homes for the Friendless, of which there are now twelve in the United States. The first of these originated with the American Female Guardian Society, in New York, and was the result of the efforts of the directors of that society to rescue these classes from ruin. It assumed its present form in 1847, and has had nearly 10,000 inmates; 683 were received as members of its schools and workrooms in 1859, and 674 were employed in the home workrooms, and furnished with situations; 640 girls were taught in its industrial schools, and 560 families aided.

These institutions are all of them maintained principally by private contributions, though most of them, in the large cities, receive school moneys, to aid in sustaining their schools, from the city or state, and some of them receive occasional grants from the state or city treasuries.

It is impossible to ascertain, with any considerable certainty, the exact percentage of children from these institutions, who eventually turn out well. In most of them, the failures are the exceptions, and the number of these is not large. The Home for the Friendless in New York city keeps up a correspondence relative to each child sent out, until their majority, unless they die before that time. This correspondence demonstrates that full 90 per cent. grow up virtuous and well behaved. This percentage is larger than can safely be predicated of the other institutions, inasmuch as the children are for the most part received into the home at a very early age, and have not acquired the evil habits of those who are older, before coming under the influence of these charities. In the Children's Aid Societies, Houses of Industry, etc., the percentage reformed is large, but not definitely ascertainable.

There is still another class of reformatory institutions not intended for children, but for that unfortunate class of women who, having led lives of unchastity, have become penitent for their sins and desire to return to the paths of virtue. This department of reform has been less actively promoted here than in Europe, and especially in Great Britain, but there are in most of our large cities Magdalen Asylums, or institutions otherwise designated, but intended for this class. New York has one of these asylums, Boston two, and Philadelphia three, one of which, the Rosine Asylum, founded in 1847, is a very active and useful organization.

The number of Houses of Refuge, or institutions of that class, is fourteen. The cost of their buildings and grounds is about $2,050,000, and the annual cost of their maintenance not far from $340,000.

Of the Juvenile Asylums, &c., there are seven, the cost of buildings and grounds is not far from $450,000, and the annual expenses of maintenance about $130,000.

The number of institutions of the third class cannot be definitely ascertained. Few or none of them are established or entirely maintained by the state or city governments, and some are altogether private enterprises. There are fifteen of them in the city of New York alone, and two or three in Brooklyn, five or six in Philadelphia, and a considerable number in smaller cities and towns. Some of these occupy leased buildings, others own their edifices.

The buildings and grounds of the New York Home for the Friendless cost nearly $60,000, and of the Five Points House of Industry, about $40,000. The annual expenses of seven of the more important of the preventive and reformatory institutions in New York city, were about $114,000. It would probably be safe to estimate the total permanent investment of all these organizations at not less than three millions of dollars, which we are satisfied is below the reality, and the current annual expenditure at not less than $750,000.

That these institutions have not yet attained to their highest degree of efficiency, and that they are not fully adequate to the reformation and preventive education of the vast number of morally endangered, vagrant, and criminal children of the country, is undoubtedly true; but among the evidences of national progress in our country since the commencement of its independent existence, there is none which reflects greater credit upon its philanthropy than the establishment and maintenance of so many institutions of reformation and preventive education.

TABLE OF EDUCATIONAL STATISTICS OF THE UNITED STATES IN 1850.

STATES AND TERRITORIES.	Colleges.					Academies.					Public Schools.					White Persons.		
				Annual Income.					Annual Income.					Annual Income.				
	Number.	Teachers.	Pupils.	Returned.	Estimated.	Number.	Teachers.	Pupils.	Returned.	Estimated.	Number.	Teachers.	Pupils.	Returned.	Estimated.	Returned as in Colleges, Academies, and Public Schools.	Attendi'g School as returned by Families.	Persons over 20 years who cannot read or write.
Alabama	5	55	567	$41,255	$48,530	166	380	8,290	$164,165	$224,279	1,152	1,195	28,380	$315,602	$390,989	37,237	62,778	33,757
Arkansas	3	14	150	3,100	3,100	90	126	2,407	27,937	34,308	353	355	8,493	43,763	68,411	11,050	23,350	16,819
California	....	......	......	....	....	6	5	170	14,270	20,392	2	2	49	3,600	14,700	219	992	5,118
Columbia, Dist. of	2	36	218	24,000	24,000	47	126	2,333	84,040	84,040	22	34	2,169	14,232	14,232	4,720	6,103	1,457
Connecticut	4	56	738	53,639	53,639	202	329	6,996	145,967	152,120	1,656	1,787	71,269	231,220	231,220	79,003	82,433	4,739
Delaware	2	16	144	17,200	17,200	65	94	2,011	47,832	53,498	194	214	8,970	43,861	43,861	11.125	14,216	4,536
Florida	....	......	......	....	....	34	49	1,251	13,089	22,742	69	73	1,878	22,386	31,777	3,129	4,746	3,859
Georgia	13	84	1,535	105,430	105,430	219	318	9,059	108,983	184,849	1,251	1,265	32,705	182,231	190,235	43,299	77,015	41,200
Illinois	6	35	442	13,300	15,389	83	160	4,244	40,488	47,678	4,052	4,248	125,725	319,712	356,416	130,411	181,969	40,054
Indiana	11	61	1,069	43,350	43,350	131	233	6,185	61,520	73,219	4,822	4,860	161,500	316,955	329,095	168,754	220,034	70,540
Iowa	2	4	100	2,000	2,000	33	46	1,111	7,980	11,180	740	828	29.556	51,492	52,620	30,767	35,456	8,120
Kentucky	15	100	1,773	131,461	131,461	330	600	12,712	252,617	306,507	2,234	2,306	71,429	211,852	215,068	85,914	130,917	66,687
Louisiana	6	41	629	85,750	85,750	143	354	5,328	193,077	283,003	664	822	25,046	349,679	362,412	31,003	32,838	21,221
Maine	3	21	282	14,000	17,784	131	232	6,648	51,187	64,966	4,042	5,540	192,815	315,436	318,597	199,745	185,941	6,147
Maryland	13	98	1,127	113,714	122,403	223	503	10,787	232,341	239,083	898	986	33,111	218,836	221,817	45,025	60,447	20,815
Massachusetts	6	85	1,043	107,901	121,929	403	521	13,436	310,177	354,521	3,679	4,443	176,475	1,006,795	1,010,346	190,924	220,781	27,539
Michigan	3	22	308	14,000	14,000	37	71	1,619	24,947	31,953	2,714	3,231	110,455	167,806	168,764	112,382	105,754	7,912
Mississippi	11	45	862	42,400	47,652	171	297	6,628	73,717	144,732	782	826	18,746	254,159	267,821	26,236	48,803	13,405
Missouri	9	65	1,009	79,528	88,277	204	368	8,829	143,171	183,403	1,570	1,620	51,754	160,770	168,961	61,592	95,245	36,281
New Hampshire	1	18	273	11,000	11,000	107	183	5,321	43,202	52,591	2,381	3,013	75,643	166,944	167,938	81,237	88,148	2,957
New Jersey	4	49	470	79,700	79,700	225	453	9,844	227,588	300,242	1,473	1,574	77,930	216,672	220,340	88,244	89,775	14,248
New York	18	174	2,673	148,258	217,267	887	3,136	49,328	810,332	1,015,249	11,580	13,965	675,221	1,472,657	1,486,423	727,222	687,874	91,293
North Carolina	5	29	513	40,700	40,700	272	403	7,822	187,648	222,695	2,657	2,730	104,095	158,564	158,564	112,430	100,591	73,566
Ohio	26	180	3,621	125,792	145,292	206	474	15,052	149,192	201,077	11,661	12,886	484,153	743,074	751,576	502,826	512,278	61,030
Pennsylvania	22	134	3,520	286,805	318,070	524	914	23,751	467,843	570,501	9,061	10,024	413,706	1,348,249	1,362,949	440,977	498,111	66,928
Rhode Island	1	12	283	23,000	23,000	46	75	1,601	32,748	37,423	416	518	23,130	100,481	100,481	25,014	28,359	3,340
South Carolina	8	43	720	104,790	104,790	202	333	7,467	205,489	205,489	724	739	17,838	200,600	200,600	26,025	40,293	15,684
Tennessee	18	83	1,705	65,307	67,689	264	404	9,928	155,902	175,926	2,680	2,819	104,117	198,518	200,253	115,750	146,130	77,522
Texas	2	7	165	1,000	4,125	97	137	3,389	39,384	79,732	349	360	7,946	44,088	94,554	11,500	19,369	10.525
Vermont	5	30	464	21,558	21,558	118	257	6,864	48,935	56,159	2,731	4,173	93,457	176,111	179.181	100,785	92,152	6,189
Virginia	12	73	1,343	159,790	162,574	317	547	9,068	234,372	351,007	2,930	2,997	67,353	314,625	341,279	77,764	109,711	77,005
Wisconsin	2	8	75	4,700	4,700	58	86	2,723	18,796	19,899	1,423	1,529	58,817	113,133	113,874	61,615	56,354	6,361
Territories. Minnesota	....	......	......	....	....	1	1	12	140	....	......	......	....	....	....	12	207	649
Territories. N. Mexico	....	......	......	....	....	1	1	40	....	....	......	......	....	....	....	40	466	25,085
Territories. Oregon	....	......	......	....	....	29	44	842	20,888	24,495	3	4	80	3,927	3,927	922	1,875	157
Territories. Utah	1	......	......	....	....	13	......	......	2,050	2,221	13	......	....	11,512	11,512	....	2,035	153
Total	239	1,678	27,821	1,964,428	2,142,359	6,085	12,260	263,096	4,644,214	5,831,179	80,978	91,966	3,354,011	9,529,542	9,850,793	3,644,928	4,063,046	962,898

CHRONOLOGICAL TABLE OF AMERICAN COLLEGES.

Corporate name.	Location.	Date.	No. of Professors.	No. of Students.	Vols. in Library.
Harvard University	Cambridge, Mass.	1636	24	420	125,000
William and Mary	Williamsburg, Va.	1693	6	60	53,000
Yale	New Haven, Ct	1700	21	523	67,000
College of New Jersey	Princeton, N. J.	1746	19	314	24,000
University of Pennsylvania	Philadelphia, Pa.	1749	12	129	5,100
Columbia	New York, N. Y.	1754	12	173	14,000
Brown University	Providence, R. I.	1764	10	212	35,000
Dartmouth	Hanover, N. H.	1769	16	304	33.699
Rutgers	New Brunswick, N. J.	1770	6	110	12,000
Washington	Lexington, Va.	1781	8	75	6,200
Dickinson	Carlisle, Pa.	1783	8	134	23,493
Washington	Chestertown, Md.	1783	5	70	1,200
St. John's	Annapolis, Md.	1784	6	115	8,000
Franklin	Athens, Ga.	1785	10	113	18,250
Charleston	Charleston, S. C.	1785	6	37	5,000
University of North Carolina	Chapel Hill, N. C.	1789	15	450	21,000
Hampden-Sidney	Prince Edward Co., Va.	1789	5	128	7,000
University of Vermont	Burlington, Vt.	1791	7	104	13,000
Bowdoin	Brunswick, Me.	1792	9	219	27,048
Georgetown	Georgetown, D. C.	1792	25	260	36,000
Williams	Williamstown, Mass.	1793	11	240	19,700
Washington	Washington Co., La.	1795	3	22	1,800
Union	Schenectady, N. Y.	1795	15	320	15,500
Greenville	Greenville, Tenn.	1796	2	20	3,500
Transylvania	Lexington, Ky	1798	8	..	14,000
Middlebury	Middlebury, Vt.	1800	6	103	13.500
South Carolina	Columbia, S. C.	1801	8	202	24,000
Jefferson	Canonsburg, Pa.	1802	10	215	10,000
Ohio University	Athens, Ohio	1804	6	154	5,000
East Tennessee	Knoxville, Tenn.	1806	..	..	8,000
University of Nashville	Nashville, Tenn.	1806	8	104	9,666
Washington	Washington, Pa.	1806	6	103	3,900
Miami University	Oxford, Ohio	1809	8	121	8,100
Hamilton	Clinton, N. Y.	1812	9	131	12,500
Alleghany	Meadville, Pa.	1817	6	104	9,600
St. Joseph's	Bardstown, Ky.	1819	15	60	8,600
University of Virginia	Charlottesville, Va.	1819	14	417	30,000
Waterville	Waterville, Me.	1820	6	117	10,000
Amherst	Amherst, Mass.	1821	15	242	26,000
Columbian	Washington, D. C.	1821	8	66	7,500
Trinity	Hartford, Ct.	1823	9	56	13,500
Centre	Danville, Ky.	1823	5	180	5,600
Franklin	New Athens, Ohio	1824	4	85	2,000
Hobart Free College	Geneva, N. Y.	1825	7	108	13,550
Western Reserve	Hudson, Ohio	1826	7	48	8,451
Kenyon	Gambier, Ohio	1826	10	129	13,384
Georgetown	Georgetown, Ky.	1829	8	171	7,000
Indiana State University	Bloomington, Ind.	1830	6	115	2,200
Florence Wesleyan	Florence, Ala.	1830	5	112	2,000
Mount St. Mary's	Emmetsburg, Md.	1830	24	126	4,000
Illinois	Jacksonville, Ill.	1830	7	70	3,660
Wesleyan University	Middletown, Ct.	1831	7	140	13,000
University of Alabama	Tuscaloosa, Ala.	1831	9	120	12,000
University of City of New York	New York, N. Y.	1831	16	138	4,300
Lafayette	Easton, Pa.	1832	6	100	4,000
Hanover	South Hanover, Ind.	1832	5	45	5,400
Dolbear's Commercial	New Orleans, La.	1832	10	375	..
Randolph-Macon	Boydon, Va.	1832	6	130	8,000
St. Louis University	St. Louis, Mo.	1832	18	134	22,000
Denison	Granville, O.	1832	7	73	5,000
Delaware	Newark, Del.	1833	6	50	10,000
Wabash	Crawfordsville, Ind.	1833	7	40	9,600

CHRONOLOGICAL TABLE OF AMERICAN COLLEGES.—*Continued.*

Corporate name.	Location.	Date.	No. of Professors.	No. of Students.	Vols. in Library.
Jackson	Columbia, Tenn	1833	5	84	4,400
Oberlin	Oberlin, Ohio	1834	8	110	4,000
Norwich University	Norwich, Vt	1834	4	80	1,650
Pennsylvania	Gettysburg, Pa	1834	7	154	11,000
Shurtleff	Upper Alton, Ill	1835	6	40	1,900
McKendree	Lebanon, Ill	1835	6	99	5,500
Marietta	Marietta, Ohio	1835	6	56	16,000
Franklin and Marshall	Lancaster, Pa	1836	6	96	19,000
University of Michigan	Ann Arbor, Mich	1837	17	282	10,000
St. Charles	St. Charles, Mo	1837	6	50	1,000
Knox	Galesburg, Ill	1837	7	56	3,300
Emory	Oxford, Ga	1837	6	126	1,700
Emory and Henry	Washington Co., Va	1838	5	54	8,470
Oglethorpe	Milledgeville, Ga	1838	5	100	4,500
Wake Forest	Forestville, N. C	1838	5	76	5,000
University of State of Missouri	Columbia, Mo	1839	10	102	3,500
Mercer University	Penfield, Ga	1839	7	140	8,700
Wesleyan Female	Macon, Ga	1839	11	188	2,450
Virginia Military Institute	Lexington, Va	1839	13	150	4,000
Richmond	Richmond, Va	1840	7	93	1,800
Davidson	Mecklenburg Co., N. C	1840	7	112	5,600
Bethany	Bethany, Va	1841	10	124	1,700
St. James's	Washington Co., Md	1842	14	52	9,500
Holy Cross	Worcester, Mass	1843	8	75	6,500
Masonic	Lexington, Mo	1844	3	28	1,200
Franklin	Near Nashville, Tenn	1844	6	106	3,500
Cumberland University	Lebanon, Tenn	1844	11	165	4,000
Centenary	Jackson, La	1845	11	103	5,200
Wittenberg	Springfield, Ohio	1845	5	59	6,200
Madison University	Hamilton, N. Y	1846	9	145	7,457
St. John's	Fordham, N. Y	1846	19	43	15,465
Kentucky Military Institute	Franklin Springs, Ky	1846	9	154	3,000
Beloit	Beloit, Wis	1847	8	60	3,500
St. Mary's	Wilmington, Del	1847	7	..	5,500
St. Charles's	Ellicott's Mills, Md	1848	8	104	450
Union	Murfreesboro', Tenn	1848	6	150	4,500
University of Mississippi	Oxford, Miss	1848	9	175	5,000
Howard	Marion, Ala	1848	6	83	3,000
Lawrence University	Appleton, Wis	1849	10	100	15,000
University of Louisiana	New Orleans, La	1849	7	..	..
University, at Lewisburg	Lewisburg, Pa	1850	6	55	4,000
Urbana University	Urbana, Ohio	1850	8	21	3,500
Carroll	Waukesha, Wis	1850	5	20	926
University of Rochester	Rochester, N. Y	1850	8	165	5,200
Madison	Sharon, Miss	1851	5	102	450
Mississippi College	Clinton, Miss	1851	7	50	3,750
Wisconsin University	Madison, Wis	1851	7	30	1,900
Aranama	Goliad, Tex	1852	3	75	1,800
Racine	Racine, Wis	1852	6	17	1,700
Milwaukee Female	Milwaukee, Wis	1852	4	36	729
Polytechnic	Philadelphia, Pa	1853	8	58	..
Antioch	Yellow Springs, Ohio	1853	12	98	4,200
Tufts	Medford, Mass	1854	5	54	8,000
Ohio Wesleyan University	Delaware, Ohio	1854	8	147	10,450
Santa Clara	Near San Jose, Cal	1855	..	..	..
Iowa State University	Iowa City, Iowa	1855	4	..	200
Iowa Wesleyan University	Mount Pleasant, Iowa	1855.	9	..	..
Semple Broaddus	Centre Hill, Miss	1856	4	75	..
Indiana Asbury University	Greencastle, Ind	1857	8	100	10,000
Kentucky	Harrodsburg, Ky	1858	8	156	1,600
University of Chicago	Chicago, Ill	1860	9	20	2,000

THEOLOGICAL SCHOOLS.

Name.	Place.	Denomination.	Commenced operations.	No. Professors.	Students near 1859-1860.	Number educated.	Volumes in Library.
Th. Sem. Dutch Ref. Church....	N. Brunswick, N. J..	Dutch Ref....	1784	3	50	179	7,000
St. Mary's Seminary...........	Baltimore, Md........	Rom. Catholic.	1791	6	27	..	10,000
Theological School............	Canonsburg, Pa......	Asso. Church.	1792	2	33	147	2,000
Theological Seminary..........	Andover, Mass.......	Congregation..	1807	5	110	1,206	21,259
Theol. Sem. Presbyt. Church....	Princeton, N. J.......	Presbyterian..	1812	5	153	1,626	11,000
Bangor Theological Seminary...	Bangor, Me..........	Congregation..	1816	4	40	330	10,500
Divinity School, Harv. Univ....	Cambridge, Mass....	Cong. Unit....	1816	2	17	295	8,700
Hartwick Seminary............	Hartwick, N. Y.....	Lutheran.....	1816	2	5	52	1,250
Georgetown College...........	Georgetown, D. C...	Rom. Catholic.	1816	3	12	..	2,000
Theol. Inst. Episc. Church......	New York, N. Y.....	Prot. Episcop.	1817	5	58	430	11,963
Hamilton Theol. Seminary......	Hamilton, N. Y......	Baptist	1820	3	24	262	7,500
Theol. Sem. of Auburn.........	Auburn, N. Y........	Presbyterian..	1821	4	30	580	6,000
Southwest Theol. Seminary.....	Maryville, Tenn.....	Presbyterian..	1821	2	24	90	6,000
Theol. Dep. Yale College.......	New Haven, Conn...	Congregation..	1822	5	27	680	..
Epis. Theol. School of Virginia..	Fairfax Co., Va......	Prot. Episcop.	1822	4	47	356	7,500
Union Theological Seminary....	Prince Ed. Co., Va...	Presbyterian..	1824	3	20	175	4,000
N. Hampton Theol. Seminary...	New Hampton, N. H.	Baptist......	1825	2	36	..	2,000
Theological Institution.........	Newton, Mass......	Baptist.......	1825	4	33	201	5,500
Wittenberg Theol. Seminary....	Gettysburg, Pa......	Evang. Luth..	1825	3	25	250	10,000
German Reformed.............	Mercersburg, Pa.....	Germ. Ref. Ch.	1825	2	18	121	6,000
Furman Theol. Seminary.......	Fairfield Dist., S. C..	Baptist.......	1826	2	30	30	1,000
Theol. Dep. Kenyon College....	Gambier, Ohio......	Prot. Episcop.	1827	4	23	91	6,500
Theological Seminary..........	Pittsburg, Pa.......	Asso. Ref.....	1828	3	35	85	1,500
Theological Seminary..........	Columbia, S. C......	Presbyterian..	1828	4	42	249	17,260
Western Theol. Seminary.......	Alleghany, Pa.......	Presbyterian..	1828	5	140	537	10,000
Theol. Dep. St. Louis Univ.....	St. Louis, Mo.......	Rom. Catholic.	1829	4	14	86	4,000
Lane Seminary...............	Cincinnati, Ohio.....	Presbyterian..	1829	3	36	257	10,500
Theol. Dep. West. Res. College..	Hudson, Ohio.......	Presbyterian..	1830	3	14	..	79
Virginia Baptist Seminary......	Richmond, Va......	Baptist.......	1832	3	67	..	1,000
Granville Theol. Department....	Granville, Ohio......	Baptist.......	1832	2	8	..	500
New Albany Theol. Seminary...	Hanover, Ind.......	Presbyterian..	1832	3	15	156	4,000
Theol. Inst. of Connecticut......	East Windsor, Conn..	Congregation..	1834	3	17	151	5,000
Gilmanton Theol. Seminary.....	Gilmanton, N. H....	Congregation..	1835	3	23	69	4,300
Theological Seminary..........	Lexington, S. C.....	Lutheran.....	1835	2	10	20	1,800
Oberlin Theol. Department.....	Oberlin, Ohio.......	Congregation .	1835	3	24	157	500
Alton Theol. Seminary..........	Upper Alton, Ill.....	Baptist.......	1835	.	..	..	..
Union Theological Seminary....	New York, N. Y....	Presbyterian..	1836	5	106	211	18,000
Theol. Sem. Ass. Ref. Church...	Newburg, N. Y.....	Ass. Ref. Ch..	1836	1	11	143	3,200
Theol. Sem. Ass. Ref. Church...	Oxford, Ohio	Asso. Ref....	1839	1	12	31	1,500
Nashotah Theol. Seminary......	Nashotah, Wisc.....	Prot. Episcop.	1841	8	49	46	3,000
Western Theol. School.........	Meadville, Pa.......	Cong. Unit...	1844	4	17	60	8,000
Western Bapt. Theol. Institution.	Georgetown, Ky.....	Baptist.......	1845	2	12	180	500
Wittenberg..................	Springfield, Ohio....	W. Lutheran..	1845	1	6	49	..
Theol. Sem. of Mercer Univ.....	Penfield, Ga........	Baptist.......	1846	2	13	..	2,200
Meth. Gen. Bib. Institute.......	Concord, N. H......	Methodist....	1847	3	40	..	2,000
Howard Theol. Institution......	Marion, Ala........	Baptist.......	1848	1	6	..	1,000
Bibl. Dep't Ohio Wesl. Univ....	Delaware, Ohio.....	Methodist....	1849	1	11	..	..
Rochester Theol. Seminary.....	Rochester, N. Y.....	Baptist.......	1850	3	36	50	5,500
Danville Theol. Seminary.......	Danville, Ky........	Presbyterian..	1853	4	52	115	..
Theol. Dep. Lewisburg Univ....	Lewisburg, Pa......	Baptist.......	1855	2	12	20	..
Theol. School, Cumb. Univ......	Lebanon, Tenn......	Cumb. Presby.	1855	2	33	..	..

LAW SCHOOLS.

Name.	Place.	Founded.	Pro-fess'rs.	Students 1859-60.	Graduates.	Vols. in Library.
William and Mary College	Williamsburg, Va.	1730	1	..	..	..
Dane Law School, H. Univ.	Cambridge, Mass.	1817	3	150	1,005	14,500
Law School, Yale College	New Haven, Conn.	1820	2	28	122	2,200
Law School, Univ. of Virginia	Charlottesville, Va.	1825	2	109	247	2,000
Law School, Cincinnati College	Cincinnati, Ohio	1833	3	85	512	3,000
Indiana State University	Bloomington, Ind.	1840	1	18	78	..
North Carolina University	Chapel Hill, N. C.	1845	2	23	..	..
N. Y. State and National L. S.	Poughkeepsie, N. Y.	1845	4	119	..	3,000
Cumberland University	Lebanon, Tenn.	1847	3	188	79	500
University of Pennsylvania	Philadelphia, Pa.	1850	3	60	80	..
University of Albany	Albany, N. Y.	1851	3	129	85	State lib.
Indiana Asbury University	Greencastle, Ind.	1853	1	16	50	..
Maynard L. S. Hamilton College	Clinton, N. Y.	1853	1	9	36	500
University of Mississippi	Oxford, Miss.	1857	1	35	33	1,000
Kentucky Military Inst.	Franklin Springs	1858	1	20	..	..
Law School, Col. College	New York, N. Y.	1859	3	30	..	2,000
University of Michigan	Ann Arbor	1859	3	90	24	1,000
University of Louisiana	New Orleans, La.	..	3	..	..	..
University of Louisville	Louisville, Ky.	..	3	..	..	..

MEDICAL SCHOOLS.

Name.	Place.	Founded.	Prof.	Stud'ts.	Graduates.	Lectures commence.
Med. Dep. Univ. Penn.	Philadelphia, Pa.	1765	9	453	7,100	Early in October.
Medical School, Harv. Univ.	Boston, Mass.	1782	6	104	1,125	1st Wedn. in Nov.
N. H. Medical School	Hanover, N. H.	1797	6	50	928	Thurs. after Com't.
Coll. Phys. & Surg., N. Y	New York, N. Y.	1807	6	219	852	1st Mon. in Nov.
Med. School, Univ. Md.	Baltimore, Md.	1807	6	100	909	October 31st.
Medical Inst. Yale College	New Haven, Ct.	1813	6	45	709	September.
Castleton Medical College	Castleton, Vt.	1818	7	104	555	4th Thurs. in Aug.
Med. Dep. Transylv. Univ.	Lexington, Ky.	1818	.	..	1,351	..
Medical College of Ohio	Cincinnati, Ohio.	1819	8	130	331	1st Mon. in Nov.
Medical School of Maine.	Brunswick, Me.	1820	7	50	880	Early in February.
Med. Dep. Univ. Vt.	Burlington, Vt.	1821	6	49	163	Last of February.
Nat. Med. Col., Columbia Col.	Wash'gton, D. C.	1821	8	17	86	4th Mon. in Oct.
Berkshire Medical School	Pittsfield, Mass.	1823	5	103	473	1st Th. in Sept.
Jefferson Medical College	Philadelphia, Pa.	1824	7	514	2,036	1st Mon. in Nov.
Washington Med. College	Baltimore, Md.	1827	6	25	..	1st Mon. in Nov.
Med. School, Univ. Va.	Charlottesville.	1827	5	99	35	1st October.
Med. College of Georgia	Augusta, Ga.	1830	7	115	124	2d Mon. in Nov.
Med. Faculty, Univ. N. Y.	New York, N. Y.	1831	9	300	1,715	3d Mon. in Oct.
Med. Coll. State of S. C.	Charleston, S. C.	1833	8	158	..	2d Mon. in Nov.
Geneva Medical College	Geneva, N. Y.	1834	9	22	935	1st Wednes. in Oct.
Vermont Medical College	Woodstock, Vt.	1835	8	91	350	1st Th. in March.
Med. Dep. Univ. Louisiana	N. Orleans, La.	1835	9	333	..	3d Mon. in Nov.
St. Louis Medical College	St. Louis, Mo.	1836	10	128	..	1st Thurs. in Nov.
Med. Dep. Univ. Louisville	Louisville, Ky.	1837	.	..	53	..
Med. Dep. Hamp. Sid. Coll.	Richmond, Va.	1838	7	90	40	October 13.
Albany Medical College	Albany, N. Y.	1839	8	114	58	1st Tues. in Oct.
Med. Dep. Penn. College	Philadelphia, Pa.	1839	8	150	35	2d Tues. in Oct.
Rush Medical College	Chicago, Ill.	1842	6	70	16	1st Mon. in Nov.
Med. Dep. West. Reserve Coll.	Cleveland, Ohio.	1844	8	67	640	1st Wed. in Nov.
Med. Dep. of Missouri Univ.	Columbia, Mo.	1846	7	103	13	1st Mon. in Nov.
Starling Medical College	Columbus, Ohio.	1847	8	124	53	1st Mon. in Nov.
Med. Dep. State Univ.	Keokuk, Iowa.	1849	6	80	64	1st Mon. in Nov.
Med. Dep. Univ. Nashville	Nashville, Tenn.	1850	8	436	669	1st Mon. in Oct.
West. Coll. Homœpath. Med.	Cleveland, Ohio.	1850	8	62	17	1st Mon. in Nov.
University of Michigan	Ann Arbor	1850	9	164	305	1st Mon. in Oct.
Med. Dep. Georgetown Coll.	Wash'gton, D. C.	1851	8	36	10	4th Mon. in Oct.
Med. Dep. E. Tenn. Univ.	Knoxville, Tenn.	1856	8	..	..	October.
Med. Dep. State Univ.	Madison, Wisc.	1856	6	..	..	..
Philadelphia Coll. of Med.	Philadelphia, Pa.	..	7	75	250	..
Winchester Med. Coll.	Winchester, Va.	..	5	..	..	1st Mon. in Oct.

STATISTICS OF DEAF AND DUMB INSTITUTIONS IN THE UNITED STATES.—1860.

NAME OF INSTITUTION.	Location.	Date of opening.	Number of deaf-mute pupils.	State beneficiaries.	Cost of building and grounds.	Annual amonnt received from states.	Amount from paying pupils.	Ordinary current expenses.	Permanent funds.	Annual charge to paying pupils.	No. of instructors, including principal.	No. of D. M. Instructors.	No. of female teachers.	No. educated previous to 1860.	Remarks.
American Asylum for Deaf and Dumb.	Hartford, Ct. .	1817	226	205	$ 75,000	$22,265	$2,100	38,288	$307,000	$100	19	5	6	1,243	
N. York Institution for Deaf and Dumb	N. York city.	1818	303	265	600,000	48,783	4,309	48,659	None.	150	16	7	2	1,153	
Pennsylvania " " " "	Philadelphia. .	1820	218	182	120,000	22,722	2,227	25,000	None.	140	12	3	. .	970	
Kentucky " " " "	Danville.	1823	78	70	66,000	15,444	350	14,658	22,000	105	6	2	1	409	
Ohio " " " "	Columbus. . . .	1829	159	156	35,000	20,000	400	20,000	None.	100	9	3	. .	606	
Virginia Institution for Deaf, Dumb, and Blind, ...	Staunton.	1839	75	. .	75,000	25,000	. .	25,000	None.	130	6	3	1	130	
Indiana Institution for Deaf and Dumb	Indianapolis . .	1844	182	182	132,000	28,250	. .	30,000	Land.	100	10	5	2	291	
Tennessee " " " "	Knoxville. . . .	1845	61	60	41,780	13,000	130	13,000	None.	130	5	2	1	16	
North Carolina Institution for Deaf, Dumb, and Blind, ...	Raleigh.	1845	68	. .	. .	8,000	. .	. .	None.	. .	3	2	. .	. .	
Illinois Institution for Deaf and Dumb	Jacksonville. .	1846	205	205	200,000	27,000	. .	27,000	None.	100	10	4	1	100	
Georgia Asylum " " "	Cave Spring Floyd Co.	1846	29	29	18,500	8,000	1,750	8,500	None.	175	4	1	. .	83	
South Carolina Asylum for Deaf, Dumb, and Blind, ...	Cedar Spring.	1849	16	16	45,000	7,728	None.	7,728	None.	150	3	1	2	41	
Missouri Institution for Deaf and Dumb.	Fulton.	1851	80	75	55,400	10,800	. .	11,750	None.	100	5	4	. .	55	
Louisiana Institution for Deaf, Dumb, and Blind.	Baton Rouge.	1852	56	. .	200,000	17,600	. .	14,590	None.	. .	5	. .	. .	. .	
Wisconsin Institution for Deaf and Dumb.	Delavan.	1852	70	68	67,000	11,000	200	11,200	None.	100	6	2	1	. .	
Michigan Asylum for Deaf, Dumb, and Blind.	Flint.	1854	70	70	154,000	7,000	. .	7,000	None.	100	4	2	. .	. .	Expenses for both departments.
Iowa Institution for Deaf and Dumb.	Iowa City . . .	1855	50	50	Rent. build.	8,000	. .	4,500	None.	140	4	2	. .	. .	
Mississippi " " " "	Jackson.	1855	49	49	10,500	9,000	. .	8,272	. .	150	4	3	. .	38	
Texas " " " "	Austin	1857	30	30	9,000	9,000	. .	. .	100,000 acr. state lands.	. .	2	1	1	. .	
Columbian Institution for Deaf, Dumb, and Blind.	Washington D. C.	1857	27	24	12,000	7,500	450	6,896	None.	150	5	1	1	. .	6 blind pupils.
Alabama Institution for Deaf and Dumb.	Talladega. . . .	1858	24	18	20,000	5,000	840	5,000	None.	140	3	1	1	6	

GENERAL VIEW OF BLIND INSTITUTIONS IN THE UNITED STATES, 1860.

Name of Institution.	Location.	Cost, or estimated value of buildings and grounds.	Date of opening.	Number of pupils.	Annual amount received from states.	Annual current expenses.	Charge to paying pupils.	Number of instructors.	No. of blind instructors.	Number of graduates.	Remarks.
Perkins Institution and N. England Asylum.	Boston, Mass.	$100,000	1832	85	$17,000	$20,000	$200	6	3	405	30 graduates furnished work on premises.
New York Institution for the Blind	New York	300,000	1832	210	22,000	30,000	550	26	18	650	
Pennsylvania " " " "	Philadelphia	175,000	1833	157	26,850	30,000	200	16	8	258	A "Home" for infirm graduates, 16 inmates.
Ohio " " " "	Columbus	50,000	1837	120	16,500	16,500	120	9	2	250	
Virginia Institution for Deaf, Dumb, and Blind	Staunton	75,000	1839	42	25,000	28,000	130	9	..	125	
Kentucky Institution for Blind	Louisville	70,000	1842	50	9,000	9,000	140	4	1	75	
Tennessee Institution for Blind	Nashville	15,000	1844	36	7,620	7,642	200	5	3	..	
Indiana Institution for Blind	Indianapolis	100,000	1847	66	15,000	15,000	100	4	1	..	
Illinois Institution for Blind	Jacksonville	80,000	1849	65	12,000	12,000	100	4	0	67	
Wisconsin Institution for Blind	Janesville	60,000	1850	36	8,000	8,000	..	4	1	15	
Missouri Institution for Blind	St. Louis	45,000	1851	52	10,000	9,000	200	4	1	43	
Mississippi Institution for Blind	Jackson	11,000	1848	20	7,000	7,000	..	..	..	..	
Georgia Academy for Blind	Macon	66,000	1852	26	6,000	6,700	200	3	1	5	
Iowa Institution for Blind	Vinton	19,000	1853	23	5,000	5,000	..	3	..	..	
Louisiana Institution for Deaf, D., and Blind.	Baton Rouge	128,000	1852	14	3,550	3,550	250	..	..	..	
Maryland Institution for Blind	Baltimore	35,000	1854	25	4,800	5,000	100	5	3	3	
Columbian Institution for Deaf, Dumb, and Blind	Washington, D. C.	12,000	1857	..	...	..	..	..	..	..	Only 6 blind pupils.
Michigan Asylum for Deaf, Dumb, and Blind	Flint	154,000	1854	25	7,000	7,000	100	3	..	..	
North Carolina Institution for Deaf, Dumb, and Blind	Raleigh	20,000	1848	18	12,000	12,500	175	3	..	..	
South Carolina Institution for Deaf, Dumb, and Blind	Cedar Spring	45,000	1855	17	7,728	7,728	150	2	1	..	
Arkansas Institute for the Blind	Arkadelphia	..	1859	10	..	..	..	..	..	..	
Texas Institute for Blind	Austin	Rented buildg's.	1856	..	..	..	..	..	..	..	100,000 acres of land granted by the state.
Alabama " " "	Mobile	..	..	..	..	..	..	..	..	..	
Institution for colored Deaf Mutes and Blind	Niagara Falls	..	1860	..	..	..	..	..	..	..	

INDEX

Accident insurance companies, 227.
"Academician," the first educational periodical, 398.
Academies and high schools, 388.
"Academy," an, in Virginia, 377.
Adams, Hannah, works of, 285.
Adams, Mr., designer and wood engraver, 332.
Adams, John, extract from, upon education, 352.
Adams, John Quincy, works and career of, 276; extract from, upon education, 353.
Adams press, the, 297; illustration of, 295.
Adirondac iron mines, 25.
Adventure copper mine, the, 54.
Advertising, newspaper, 304.
Ætna Insurance Company, 222.
Agricultural machines, use of, at the West, 175.
Agriculture, schools of, 402.
Alabama, iron mines and furnaces of, 28; banks and banking in, 208.
Albany, iron foundries of, 36.
Albion coal mines, Nova Scotia, 129.
Alcuin, Bible copied by, in 22 years, 264, 272.
Alfred, King, price for a book paid by, 262.
Alison, Rev. Francis, 349.
Alleghany mountain, iron ores of the, 28.
Allston, Washington, career of, as a painter and author, 321.
Almaden quicksilver mines, Spain, 111.
Alphabets for the blind, 440.
Aluminum, discovery and uses of, 251.
Amalgamation for extraction of gold, 74; Eaton's improvement in, 76.
Amalgams, uses of, 114, 115.
America, discovery of, 228; colonization of, 229, 234.
American Academy of Fine Arts, 320, 335.
American Academy of Natural Sciences, museum and library of the, 427.
"American Annals of Education," 398.
American Asylum for the Deaf and Dumb, 435, 436; view of, 437.
American Bible Society, formation and issues of the, 264.
American Bible Union, organization and publications of the, 264.
American Institute of Instruction, 397.
"American Journal of Education," 398, 399.
American Female Guardian Society, 449.
American Philosophical Society, origin of the, 349.
American Telegraph Company, 313.
Ames, Messrs., foundry of, 63.
Ancram lead mine, New York, 82.
Anæsthesia, discovery and use of, 261.
Anderson, Dr., early engraving by, 332.
Andover Theological School, 393.
Aniline, origin and value of, 149.
Annapolis, Md., Naval Academy at, 396.
Anthracite coal, use of, in iron-making, 23; first successful application of, 25–6; first knowledge and use of, 120; geological position of, 122; composition and varieties of, 123; strata of, illustrated, 131–2; mining of, 142; open quarries of, 143; concentration of beds of, 144; breaking and screening of, 147; employment of, in house-warming, 248.
Appalachian coal-basin, 124.
Appalachian mountains, gold mines of the, 64.
Appleton, D., & Co., sales of Webster's Spelling-book, &c., by, 264, 268.
Aqua regia, 107.
Aquatint engraving, 334.
Architecture, domestic, 245; modern improvements in, 247.
Argentiferous lead ores, methods of working, 90.
Arizona, rich gold deposits of, 71; silver mines of, 115.
Arkansas, magnetic iron in, 32; zinc in, 98; banks in, 207.
Arks, transportation of coal by, 136.
Arrastre, the, description and illustration of, 75.
Arsenic associated with zinc, 100.
Arts of design in America, 316.
Assay office, New York, gold deposits at the, 79; establishment of the, 215.
Associated Press, the, 303; use of the telegraph by, 313.
Astor Library, 424.
Atlantic cities, account of the, 181; table of exports of the, 187; of imports, 192.
Atlantic Mutual Marine Insurance Company, 223.
Atlantic Telegraph, history of the, 314.
Atwood, Luther, patent coal-oil kiln of, 158.
Audubon, John James, career and works of, 283.
Austin, Moses, mining operations of, 86.
Authors, American, 274; younger, list of, 281.

Bachus, Elijah, manufacture of cannon by, 19.
Backus, Levi S., deaf-mute editor, 439.
Backus, Senator F. F., report of, upon the instruction of idiots, 443.
Bacon, Rev. Samuel, proposal of, for an educational journal, 398.
Bain's electro-chemical telegraph, 310 (illustration), 312.
Baldface Mountain, N. H., iron ores of, 24.
Baltimore, iron mines near, 22; the charcoal iron of, 23; copper smelting at, 59; chrome at, 118; receipts of coal at, 139; origin, growth, and commerce of, 183; orphan asylums in, 445.
Baltimore Company's open coal mines, Wilkesbarre, Pa., picture of, opposite 137; account of, 144.
Baker, George A., painter, 325.
Bakoo, the petroleum of, 161.
Bancroft, George, 284.
Bank note engraving, 333.
Bank of the United States, the, charter of, 200–201; winding up and recharter of, 201; operations of, 201–2; removal of the deposits from, 202; State charter and failure of, 203.
Banking, method of, in New York, 193; Suffolk system of, 203; safety-fund and free, 204; National and private, 211.
Banks, disastrous speculations of, 170, 172; State, establishment and operations of, 199; over-issues of, 200; opposition of, to the United States Bank, 201; suspension of, in 1814, 201; increase and expansion of, 202; failure of, in 1837, 203; history of, 203–9; table of, 1791–1860, 209; method of transacting business by, 210; settling of balances by, 210–11. (See National banks.)
Bare Hill copper mine, Maryland, 49; chromium at, 118.
Barnard, Henry, educational journals edited by, 398–9.
Barnes, A. S., & Co., sales of school books by, 268.
Bars, iron, how made, 39.
Bartlett, J. R., illustration of the New Almaden quicksilver mine by, 114.
Barytes, sulphate of, used in adulterating white lead, 95.
Beaumont's method of arresting lead fumes, 90.
Bedsteads and bedding formerly used, 250.

Beecher, Miss Catharine E., 285; efforts of, for female education, 405.
Belgium, zinc manufacture in, 101.
Belleville, N. J., copper mine at, 49.
Bell-metal, composition and use of, 63, 120.
Bells, production of, 63.
Bennet, William James, painter, 320.
Bennett, James Gordon, 303.
Benton, Thomas H., works of, 277.
Benzole, character and use of, 148.
Berkeley, Sir William, report of, upon education in Virginia, 341.
Berks county, Pa., iron mines of, 26.
Berkshire, Mass., iron mines and furnaces of, 24.
Bethlehem, Pa., manufacture of zinc at, 99, 104; Moravian female seminary at, 349, 404.
Beuthen, Silesia, zinc mines at, 102.
Bible, the, early printing of, 263; issues and low price of, by the Bible Society, 264; Charlemagne's, 264, 272; the educational influences of, 381–2.
Bible Societies, formation of, 264.
Bills of credit, State, constitutional prohibition of, 199.
Bingham, Caleb, girls' school of, 405.
Birch, Thomas, marine painter, 322.
Birmingham, Eng., manufacture of nails at, 41.
Bishop sleeves, 258.
Bituminous coal, first trade in, 121; geological position of, 122; character and kinds of, 122; spontaneous combustion of, 124; beds of, 129; mining of, 141. (See Gas, and Coal oils.)
Black jack, 96.
Black river, Wis., iron mines of, 30.
Blanc de neige, 104.
Blast furnaces in the colonies, 17; construction and working of, 32; American, superior economy of, 33; illustrations of, 34, 35; tables of production and distribution of, 46.
Bleaching powder, manufacture of, from manganese, 119.
Blende, zinc ore, 96.
Blind, the, institutions for the instruction of, 439; alphabets for, 440; course of instruction of, 441; printing for, and writing by, 441; statistics of, 457.
Block-tin lining of lead pipe, 92.
Bloodgood & Ambler, silver-lead smelting works of, 91.
Bloomaries, description and working of, 36; localities of, 37.
Blooms, iron, how made, 39.
Blue mass, preparation of, 115.
Blue Ridge, the, copper ores of, 49–50; lead mines of, 83.
Boghead cannel coal, 123; composition of, 147.
Bog ores, iron, 22.
Boiler-plate iron, production of, 41.
Boise Basin gold mines, Idaho, 71.
Bonnets, fashions of, 254, 257, 258, 259.
Book-binding, 269; illustrations of machines for, 270, 271; origin of, 272; processes of, 272.
Books, ancient cost of, 262; effect of the discovery of printing upon, 263; early market for, in New England, 263; religious, cheapening of, 264; process of the manufacture of, 264; methods of the sale of, 265; old, the trade in, 266; subscription, publication of, 267; great sales of, 267; statistics of, 269; increased cost and use of, 269; sizes of, 272.
Booksellers, American Company of, 263, 264; number and classes of, 265.
Book-stalls, the business of, 266.
Book trade, the, 262; competition in, 264; number engaged in, and operations of, 265; the statistics of, 269.
Book trade sales, 265.
Borneo, platinum from, 107.
Boston, origin, growth, and commerce of, 185; banking system of, 203–4; early bookselling at, 263; early town provision for schools in, 339; past experiences in the high schools of, 390, 391; orphan asylums in, 445.
Boston Athenæum, art gallery of the, 335; library of the, 423, 427.
Boston City Library, 424, 425–6 (illustrations).
"Boston Courant," the, 301.
Braidwood, Thomas, in Virginia, 435.
Braidwoods, the, deaf-mute instructors, 435, 438.
Braille's system of writing and printing for the blind, 441.
Bramah's pump for making lead pipe, 92.
Brass, manufacture and uses of, 62.
Bray, Rev. Thomas, libraries in Maryland established by, 348.
Bread, kinds of, formerly most used, 252.
Breckenridge Coal Oil Works, Kentucky, 154.
Bremen, regulations for emigrants at, 233.
Brick, invention of machines for, 244.
Bridgewater, Vt., gold at, 64.
Bridgewater copper mine, New Jersey, 49.
Bristol, Conn., copper mine at, 49.
British coal-fields, the, 133.
British immigration into the United States, 234–5.
Brokers, board of, New York, 195.
Bronze, composition of, 62, 63, 120.
Brooklyn, manufacture of white lead in, 940; orphan asylums in, 445.
Brooks, Mrs. Maria, 285.
Brown, Charles B., works of, 278.
Brown, Henry Kirke, sculptor, works of, 328.
Brown, Thomas, deaf-mute, 439.
Brown, William, process of, for dry distillation of coal oil, 158.
Brown coal, beds of, 122.
Brown University, origin of, 344.
Brownson, Orestes A., writings of, 282.
Bruce, George, Jr., type-casting machine invented by, 298.
Bruce, George, Sr., stereotyping introduced by, 300.
Bryant, William C., 284.
Buckingham, Joseph T., letter of, upon his early school experience, 359.
Buckminster, Joseph S., 282.
Buffalo, origin, growth, and trade of, 176.
Buhrstone iron ore, 22.
Building associations, fallacy of, 225.
Buildings, ventilation of, 249. (See Houses.)
Bulls and bears, in stock operations, 195.
Burden, Henry, rotary squeezer invented by, 39; machines of, for spikes and horse-shoes, 43.
Bureaus, former style of, 250.
Burke rocker, the, illustration and description of, 74.
Burmah, the petroleum of, 161.
Burnett, John T., deaf-mute writer, 439.
Burning-fluid, use of, for light, 253.
Burr, Thomas, process of, for making lead pipe, 91.
Burra Burra Mining Company, 50, 51.
Bushnell, Horace, 282; extract from, upon the homespun era of common schools, 369.
Bushnell's anthracite stove, 248.
Bussey, Benjamin, bequest of, to Harvard College, 401.
Bustle, use and construction of the, 258.
Butler, E. H., & Co., sales of school books by, 268.
Butler, W. Allen, 281.

Calamine, silicate of zinc, 96, 97.
Calash, the, for the head, 254, 258.
Calhoun, John C., career and works of, 277.
California, history, methods, and yield of gold-mining in, 71–3; quicksilver mines of, 111–12; silver mines of, 116; petroleum in, 167.
California Quicksilver Mining Association, 112.
Camphene, introduction and use of, 253.
Canada, railroads of, 173; public improvements and trade of, 179; effect of the reciprocity treaty with, 179.
Canada East, gold mines of, 64.
Canada West, oil region of, 167.
Canals, in California, for gold-mining, 72; built for coal transportation, 139, 140 (table); opening of, 171, 172; effect of, upon Western trade and settlement, 172.
Candles, paraffine, manufacture of, 159; use and varieties of, 253.
Cannel coals, use of, in manufacturing gas, 150.
Cannon, manufacture of, in the revolution, 19.
Cape Breton, coal-field of, 129.
Carbonate of iron, ores and mines of, 21.
Carlin, John, deaf-mute artist, 439.
Carlisle tables, the, of average duration of life, 224; inaccuracy of, 226.
Carpets, early use of, 250.
Castillero, Andres, working of cinnabar by, 112.
Cast iron, manufacture of, 32; uses of, 36; decarbonizing of, 36; manufacture of steel from, 44.
Castle Garden, New York, emigrant depot, 240.
Central Park, the, of New York, 190.
Ceracchi, sculptor, career of, 326.
Chairs, old and new varieties of, 250.
Champlain canal, opening of, 171.
Chandler, Abiel, 401.
Chandler Scientific School, 400.
Channing, William E., writings of, 281.
Chapman, John G., painter and designer, 323.
Character, formation of, 383.
Charcoal, use of, in iron-making, 22.
Charlemagne's Bible, 264, 272.
Charleston, origin, growth, and commerce of, 183.
Charleston Library Society, 423.
Charlotte, N. C., branch mint at, 64; gold deposits at, 79.
Chatham, Conn., cobalt mine at, 18; nickel at, 117.
Chaudiere river, gold mines of, 64.
Cheever, Rev. George B., D. D., 280.
Cheever, Ezekiel, schoolmaster, 340.
Cherokee lands, the, of Georgia, 69.
Chesapeake, iron mines on the, 22.
Chesapeake and Ohio canal, charter for, 171.
Chester county, Pa., lead mines of, 83.

Chestnut Hill iron mine, Pa., 20; account of, 27.
Chicago, trade and railroad system of, 177; shipments of flour and grain from, 178.
Chicago City University, view of, 412.
Child, Mrs. Lydia Maria, works of, 285.
Children's Aid Society, New York, 449.
Chilian mill, the, 75.
Chillicothe, Ohio, first land office opened at, 169.
China, quicksilver mines of, 111.
Chinese immigration into California, 232.
Chlorine, manufacture of, from manganese, 119.
Chrome, composition and sources of, 118; uses and treatment of, 118.
Chrome iron in Maryland, 27, 28.
Chrysocolla, 48.
Church, landscape paintings of, 325.
Cinnabar, 111; early knowledge of, in California, 112; metallurgic treatment of, 114.
Cincinnati, origin, growth, and trade of, 180.
Circular saw, invention of the, 247.
Cities, lake, account of, 176; recapitulation, 178; river, 180; recapitulation, 181; Atlantic, 181.
Clausthal, lead-melting at, 89; treatment of argentiferous ores at, 116.
Clay, Henry, 277.
Clay's plan for making wrought iron, 87.
Clearing-house system, the, 210.
Clerc, Laurent, deaf-mute, 435, 439.
Clergymen, distinguished, list of, 282.
Cleveland, origin and trade of, 176; direct trade of, with Europe, 177.
Clevenger, Shobal Vail, sculptor, 326.
Cliff copper mine, the, 53.
Clinton, De Witt, extract from, upon education, 353.
Clinton county, New York, iron works of, 25; bloomaries in, 37.
Clocks, former styles of, 251.
Clymer press, the, 287.
Coal, early neglect and first use of, 120; varieties of, 121; the ash of, 123; composition of different kinds of, 122, 123 (table); qualities of, 123; relative values of, 124 (table); geological and geographical distribution of, 124; strata of, illustrated, 129, 130; amount of, available, 133; relative amount of, in Europe and America, 134 (table); production of, in eastern Pennsylvania and Maryland, 1820-1860, 134-5 (table); transportation of, to market, 135; table of public works for, 140; mining, general account of, 140; useful applications of, 144. (See Anthracite, Bituminous, &c.)
Coal Hill lead mine, New York, 83.
Coal mining, early, on James river, 18. (See Coal.)
Coal oils, manufacture of, 155; table of American factories of, 155; history and method of the manufacture of, 156; coals used for, 157; retorts for, 157; kilns and pits for, 158; process of refining, 158; uses of, 160; use of, for light, 160, 252. (See Petroleum.)
Coal tar, production and composition of, 148.
Coats, fashions of, 253, 257, 258.
Cobalt, mine of, at Chatham, Conn., 18; use of, 116; ores and mines of, 117; treatment of, 117.
Coinage, colonial, 212-13; adoption of Jefferson's plan of, 213; modifications of, 214, 215; table of, 1793-1860, 214; of silver, number of pieces, 216; process of, 217; of platinum, 107.
Coins, foreign, in the colonies, 213.
Coke, production of, 150; from coal-oil works, 159.
Cole, Thomas, career and paintings of, 324.
College of New Jersey, charter of, 348.
Colleges in the United States, 392; table of, 452-3.
Colliery slope and breaker at Tuscarora, Pa., picture, opposite 139; description of, 142, 144.
Colonies, the, issue of paper money by, 198; coinage in, 212-13; literature in, 274; education in, 337.
Colorado, gold mines of, 71.
Columbia College, New York, origin of, 347.
Columbian or Clymer press, the, 287.
Columbite and columbium, discovery of, 18.
Combination press, the, 287.
"Commercial Advertiser," New York, 302.
Commercial schools, 403.
"Common School Almanac," 398.
"Common School Assistant," 398.
Common schools, accounts of the early state of, 355-80; State provisions for the maintenance of, 385-6; present condition of, 387.
"Common Sense," Paine's, 275.
Communipaw, N. J., zinc manufacture at, 104.
Congress, school laws of, 354; library of, 423, 427.
Connecticut, early mining in, 17; iron mines and furnaces of, 24; copper mines of, 48; lead mines of, 82; manufacture of tin in, 120; town action for schools in, 339; colonial legislation of, upon education, 344; provisions of, for the support of schools, 386.
"Connecticut Common School Journal," 398.
Continental money, issues and depreciation of, 199, 245.
Cooking, former method of, 253.
Cooking range, the, 253.
Cooper, James Fenimore, difficulty experienced by, in getting a book printed, 264; works of, 279.
Cooper Union, New York, 434.
Copley, John Singleton, 318.
Copper, ores of, 48; mines of, 48 *et seq.*; process of mining, on Lake Superior, 52; statistics of, 56-8; ancient uses of, 60; modern uses of, 61; sheet, manufacture of, 61; alloys of, 61, 62-3; mines of, 116.
Copper mining in the colonies, 18.
Copper-plate engraving, 333.
Copper-smelting, 58; processes of, 59.
Coram, Robert, account of country schools by, in 1791, 373.
Cornell's lead-pipe machine, 92.
Cornwall, Pa., iron mines of, 26.
Costume, changes in, illustrated, 253.
"Courier and Enquirer," New York, 302.
Crawford, sculptor, career and works of, 327.
Credit system, of New York, 191-2.
Cretins, Dr. Guggenbühl's school for, 443.
Crockery, former style of, 251.
Croton aqueduct, the, 249.
Crucibles for steel-making, 44, 45.
Cuba, the bitumen of, 161.
Cummings, Thomas S., miniature painter, 328.
Cupellation of argentiferous lead, 90.
Cupola furnaces for copper slags, 60.
Currency, national issues of, 211. (See Banks, Paper money.)
Curtius, Dr. Alexander Carolus, 347.
Cut nails, invention of, 41, 246.

Daguerreotyping, introduction of, 261; American use and improvement of, 335.
Dahlonega, Ga., branch mint at, 64; gold-mining at, 70; gold deposits at, 79.
Damascus Steel Company, 44.
Danville, Pa., iron furnaces at, 24.
Darley, F. O. C., designer, 325.
Darlington, William, letter of, upon country schools, 370.
Dartmouth College, origin of, 345.
Davenport, Rev. John, 339, 340.
Davidson county, N. C., gold in, 69; lead in, 84.
Davidson sisters, the, 286.
Davis, John, account of an old field school in Virginia by, 377.
Davy, Sir Humphry, improvement in copper sheathing by, 61.
Day, Benjamin H., first penny paper published by, 303.
Deaf and dumb, the institutions for the instruction of, 434; natural condition of, 437; methods of instructing, 438; distinguished individuals among, 439; statistics of, 456 (table).
Deep River coal-beds, North Carolina, 129.
Delaware, banks in, 205; colonial school legislation of, 349.
Delaware and Hudson canal, coal transportation of, 139.
De l'Epée's method of deaf-mute instruction, 435, 438.
Demand notes issued by Government, 211.
Dentistry, use of platinum in, 109.
Detmold, C. E., report of, 104.
Detroit, copper-smelting at, 60; origin and railroad connections of, 177.
Dewey, Orville, works of, 282.
Die sinking, 334.
Discounts by banks, 199, 200.
District of Columbia, banks in, 209.
Dollar, the Spanish, 213.
Dorn gold mine, South Carolina, 69.
Doughty, Thomas, painter, 324.
Drake, Col. E. L., petroleum production developed by, 163.
Dress, styles of, by periods, 253; illustrations of, 255-6.
Drummers for New York jobbing houses, 188.
Dry diggings, gold, 72.
Dubuque, discovery of lead mines at, 18.
Dubuque, Julien, lead mines worked by, 84.
Dummer, Gov. William, educational legacy of, 344.
Dunlap, William, painter and author, 319.
Durand, Asher B., landscape and portrait painter, 323.
Dutch colonization in America, 229.
Dutch gold-leaf, 80.
Dutch West India Company, educational policy of the, 338.
Dutchess county, N. Y., lead mines of, 82.
Dwight, Hon. Edmund, 400.
Dwight, Timothy, D. D., works of, 281; school of, at Greenfield, 405.
Dyestone iron ore in Tennessee, 28.

East India School, the, at Charles City, Va., 337.
Eaton, A. K., inventions of, for decarbonizing cast iron, 36;

for making steel, 44; improvement of, in amalgamation, 76; compounds of chromium obtained by, 119.
Eaton, Governor, of New Haven, promotion of education by, 340.
Eaton, N. H., lead mine at, 82.
Eaton copper mine, Pennsylvania, 49.
Edmonds, Francis W., painter, 323.
Education in the colonies, 337; revolutionary and transitional period of, 351; extracts upon the benefits of, 352; action of Congress upon, 354; social influences favorable to, 380; considerations upon the nature of, 383; upon the present system of, 385; works on the principles and methods of, 397; journals of, 398.
Edwards, Jonathan, 274.
Ehninger, John W., painter and designer, 325.
Electrotyping, process of, 300.
Eliot and Storer, analysis of zinc by, 100.
Ellenville, N. Y., lead and copper mines at, 82.
Elliott, Charles L., portrait painter, 325.
Emancipation proclamation, effect of the, upon the book trade, 269.
Embossing machine, for books, 271 (illustration), 272.
Emerson, George B., young ladies' school of, 405.
Emerson, Rev. Joseph, young ladies' school of, 405.
Emigration, early, to America, 229; from Germany, 232; from Great Britain, 234; from Ireland, 235; English law for the regulation of, 236; Commission of, at New York, operations of, 240; statistics of, 240.
Emigrants, treatment of, at Liverpool, 236; care of, at New York, 240; table of location of, 242; expenses and capital of, 243; remittances of, 243.
England, introduction of illuminating gas into, 145; origin of newspapers in, 301-2.
English, the, colonization of America by, 229.
English basement houses, 247.
Engraving in the United States, present and past state of, illustrated, 329, 331; wood, improvements in, 332; copperplate and steel, 333.
Enrequita quicksilver mine, California, 112.
Equitable Life Insurance Company, London, 225.
Erie canal, construction of, 171; effect of, upon western trade and settlement, 172.
Erie, Pa., building of Perry's fleet at, 169-70.
Erie railroad, 172.
"Essays to do Good," by Cotton Mather, 274.
Essex county, N. Y., iron mines of, 25; bloomaries in, 37.
Etching, process of, 334.
Eureka copper mine, Tennessee, 50.
Eveleth and Bissell, petroleum operations of, 162.
"Evening Post," New York, 302.
Everett, Alexander, career of, 277.
Everett, Edward, career of, 277; account of former school life in Boston by, 391; at Harvard College, 392.
Exchange, course of, at New York, 193-4; par of, how ascertained, 212.
Exports of the Atlantic cities, table of, 187.
Express, transmission of newspapers by, 306.
Expresses, origin and extension of, 188.
Extension tables, invention of, 250.

Faculties, development of the, 384.
Fairmount Water Works, 249.
Falling Creek, Va., iron works at, 17.
Family instruction, colonial law for, in Massachusetts, 343.
Family training, educational influence of, 381.
Fanny Fern, 285.
Farmers' High School of Pennsylvania, 402.
Fashions, changes in, illustrated, 253.
Fay, Theodore S., works of, 280.
"Federalist," the, 275.
Felt hats, introduction of, 258.
Female education, 404.
Female writers, list of, 285.
Fiction, great sales of books of, 267; writers of, 278.
Field, Cyrus W., establishment of the Atlantic telegraph by the efforts of, 314.
Fine arts, instruction in the, 404. (See Arts of design.)
Fire, losses by, 223.
Fire insurance companies, 220; statistics of, 222, 223.
Fire-places, old-fashioned, 246.
Fisher, Alvan, painter, 320.
Fiske, Rev. Wilbur, 405.
Flemington copper mine, New Jersey, 49.
Flint, Timothy, works of, 281.
Flint glass made with oxide of zinc, 107.
Florida, cession of, 171; banks in, 209.
Folding machine, the, for books, 272; for newspapers, 306.
Food, former kinds and preparation of, 252.
Foreigners in the United States, 228.
Forks, kinds of, 251.
Foundries, iron, 36.
Four-color printing press, the, 297; illustration of, 294.
Fowle, William B., account of the early Boston schools by, 390.
Fractional currency, national, 211.
Franconia, N. H., iron mines and works of, 24.
Franklin, Benjamin, bequest of, to the city of Boston, 199; works of, 275; the press used by, 286, 289 (illustration); first editorial experience of, 301; the "Philadelphia Gazette" of, 305; educational proposals of, 349; lyceums originated by, 433.
Franklin, Pa., petroleum at, 103.
Franklin copper mine, New Jersey, 49.
Franklin copper mine, the, of Michigan, 54; production of, 58.
Franklin Institute, the, 403.
Franklinite iron ore, 25.
Franklinite, manufacture of, from zinc ores, 105-6.
Frasee, John, sculptor, 326.
Fraser, Charles, miniature painter, 321.
Fremont, Col., the mining operations of, 78.
French indemnity, payment of the, 215.
French Revolution, fashions during the, 254.
Friedlander's alphabet for the blind, 440.
Frock coat, introduction of the, 257.
Fry, Richard, bookseller, advertisement of, 263.
Fuel, use of gas for, 153.
Fuels used in iron-smelting, 20; for puddling, 38.
Fuller, S. Margaret, 285.
Fulton, Robert, as an artist, 318.
Furnaces, iron, construction of, for anthracite, 23; location and working of, 23; for copper-smelting, 58, 59; for lead-smelting, 88; for zinc, 99, 104; for quicksilver, 114; hot-air for heating, 248. (See Blast furnaces.)
Furniture, manufacture and varieties of, 249.

Galena, lead ore, 81.
Galena and Chicago railroad, 173.
Gallaudet, Rev. Thomas H., labors of, for the instruction of the deaf and dumb, 435; system of, 438.
Galvanized iron, invention, manufacture, and uses of, 40.
Game, former use of, for food, 252-3.
Gap copper mine, the, 18.
Gas, illuminating, history of, 145; cost of, 146; table of companies for, 146; table of works for, by states, 147; constituents of, 147; combustion of, 148; construction of works for, and process of manufacturing, 149; coals used for, 150; the measurement of, 150; economy in the use of, 151; mode of testing the quality of, 152; from other materials than coal, 152; for steamboats and railroad cars, 153; use of, for fuel, 153; introduction of, for lighting streets and houses, 249.
Gas-holders, construction of, 151.
George IV., fashions introduced by, 257.
Georgia, iron mines and furnaces of, 28; copper mines of, 50; gold mines of, 63, 69; banks in, 208; early schools of, 350; school holiday in, 373.
German immigration into the United States, 232; motives of, 233; home efforts to check, 234; causes of, 234.
German silver, composition of, 63, 117.
Gift-book system, the, 266.
Girard, Stephen, purchase of the United States Bank by, 201.
Girard College, view of, 408; organization of, 446.
Gisborne, F. N., telegraph engineer, 314.
Glass made with oxide of zinc, 107.
Gleason's "American gas-burner," 152.
Gold, imitations of, 62; localities and mining of, in the Appalachian range, 63-70; in the Rocky Mountains, 70; in California, 71; production of, 1848-1852, 73; natural distribution of, 73; variation in the value of native, 77; mint deposits of, 77-79 (tables); uses made of, 80; platinum associated with, 107; iridium, 110; course of the trade in, 193; coinage of, 214; coins of, 215; mint deposits of, 216.
Gold Hill, N. C., gold-mining at, 69.
Gold-leaf, manufacture and uses of, 80.
Gold-mining, illustrations of, 65-8; processes of, 72-77.
Gong, Chinese, American manufacture of the, 63.
Gordon, J. W. W., 115.
Gotha Life Insurance Company, Germany, 225.
Gould, Miss Hannah F., 286.
Grafton, Ohio, the petroleum of, 167.
Graham, Augustus, process of, for making white lead, 94.
Grain, tables of Western shipments of, 178.
Grand Trunk railway, the, of Canada, 179.
Graphite, geological position of, 122.
Grates, use of, for anthracite, 248.
Gravel walls, 246.
Gray, Henry Peters, painter, 325.
Great Britain, development of the iron manufacture of, 19; lead mines of, 87; process of zinc manufacture in, 99; thickness of the coal-beds of, 133; succession of races in, 228; emigration from, 229.
Green Mountains, the, iron mines of, 24.

Greenbacks, 211.
Greene, E. D. E., painter, 325.
Greenough, Horatio, sculptor, career of, 326.
Greenwood furnace, the, 25.
Griggstown, N. J., copper mine near, 49.
Guadalupe quicksilver mine, California, 112.
Guggenbühl, Dr. Louis, institution of, for cretins, 443.
Gun metal, composition and uses of, 62–3, 120.
Guyton de Morveau, zinc paint first recommended by, 103.

Habersham county, Ga., gold mines of, 63.
Hall, James, works of, 280.
Hall, Rev. Samuel Read, first teachers' seminary opened by, 399.
Halleck, Fitz-Greene, poems of, 281.
Hamilton's report, 275.
Hanging Rock iron district, the, 29.
Harding, Chester, portrait painter, 321.
Hare, Robert, fusion of platinum by, 109.
Harnden, W. F., express business originated by, 188.
Harper & Brothers, publishers, 264, 265; the operations of, 268.
"Harper's Weekly," 307.
Hartford Society for the Improvement of Common Schools, 398.
Harvard, John, bequest of, to Harvard College, 342.
Harvard College, foundation of, 342; Everett's account of life at, fifty years ago, 392.
Harvard University, Scientific School of, 401; library of, 424.
Harvey's or Salter's plan for making wrought iron, 37.
Hats, fashions of, 253, 257, 258.
Haüy, Valentin, labors of, for the blind, 439.
Havre, German emigration by way of, 233.
Hawthorne, Nathaniel, career and works of, 280.
Hays, W. J., animal painter, 325.
Head-dresses, old styles of, 254, 258.
Heinicke's method of deaf-mute instruction, 435, 438.
Hematite iron ores and mines, 20; distribution of, 24.
Henry, Alexander, copper mining by, 51.
Henry, Patrick, 275.
Hewitt, Abram S., on iron production, 19.
Hicks, Thomas, portrait painter, 325.
Highlanders, emigration of, to the United States, 229.
Hildreth, Richard, 284.
Historians, minor, list of, 284.
Hitz, John, first American maker of zinc, 99.
Hoe, Richard M., inventor of the type-revolving press, 288.
Hoffman, Charles F., works of, 280.
Holbrook, Josiah, labors of, in founding lyceums, 433.
Holmes, Oliver Wendell, 281.
Homes for the Friendless, 449.
Homœopathy, introduction of, 260–61.
Hoofstetter, attempts of, to manufacture zinc, 99.
Hooker, Herman, 282.
Hoop skirts, use and construction of, 258.
Hopkins, Gov. Edward, grammar schools founded under the will of, 340.
Horn-book, the, 413.
Horse-shoe nails and horse-shoes, machines for, 43.
Hose-washing in California, 72.
Hosmer, Harriet, sculptress, works of, 328.
Hotel, the modern American, 261.
Hotels of New York, 196.
Houdon, statue of Washington by, 326.
Houghton, Dr. Douglass, exploration of the Michigan copper mines by, 51.
Houses, early style of building, 245; improvements in, 246–7; in the Southern States, 247; improvements in warming, 248; lighting of, 249, 251.
House's printing telegraph, 310 (illustration), 311.
Howe, Mrs. Julia Ward, 286.
Howe, Dr. Samuel G., 439, 443.
Huancavelica quicksilver mines, Peru, 111.
Hubbard, Wis., immense iron bed of, 30.
Hudson river, iron furnaces on the, 23; early trade of the, 186.
Hughes's system of telegraphing, 311.
Humphrey, Heman, D. D., letter of, upon the early state of common schools, 356.
Huntington, Daniel, painter, 325.
Huron copper mine, production of, 58.
Hydraulic gold-mining, 65.
Hydraulic works of California, 72.
Hydrocarbon gas, manufacture and character of, 152.
Hydrocarbon or coal oils, 154. (See Coal oils.)
Hydropathy, introduction of, 261.

Idiots, institutions for the training of the, 442; modes of teaching, 444.
Idria quicksilver mines, Carniola, 111.
Illinois, lead mines of, 84; coal in, 124; banks in, 206.
Illinois Central railroad, 173.
"Illustrated News," the, 307.
Immigration into the United States, 230; laws regulating, 231; table of, 1820-1856, 231; sources of, 232 *et seq.*; statistics of, 241.
Imports and exports of Canada, 179; of Cincinnati, 180; of New Orleans, 182; of Charleston, 183; of Baltimore, 183; of Philadelphia, 184; of Boston, 185; of New York, 187.
Indiana, banks and banking system of, 205.
Indian corn, Western crops of, 174; importance of, 175.
Industrial schools, 449.
Ingham, Charles C., painter, 322.
Ink balls, use of, in printing, 287.
Inking machine, hand, 287, 290 (illustration); patent hand-press steam, 290 (illustration).
Inman, Henry, painter, 323.
Inoculation, vaccine, introduction of, 260.
Insurance, principles of, 219; companies, classes of, 220, 221. (See Accident, Fire, Life, Marine.)
Intelligence, general, causes of, 380.
Intercourse, social, importance of means of, 260.
Interest, fallacious idea of, 225.
Iowa, lead mines of, 84; banks in, 206.
Ireland, emigration from, 235; effects of misgovernment and the famine in, 235; reformatory measures in, 236.
Iridium and osmium, use and sources of, 110.
Iridosmium, 110.
Irish emigrants, impositions upon, at Liverpool, 236; tricks of, 238; the passage of, 239.
Irish emigration to the colonies, 229.
Iron, early exportation of pig, 18; production of, 1828–1855, 20; principal ores of, 20; comparative cost of the production of, 23; distribution of the ores of, 24; kinds of, 32; production and importations of, 46; domestic, amount and value of, 47; chromate of, 118.
Iron manufacture, historical sketch of, 18; advantages of the United States for, 19; materials employed in, 20; fuels used in, 22; furnaces for, 23; processes of, 32 (see Cast iron, Wrought iron, Sheet iron, Puddling, &c.); statistics of, 45; effect of the war upon, and prospects of, 47.
Iron Manufacturers, Association of, 45.
Iron mines, distribution of, 24 *et seq.*
Iron mountain, Mo., 31.
Iron works, early, in the colonies, 17; table of, in 1858, 45.
Irving, Washington, works of, 278.
Isle Royale, copper mines of, 52, 58.
Ivison, Phinney, Blakeman & Co., sales of school books by, 268.

Jackson, N. H., oxide of tin at, 120.
James River coal mines, first working of, 18, 121.
Japanese ambassadors, bill for the entertainment of the, 197.
Jarvis, John Wesley, painter, 320.
Jay, John, extract from, upon education, 353.
Jay, Vt., chrome mines in, 118.
Jefferson, Thomas, plan of coinage by, 218; writings of, 275; plan of a school law by, 342; extract from, upon education, 352.
Jewelry used in gift-book sales, quality of, 266.
Johnson, Eastman, painter, 325.
Jones, Richard, process of, for making white oxide of zinc from the ore, 104.
"Journal of Commerce," New York, 302.
"Journal of the Rhode Island Institute of Instruction," 398.
Juvenile Asylums, 449, 450.

Kansas, coal-beds of, 124.
Keeseville, N. Y., nail factories of, 25.
Kemble, Mrs. Frances Anne, 286.
Kennedy, John P., works of, 278.
Kent, Chancellor, extract from, upon education, 353.
Kent ore bed, Conn., 24.
Kentucky, iron mines and furnaces of, 29; thickness of the coal-beds of, 133; banks in, 207.
Kerosene Oil Works, Newtown, L. I., 154, 158.
Keweenaw Point copper mines, 51, 52; production of, 57.
Kidder's gas-regulator, 151.
King, Chas. B., painter, 320.
King's College, New York, foundation of, 347.
Kirkland, Mrs. Caroline M., 285.
Knife-handles, balanced, 251.
Königshütte, Silesia, zinc works at, 101, 102.
Kossuth hat, introduction of the, 258.

Lakes, cities of the, 176; aggregate trade of the, 178.
Lambdins, the, painters, 325.
La Motte lead mines, Missouri, 85, 86.
Lamps, varieties of, 251–2.
Lancaster, Pa., zinc mine near, 97.
Lancaster county, Pa., nickel mine in, 117.

Land, railroad grants of, 173; sales of, 1821–1860, 174; warrants and donations of, 174; amount of, unsold, 175.
Land offices, opening of, 169, 170.
Land sales, government system of, 169; amount of, 1790–1820, 171; increase of, from speculation and public works, 172.
Land speculation, evil effects of, 171, 172.
Land States, increase of population in, 175.
Landscape painters, 325.
Lapis calaminaris, 98.
Lard oil, 154.
Lawrence, Abbott, 400, 401.
Lawrence Scientific School, 400.
Law schools, 394; table of, 455.
Lead, ores of, 81; localities of, 82–6; shipments of, from S. W. Virginia, 84; from the upper Mississippi, 85; diminished production of, 86; table of production and imports of, 1832–1858, 87; smelting, methods of, 87; fumes of, methods of arresting, 90; manufactures of, 91; separation of silver from, 116.
Lead mining in the colonies, 18.
Lead pipe, manufacture of, 91; use and danger of, 92.
Leclaire, process of, for making zinc paint, 103.
Lectures and lecturers, 433–4.
Legal-tender notes, national issue of, 211.
Legaré, Hugh S., career and writings of, 278.
Leg-of-mutton sleeves, 258.
Lehigh Coal and Navigation Company, 136.
Lehigh Coal Mine Company, 121.
Lehigh county, Pa., zinc mines of, 97.
Lehigh region, the, coal produced in, 1820–1860, 135.
Lehigh river, slack-water navigation of, 136; railroad, 139.
Lehigh valley, iron furnaces in the, 23; iron ores of, 26.
Leslie, Mrs. Eliza, 285.
Leslie's "Illustrated Newspaper," 307.
Le Sueur, discovery of lead mines by, 18, 84.
Letter-writers of the Revolution, 275.
Leutze, Emanuel, historical painter, 325.
Liberty, Md., copper mines near, 49.
Libraries in the United States, 428; principal, table of, 429–32.
Life insurance, statistics and principles of, 224; in different countries, 225; table of comparative rates of, 226; ten years' non-forfeitable plan of, 227.
Light, materials used for, 249, 251–2. (See Gas, Coal oils.)
Lignite, formation and beds of, 122.
Limestone as a flux for iron ores, 20.
Line engraving, process of, 333.
Lippincott, Mrs. Sarah J., 286.
Lippincott & Co., publishers, transactions of, 268.
Liquors, former universal use of, 253.
Litchfield, Conn., girls' school at, 405.
Literature, American, 274.
Lithography, 335.
Liverpool, fleecing of Irish emigrants at, 236.
Live-stock insurance companies, 227.
Lloyd's, marine insurance, 223.
Loadstone, the, 21.
Locust Mountain coal-measure, section of, 132.
Log houses, construction of, 247.
Looking-glass plates, preparation of, 114.
London, marine insurance at, 223.
Longfellow, Henry W., works of, 280.
Longstreet's "Georgia Scenes," extract from, 374.
Lossing, Benson J., works of, 284.
Louisa county, Va., gold mines of, 64.
Louisiana, purchase of, 170; banks in, 208.
Louisville, origin and growth of, 180.
Lovell's Latin School, Boston, account of, 390.
Lowell, James Russell, 281.
Lowell Institute, Boston, 434.
Lubricating oils from coal, 161.
Lucesco oil works, 157.
Lumpkin county, Ga., gold mines of, 70.
Luyck, Rev. Dr. Ægidius, 347.
Lyceum movement, the, 403.
Lyceums, 432; for mutual instruction, history of, 433.
Lyon, Miss Mary, Mount Holyoke Female Seminary established by, 405.

Mackintosh, Miss M. J., 285.
McCormack gold mine, Georgia, 70.
McDowell county, N. C., gold-mining in, 69.
McLean, J. S., first American pianoforte patentee, 260.
Madison, James, works of, 275; extract from, upon education, 353.
Magdalen Asylums, 450.
Magnetic iron ores, 21; localities of, 24.
Magnetic Telegraph Company, 313.
Maine, lead mines of, 82.
Maine law, the, 260.
Maine Telegraph Company, 313.
Malachite, green, 48.
Malbone, Edward G., miniature painter, 320.
Mallet's method of making galvanized iron, 40.
Manassas Gap, Va., copper ores at, 49.
Man-catchers of Liverpool, 236–7; tricks of, 238.
Manganese, use, sources, and treatment of, 119.
Manhattan Gas Light Company, 145.
Mann, Horace, 387.
Manual labor schools, 403.
Maricopa Mining Company (silver), 116.
Marine insurance, 223; table of, in New York, 224.
Mariposa county, Cal., quartz-mining in, 73.
Marshall, John, works and character of, 276.
Maryland, iron mines and furnaces of, 28; copper mines of, 49; gold in, 64; cobalt in, 117; chromium in, 118; coal-field of, 124, 135; banks in, 205; colonial legislation of, upon education, 347.
Maryland Agricultural College, 402.
Massachusetts, early iron works in, 17; lead mines of, 82; manganese in, 119; coal in, 129; colonial issues of paper money in, 198; colonial coinage of, 212; marine insurance in, 224; life insurance in, 225; colonial legislation of, upon education, 342; the constitution and laws of, upon education, 385.
Massachusetts Hospital and Life Insurance Company, 224.
Massachusetts School for Imbecile and Feeble-minded Youth, 443.
Mather, Cotton, works of, 274.
Mauch Chunk railroad and coal business, 136.
Mauch Chunk Summit mine, section of, 132.
Mecca, Ohio, the petroleum of, 167.
Mechanics, schools for, 403.
Medical schools, 394; table of, 455.
Melville, David, efforts of, to establish the use of gas, 145.
Meneely, Messrs., bell foundry of, 63.
Mercurial medicines, preparation of, 115.
Mercury, use of, in gold-mining, 74, 76; uses of, 110; ores of, 111; mines and yield of, 111; mining of, in California, 112; total production of, 112; metallurgic treatment of, 114; useful applications of, 114.
Mezzotint engraving, 334.
Michigan, iron mines and furnaces of, 29; copper mines of, 51; coal-field of, 129; banks in, 206; Agricultural College of, 402; University of, scientific course of, 402.
Middletown, Conn., argentiferous lead mine at, 18, 82.
Migration, universality of, 228.
Military Academy, the, 395.
Military schools in Virginia, South Carolina, &c., 396.
Mills, Clark, sculptor, 328.
Milson, Mr., Carlisle tables constructed by, 224.
Milwaukee, origin, growth, and trade of, 178.
Mimbres copper mines, 116.
Mine Hill, N. J., zinc mines at, 97.
Mine la Motte lead mine, 86; cobalt at, 117; nickel at, 117, 118.
Mineral paints, 247.
Minesota copper mine, the, ancient and modern working of, 54; production of, 56.
Mining, the earliest American charter for, 18.
Mining industry of the United States, history of, 17.
Minnesota, banks in, 206.
Mint, the United States, establishment of, 213; operations of, 214 *et seq.* (See Coinage.)
Mints, table of gold deposits at the, 78–9.
Mirrors, silvering of, 114.
Mississippi, banks and banking in, 207.
Mississippi basin, settlement of the, 170.
Mississippi valley, the, early style of house furniture in, 251.
Missouri, iron mines of, 31; lead mines of, 85; cobalt and nickel in, 117, 118; banks in, 208.
Money, origin and nature of, 212.
Monroe, N. Y., iron beds of, 25.
Montana, gold and silver mines of, 71.
Montour's ridge, Pa., iron mines of, 27.
Moor's Indian Charity School, 345.
Moravian schools in Pennsylvania, 349, 404.
Moresnet, Belgium, zinc mine at, 101.
Morse, S. F. B., career of, as a painter, 322.
Morse's telegraph apparatus, 308, 309 (illustration).
Morris, Robert, report of, upon coinage, 213.
Moselem iron bed, the, 26.
Motley, John Lothrop, works of, 284.
Mount, William S., paintings of, 323.
Mount Pisgah coal mines, 136; railroad plane, description and illustrations of, 136, 137, 139.
Muntz's yellow metal, 61.
Music books, sales of, 268.

Nack, James, deaf-mute poet, 439.
Nacoochee valley gold mines, Georgia, 63, 70.
Nails, manufacture of, and American improvements in, 41;

table of factories and production of, 42; process of making, 42; horse-shoe, 43.
Napier press, the, description of, 287; improvements in, 288, 297.
National Academy of Design, establishment of the, 319, 323; origin and progress of the, 335.
National Bank. See Bank of the United States.
National banks, system of, 211.
Naturalization laws, the, 230.
Naval Academy, the, 396.
Nazareth, Pa., Moravian school at, 349.
Nickel, uses and mines of, 117; ores of, 118.
Neal, Joseph C., writings of, 281.
Neal, Mrs. Alice B. (Haven), 285.
Nebraska, banks in, 207.
New Almaden quicksilver mine, California, 112; picture of, 113.
Newark, N. J., manufacture of zinc at, 104.
Newberry, Dr. J. S., opinion of, upon the source of petroleum, 164.
New Brunswick, N. J., copper mine at, 49.
New England, early iron works in, 17; iron mines and furnaces of, 24; use of peat in, 122; decline of the whaling business of, 154; banks in, 203; fire insurance in, 222; origin and progress of the book trade in, 263; colonial school system of, 338.
New England Primer, specimen of the, 414.
Newfane, Vt., gold found at, 64.
Newfoundland, ancient Norse colony in, 228.
New Hampshire, iron mines of, 24; copper in, 49; lead in, 82; tin mine in, 120; colonial legislation of, upon education, 345; State law for education in, 386.
New Haven, early town action for schools in, 338.
New Jersey, early copper mining in, 18; iron mines and furnaces of, 25; copper mines of, 49; zinc mines of, 97; banks in, 205; early schools in, 348.
New Jersey Franklinite Company, 106.
New Jersey Zinc Company, 104.
New Orleans, gold deposits at the branch mint of, 78; acquisition and early commerce of, 170; origin, growth, and commerce of, 181; trade and valuation of, 1804–1859, 182; course of trade and exchange at, 182; competition of other places with, 183.
Newsam, Albert, deaf-mute sculptor, 439.
Newspapers, establishment of, in England, 301; in the United States, 302; in New York, statistics of, 304; advertising in, 304; daily, former and present business management of, 305; other classes of, 307; aggregate number and circulation of, 307.
New York, iron mines and furnaces of, 24; copper in, 49; lead mines of, 82; petroleum in, 167; the canals of, 171; the railroads of, 172; issues of paper money by, 199; banks and banking systems of, 204; fire insurance in, 221; marine insurance in, 223; life insurance in, 224; number of foreigners in, 242; Dutch colonial school system in, 338; colonial legislation of, upon education, 346; State school law of, in 1795, 386; school superintendent appointed in, 386–7; State Library of, 427.
New York Asylum for the Deaf and Dumb, 436.
New York Central railroad, 172.
New York Children's Aid Society, 449.
New York city, shot towers in, 94; introduction of gas into, 145; extent of gas pipes in, 146; early trade of, 185; trade and finance centred at, 186; course of trade at, 186; population, commerce, and valuation of, 1684–1860, 187; speculation at, 187; mode of business in, 188; effects of discoveries and public improvements upon, 188; movement of business and population in, 190; railroads and telegraphs in, 190; subdivisions and methods of business in, 191; exports and imports of, 187, 192; trade in gold at, 193; exchange, banking, and stock operations at, 194; hotels in, 196; the retail trade of, 197; assay office at, 215; insurance in, 222–4; newspapers of, 302; circulation of the, 303; Sunday press of, 307; Mechanics' School of, 403; orphan asylums in, 445.
"New York Express," the, 305.
New York Gas Light Company, 145.
"New York Herald," the, 303.
New York Home for the Friendless, 449, 450.
"New York Illustrated News," the, 307.
"New York Journal," the, 307.
New York Juvenile Asylum, 448.
"New York Ledger," the, 307.
New York Society Library, foundation of, 347.
New York Life and Trust Company, 224.
New York Mercantile Library, 427.
New York Society Library, 428.
New York State Asylum for Idiots, 443; view of, 444.
"New York Times," the, 304.
"New York Tribune," the, 304.
Normal schools, 397, 399.
Norsemen, discovery of America by, 228.
North Carolina, iron mines and furnaces of, 28; copper mines of, 50; gold mines of, 63, 69; lead in, 84; cobalt in, 117, nickel in, 118; coal-beds of, 129; banks in, 208; colonial legislation of, upon education, 349.
Northeast, N. Y., lead mine at, 82.
Norton, Andrews, 282.
Norwich Free Academy, Conn., view of, 411.
"Notes on Virginia," Jefferson's, 276.
Nott, Eliphalet, D. D., letter of, upon school-teaching, 362; the anthracite stove of, 248.
Nova Scotia, coal-field of, 129.

Ohio, iron mines and furnaces of, 29; petroleum in, 162, 167; government land sales in, 169, 170; banks and banking system of, 205.
Ohio Institution for the Deaf and Dumb, 436.
Ohio State School for Idiots, 443.
Oil, whale, diminished production of, 154; lubricating, from coal, 160. (See Coal oil, Petroleum.)
Oil Creek, Pennsylvania, petroleum on, 162.
Old field school in Virginia, account of an, 377.
Olefiant gas, composition of, 147.
Olmsted, Prof. Denison, 399.
Olmsted's anthracite stove, 248.
Oneida Lake, iron mines near, 25.
Ontonagon copper mines, 52, 54; production of, 57.
Orators, celebrated American, 275.
Oregon, platinum in, 107; iridium in, 110.
Oreide, discovery of, 251.
Orphans, institutions for the education and training of, 445.
Orr, Hugh, manufacture of cannon by, 19.
Orr, Isaac, inventor of the air-tight wood stove, 248.
Osgood, Mrs. Frances, 286.
Osmium, 110.
Oswego, origin, growth, and trade of, 176.
Ovens, construction of, in old-fashioned houses, 246.
Ovid, N. Y., agricultural college at, 402.
Oxide of cobalt, 117; of manganese, 119; of zinc, see Zinc paint.
Oxy-hydrogen blowpipe, fusion of platinum by the, 109.
Owen, D. D., survey of the lead region by, 84.
Owyhee gold and silver mines, Idaho, 71.

Packer Collegiate Institute, the, 405, 409–10 (illustrations).
Page, William, painter, 323.
Paine, Thomas, revolutionary writings of, 275.
Painting, academies and schools of, 335.
Painting and painters in the United States, 316.
Paints, new kinds of, 247. (See White lead, Zinc paint.)
Paletot, introduction of the, 258.
Palmer, sculptor, works of, 328.
Pantaloon, definition of, 257.
Paper, printing, sizes of, 272.
Paper money, origin, kinds, and use of, 198; comparative depreciation of, in the colonies, 213.
Paraffine, preparation and use of, 159.
Parley, Peter, school recollections of, 363.
Parton, Mrs. S. P. W. (Fanny Fern), 285.
Partridge, Captain Alden, military schools of, 396.
Passaic Mining and Manufacturing Company, 104, 106.
Passengers, arrivals of foreign, 1820–1859, 240; of native, from abroad, 244.
Patents, number of, issued, 259.
Pattinson's method of treating argentiferous lead, 90.
Paulding, James K., works of, 278.
Pawnbrokers, the business of, 197.
Peabody, George, 427, 434.
Peabody Institute, Baltimore, 427.
Peale, Charles Wilson, 320; art academy founded by, 335.
Peale, Rembrandt, career and paintings of, 320.
Peat, formation and beds of, 122.
Peele, J. T., painter, 325.
Peet, Harvey P., 436.
Peet, Mrs. Mary Toles, deaf-mute poetess, 439.
Pennsylvania, iron mines and works of, 26; copper mines of, 49; lead mines of, 83; zinc mines of, 97; chromium in, 118; manganese in, 119; first use of the coal of, 120; chart of the anthracite region of, 126–7; coal strata of, 129; thickness of the coal-beds of, 135; production of coal in, 1820–1860, 134–5; public improvements of, for coal transportation, 135; history and production of petroleum in, 162–3; banks in, 205; early educational laws and institutions of, 349.
Pennsylvania Academy of Fine Arts, 335.
Pennsylvania and Lehigh Zinc Company, 104.
Pennsylvania Asylum for the Blind, view of, 441.
Pennsylvania canal, opening of, 171.
Pennsylvania Institution for the Deaf and Dumb, 436.
"Pennsylvania Packet," the, first American daily newspaper, 301.

Pennsylvania Rock Oil Company, 163.
Pennsylvania Society for the promotion of public schools, 398.
Pennsylvania Training School for Idiots, 443.
Penokie range, Wis., iron mines of, 30.
Perkiomen copper mine, Pennsylvania, 49.
Perkins, Jacob, invention of, in steel engraving, 333.
Perry's lead mine, Missouri, 86.
Peru, quicksilver mines of, 111.
Petroleum, foreign sources of, 161; Burmese, products of the distillation of, 161; in the United States, localities and history of, 162, 167; the question of the source of, 164; boring wells for, 164–5; flow of, 166; qualities of, 167; works for refining, 168 (table).
Pewabic copper mine, the, 54; production of, 58.
Pewter, composition of, 120.
Phelps, Mrs. Almira H., 285.
Phelps's electro-magnetic governor, 312.
Philadelphia, resources, origin, and business of, 184; management of a model store at, 184; account of early school-teaching in, 371; orphan asylums in, 445, 446.
"Philadelphia Gazette," Franklin's, 305.
"Philadelphia Ledger," the, 304.
Philadelphia Library Company, 423, 427.
Phillips, Col. David M., deaf-mute, 439.
Phillips Academy, account of, by Josiah Quincy, 388.
Phœnixville lead mines, Pennsylvania, 81.
Photography, introduction and use of, 261.
Photometer, the, 152.
Phrenology, introduction of the study of, 260.
Pianofortes, American manufacture of, 260.
Picton coal mines, Nova Scotia, 129.
Piermont, N. H., iron ore of, 24.
Piggott, A. Snowden, on copper-smelting, 59.
Pig iron, manufacture of, 32; classification of, 36; table of production of, 46.
Pilot Knob, Mo., iron at, 81; works at, 82.
Pine-tree shilling, the, 212.
Pins, manufacture of, 62.
Pittsburg, copper-smelting at, 59, 60; coal mines at, 131; cost of mining at, 141; origin, growth, and business of, 180.
Pittsburg and Boston copper mine, production of, 58.
Planing machine, invention of the, 247.
Platinum, localities, character, and working of, 107; apparatus for working, illustration and description of, 108, 109; American consumption of, 110.
Plumbago, geological position of, 122.
Plymouth colony, appropriation for schools in, 343–4.
Poe, Edgar A., 281.
Politics, educational influence of, 382.
Polk county, Tenn., copper mines of, 50.
Polk County Mining Company, 50, 51.
Polytechnic schools, 403.
Pony expresses in California, 188.
"Poor Richard," 275.
Population, progress of, in the Western States, 171, 174; decrease of, in Ireland, 235.
Porcupine mountains, copper mines of, 52.
Portage lake copper mines, 52, 53–4; smelting works, and production of, 57.
Port Henry, N. Y., iron mines of, 25.
Portland canal, the, around the falls of the Ohio, 180.
Portsmouth, R. I., coal mine at, 129.
Post, Edwin, first successful use of anthracite by, 25.
Postage, cheap, establishment of, 261.
Potato crop, the, dependence of Ireland upon, 235.
Pot ore, iron, 28–9 (note).
Powers, Hiram, sculptor, career and works of, 327.
Preaching, educational effects of, 381.
Prescott, William H., works of, 284.
Press, the, of Franklin (Ramage press), mode of working, 286; picture of, 289. (See Printing press.)
Preventive and reformatory institutions, 446.
Printing, introduction of, in England, 263; processes of, 299; for the blind, 441.
Printing ink, qualities and composition of, 286.
Printing-press, the, 286; improvements in, 287; illustrations of, 289–97.
Professional schools, 393; tables of, 454, 455.
Providencia quicksilver mine, California, 112.
Prussia, attempts of, to check emigration, 234.
Publishers, book, number and classes of, 265. (See Book trade.)
Puddling, the process of, 37.
Putnam county, N. Y., iron mines of, 25.
Pyrites, freeing of gold from, 76.
Pyritous copper ore, 48.
Pyrolusite, ore of manganese, 119.
Pyromorphite lead ore, 81.

Quartz mining, 73.
Queen's College, New Jersey, foundation of, 348.

Quicksilver. See Mercury.
Quincy, Josiah, account of Phillips Academy by, 388.

Railroad iron, table of production of, 40, imports of, 173.
Railroads for coal transportation, 139, 140 (table); American, historical sketch of, 172; extent and cost of, 173; stimulating effects of, 173–4; Canadian, 179; street, in New York, 190.
Railroad ticket machine, illustration and operation of, 296.
Rainanghong, Burmah, petroleum at, 161.
Randall's Island Nursery, 445.
Readers, large proportion of, in the United States, 262; increase of, 269.
Reading railroad, construction and operation of the, 135.
Reciprocity treaty, trade under the, 179.
Redwood Library, the, 423.
Reed's gold mine, North Carolina, 63.
Reformatory institutions, management of, 447.
Rensselaer Polytechnic Institute, 400.
Renton's plan for making wrought iron, 37.
Retorts in gas works, 149; in coal-oil works, 157.
Reverberatory furnaces, 38; for lead-melting, 89.
Revere, John W., invention of galvanized iron by, 40.
Revere Copper Company, the, 58.
Revolution, orators and writers of the, 275; influence of the, upon education, 351.
Reynolds, L. G., inventor of horse-shoe nail machine, 43.
Rhine, valley of the, emigration from, to the United States, 232; destitution in, 234.
Rhode Island, coal-field of, 129; early town action for schools in, 340; colonial legislation of, upon education, 344.
Roberts, Dr. E. A. L., apparatus and process of, for manufacturing platinum plate, 108, 109.
Rocker, gold-washing, picture and description of, 67.
Rockers, use of, in gold-mining, 74.
Rocky Mountains, gold mines of the, 70.
Rogers, Prof. H. D., estimate of the extent of American coal-fields by, 133; of the amount of coal in Europe and America, 134.
Rolling machine, the, for books, 271 (illustration), 273.
Rolling mills in the United States, table of, 40.
Roofing, use of zinc for, 103.
Roosevelt & Sons, manufacture of mirrors by, 114.
Rosin oil, manufacture of gas from, 152.
Rossie lead mines, New York, 83.
Rossiter, Thomas P., paintings of, 325.
Rothermel, P. F., historical painter, 325.
Ruggles job press, the, 287.
Rush, Benjamin, extract from, upon education, 353; on ardent spirits, 260.
Russ, Dr. John D., 43.
Russia, platinum found in, 107.
Russian-American telegraph, the, 315.
Russian sheet iron, 40.
Rust, Samuel, press invented by, 287.
Rutgers College, New Jersey, origin of, 348.

Sack coat, introduction of the, 258.
Safety Fund banks, 204.
Saflor, ore of cobalt, 117.
St. John's College, Annapolis, origin of, 348.
St. Lawrence county, N. Y., iron mines of, 25; lead mines of, 83.
St. Lawrence river, navigation of the, 179.
St. Louis, origin, growth, and trade of, 181.
Salisbury, Conn., iron mines of, 20, 24.
San Francisco, gold deposits at the branch mint of, 78; gold-dealing at, 193; branch mint at, 215.
Sans-serif alphabet, the, for the blind, 440.
Santa Barbara quicksilver mine, Peru, 111.
Santa Clara Mining Company (quicksilver), 112.
Santa Fé, New Mexico, iron at, 32.
Santa Rita del Cobre mines (copper), 116.
Sargent, Wilson & Hinkle, sales of school books by, 268.
Saucon zinc mines, Pennsylvania, 97; analyses of ores from, 98.
Sawing machine, the, for books, 272.
Saxe, J. G., 281.
School apparatus, past and present, illustrated, 422.
School-books, early manufacture of, 263; mode of introducing, 266; great sales of, 268; improvements in, illustrated by specimens, 413–21.
School holiday in Georgia, 378.
School-houses, early, character of, 357; past and present, illustrated, 406–7.
Schoolcraft, Henry R., 283.
Schools, town action in behalf of, in the New England colonies, 339; colonial legislation for, 341; effect of the Revolution upon, 351; laws of Congress upon, 354; true use of, 382–3; secondary or higher, legislative neglect of, 388; professional, scientific, and special, 392.

Schools of design for women, 336.
Schuyler copper mine, New Jersey, 18, 49.
Schuylkill, iron mines and furnaces on the, 26, 27.
Schuylkill region, coal produced in the, 1820–1860, 134.
Scientific schools, 400.
Scotch emigration to the colonies, 229.
Scotch hearth, the, description and illustration of, 88.
Sculpture and sculptors in the United States, 325.
Sedgwick, Miss Catharine M., works of, 285.
Seguin, Dr. Edward, labors of, for the instruction of idiots, 443, 444.
Selligue, manufacture of coal oil by, 156.
Seneca Indians, use of petroleum by, 162.
Seneca oil, 162.
Sewing machines, introduction and benefits of, 261.
Shaking tables, in gold mining, 75.
Sharp Mountain, section of the coal-measure of, 132.
Shawangunk Mountain, lead mines of, 82.
Shaw, Joshua, landscape painter, 322.
Shear-steel, manufacture of, 44.
Sheathing, use of copper for, 61.
Sheet iron, manufacture and uses of, 40; production of, 41.
Sheet lead, manufacture of, 91.
Shelburne, N. H., lead mine at, 82.
Shepherd mountain, Mo., iron at, 32.
Shingles, use of, 246.
Shoes, fashions of, 253, 254, 257.
Shot, manufacture of, 92–3; towers for, 94.
Siberia, platinum in, 107.
Sicard, Abbé, 435; method of, for deaf-mute instruction, 438.
Sideboard, use of the, 250.
Siegenite, nickel ore, 118.
Sierra Nevada, the, gold mines of, 71, 72.
Sigourney, Mrs. Lydia H., 285.
Silesia, Upper, zinc works of, 101; their production, 102.
Silver, in the Lake Superior copper mines, 53; in Idaho, 71; in lead ores, 81; methods of separating from lead, 90; American mines of, 115; ores of, and their treatment, 116; coinage of, 214; circulation of foreign, 215; pieces of, 216.
Silvering of mirrors, 114–15.
Silver-ware and forks, 251.
Simsbury, Conn., copper mine at, 18, 48.
Simms, William G., works of, 280.
Skirts, fashions of, 254, 258.
Sleeves, fashions of, 258.
Sluice-washing for gold, 72.
Smalt, preparation and use of, 117.
Smelting. See Copper, Iron, Lead, &c.
Smith, David, shot-making process of, 93.
Smith, Mrs. E. Oakes, 285.
Smith, Peter, 287.
Smithsonian Institute, library of the, 427; lectures, &c., of the, 434.
Smithsonite, zinc ore, 96.
Smybert, John, portrait painter, 316; Nathaniel, 317.
Snowhill, Md., bog iron of, 22.
Social and domestic life, 245.
Social distinctions, former, 254.
Society, general progress of, 259.
Soda and its carbonates, use of, in making steel, 44.
Solder, soft, composition of, 120.
Somerville, N. J., copper mine near, 49.
Sonora Company's silver mine, Arizona, 115.
Southampton, Mass., lead mine at, 82.
South Carolina, iron mines of, 28; gold mines of, 63, 64, 69; manganese in, 119; banks in, 208; colonial legislation of, upon education, 350.
Southern States, the, iron mines and furnaces of, 28; domestic architecture of, 247.
South Joggins cliffs, coal-measures at, 129.
Southworth, Mrs. E. D. E. N., 285.
Spain, quicksilver mines of, 111.
Spanish colonization in America, 229.
Sparks, Jared, works of, 283.
Specie, amount of, 217.
Specie circular, the, 202.
Specular iron ore and mines, 21; localities of, 24.
Speculum metal, composition of, 63.
Speiter. See Zinc.
Spikes, wrought-iron, machines for, 43.
Spurzheim, phrenology introduced by, 260.
Squibb, Dr. E. R., preparation of blue mass by, 115.
Stamping mills for quartz-mining, 74.
Stamps for copper mining, 53; for gold-crushing, picture of, 68.
Statesmen, American, 276.
State Teachers' Associations, 398.
States, new, effect of land speculation upon the increase of, 171.
Steam, use of, in coal-oil making, 158; house-warming by, 248; social importance of, 260.
Steamers, ocean, introduction of, 188.
Stedman, E. C., 281.
Steel, qualities and manufacture of, 43; American methods of making, 44.
Steel engraving and engravers, 333.
Stephens, Mrs. Ann S., 285.
Stereotyping, process of, 300.
Stewart & Co., New York, the business of, 190.
Stippling, process of, 334.
Stirling Hill, N. J., zinc mine at, 97.
Stirling's gas-regulator, 151.
Stocks, origin of the trade in, 194; method and amount of, 195, 196.
Stores in New York, 190.
Story, Joseph, works of, 276.
Stoves, manufacture of, at Albany, 36; use and kinds of, 248; for cooking, 253.
Stowe, Mrs. Harriet Beecher, works of, 285.
Street, Alfred B., 281.
Street railroads in New York, 190.
Stuart, Gilbert, portrait painter, 318.
Subscription books, publication and sale of, 267.
Suffolk Bank system, 203.
Sully, Thomas, career and paintings of, 321.
Summit coal mine, open quarry, picture of, 138; account of, 143.
Sunday press, the, of New York, 307.
Superior, Lake, iron mines of, 29; copper mines of, history, extent, working, and production of the, 51–58; shipments of iron from, 57.
Susquehanna, iron mines on the, 26.
Sutter's mill, discovery of gold at, 71.
Swansea, copper-smelting at, 58; zinc works at, 96.
Sydney coal-mines, Cape Breton, 129.
Sykesville, Md., iron and copper mine at, 28, 49.

Table furniture, varieties of, 251.
Tables, old and new styles of, 250.
Tait, Arthur F., painter, 325.
Tar Lake, Trinidad, 161.
Tarentum, Pa., petroleum wells at, 162.
Taylor, Bayard, 281.
Taylor, Orville J., 398.
Teachers, training of, 397; associations of, 397; conventions of, 398.
Teachers' institutes, 399.
Teaching, works on, 397.
Telegraph, the, introduction and extension of, 188; use of, by newspapers, 303; principles of, and apparatus for, 308 *et seq.*; lines of, 313; the Atlantic, history of, 314.
Telegraphing, charges for, 314.
Temperance reform, the, 260.
Tennessee, iron mines and furnaces of, 28; copper mines of, 50; gold mines of, 70; zinc in, 97; banks in, 207.
Territories, the, surveys and sales of land in, 169.
Theologians, colonial, 274.
Theological schools, 393; table of, 454.
Thèvenet, Dr., account of iridium gathering by, 110.
Thomas Iron Company, description of the furnaces of, 34.
Thompson, Launt, sculptor, 328.
Ticknor, Elisha, 399.
Tidioute Island Oil Company, 163.
Tight-lacing, 258.
Tin, alloys of, with copper, 63; sources and uses of, 119–20; alloys with, 120; sheet, preparation of, 120.
Titusville, Pennsylvania, petroleum at, 162; operations at, 163.
Tomatoes, introduction of, 252.
Torrey, Prof. John, analysis of zinc ores by, 98.
Total abstinence societies, origin of, 260.
Trade, progress of, between the East and West, 170; construction of lines of communication for, 171; course of, 175; of the lakes, 178.
Trade sales of books, 265.
Training, mental and corporeal, 384.
Travel, importance of facilities for, 260.
Travelers' Insurance Company of Hartford, 227.
Trexler, R., anthracite stoves made by, 248.
Trimming machine, book and paper, 270 (illustration), 272.
Trinidad, petroleum and asphaltum in, 161.
Trinity School, New York, origin of the, 347.
Trouncing in school, how performed, 390.
Trowsers, introduction of, by the Duke of Wellington, 257.
Troy, iron foundries of, 36.
Trumbull, Colonel John, career and paintings of, 319.
Tuomey, M., on iron ore in South Carolina, 28.
Tuscarora, Pa., colliery slope and breaker at, picture of, opposite 139; account of, 142, 144.
Type-founding, process of, 298; machine for, 298.
Type-revolving press, the, construction and operation of, 288; illustrations of, 292–3.

Types, sizes of, 298; proportions of, in fonts, 299; cases for, and setting of, 299; copper-facing of, 301.
Type-setting machines, 299.

Ulster lead mine, copper from the, 49.
Ulster county, N. Y., lead mines of, 82.
Union Consolidated Mining Company, 50, 51.
United States, the, advantages of, for iron manufacture, 19; coal-fields of, 124; table of gas works in, 147; table of coal-oil works in, 154; total imports of, 192; immigration into, 230; comparative number of readers in, 262.
United States Bank. See Bank.
United States Military Academy, 460.
United States Zinc Company, 106.
Universal Life Insurance Company, 227.
University of Pennsylvania, origin of, 349.
Usher, Hezekiah and John, early booksellers of Boston, 263.

Vallé's lead mine, Missouri, 86.
Vanderlyn, John, career and paintings of, 320.
Van Dyke, Dr. H. M., gold-mining of, in Georgia, 70.
Vassar Female College, 405.
Venango county, Pa., petroleum in, 162.
Ventilation of buildings, 248–9.
Vermont, iron mines and furnaces of, 24; copper mines of, 49; gold mines of, 64; chromium in, 118; manganese in, 119; constitutional provision of, for education, 386.
Verplanck, Gulian C., 283.
Victoria, Queen, zinc statue of, 103.
Vieille Montagne zinc mines and works, 100.
Vincent de Paul, instruction of idiots by, 443.
Virginia, early mining industry in, 17; iron ores and furnaces of, 28; copper mines of, 49; shipments of ores from, 50; gold mines of, 63, 64; lead mines of, 83; bituminous coal-field of, 129; petroleum in, 167; banks in, 208; early schools in, 337; colonial legislation of, upon schools, 341; first general school law in, 342; account of an old field school in, 377.
Virginia Institution for the Deaf and Dumb, 436.
Vitreous copper ore, 48.

Waldo & Jewett, portrait painters, 322.
Walker, Parker & Co.'s product of silver from lead, 91.
War books, great sales of, 267.
Ware, William, works of, 282.
Warner, Miss Emily, works of, 285.
Warwick or Jones' iron mine, the, 26.
Washington, Houdon's statue of, 326; extract from, upon education, 352.
Washington College, Maryland, origin of, 348.
Washington county, Mo., iron-smelting in, 81.
Washington gold mine, North Carolina, 69, 84, 115.
Washington press, the, 287; picture of, 289.
Washington's Farewell Address, manuscript of, 301.
Washoe silver mines, 115, 116.
Washstands, movable and fixed, 251.
Waterbury, Conn., brass manufacture at, 62.
Water-cure, introduction of the, 261.
Water gas, manufacture and introduction of, 152.
Waterhouse, Dr., vaccine inoculation introduced by, 260.
Water-works in cities, introduction of, 249.
Watkinson, David, library founded by, 427.
Watson, John, portrait painter, 316.
Waverley novels, effect of the, upon the book trade, 264.
Wayland, Francis, works of, 282.
Wealth, what constitutes, 260.
Webster, Daniel, speeches of, 277; extract from, upon education in New England, 353.
Webster, Noah, account of schools and education in New England by, 345; observations of, upon a liberal policy of education, 352; upon the early state of common schools (letter), 355; upon errors in education, 355–6.
Webster's Elementary Spelling-book and Dictionary, publication and influence of, 263, 264; aggregate sale of, 267; Spelling Book, specimens of, 416–19.
Weir, Robert W., painter, 323.
Welby, Mrs. Amelia B., 286.
Welland canal, construction of the, 179; and railway, effect of, upon the trade of Buffalo, Oswego, and Cleveland, 176.
Wellington, Duke of, trowsers, frock-coats, and boots introduced by, 257–8.
Wells, petroleum, the boring of, 164–5; pipes for, 166.
Wells, John, printing-press inventor, 287.
West, the, coal-fields of, 124, 133; surveys and sales of land in, 169; early trade and settlement of, 170; effects of speculation in, 172; canals in, 172; railroads in, 173; railroads, population, and corn crop of, 1850 and 1857, 174 (table); importance of corn to, 175; use of agricultural machinery in, 175.
West, Benjamin, career of, 317; chief pictures of, 318.
West, William E., painter, 320.
West Point, Military Academy at, 395.
Whaling business, decline of the, 154.
Wetherill, Samuel, manufacture of zinc by, 99, 104.
White, Edwin, painter, 325.
Whitefield, George, Orphan House in Georgia founded by, 350, 445.
Wharton, Joseph, manufacture of zinc by, 99.
Wheatley lead mine, Pennsylvania, 83.
Wheaton, Henry, work of, on international law, 276.
Wheelock, Dr., first president of Dartmouth College, 345.
White lead, manufacture and uses of, 94; adulteration of, 95; works, table of, 96.
Whittier, John Greenleaf, career and works of, 281.
Wigs, former use of, 257.
Wilbraham, Mass., Methodist Conference Seminary at, 405.
Wilbur, Dr. H. B., 443.
Wilkesbarre, open coal-mines at, picture, opposite 137; account of, 144.
Willard, Mrs. Emma, works of, 284; the female seminary of, 405.
William and Mary College, foundation of, 342.
Williams, Mr., painter, 317.
Willis, N. P., career and works of, 280.
Willson's "School and Family Readers," specimens of, 420–21.
Windham County Teachers' Convention, 398.
Windows, weights and catches for, 247.
Winthrop, Governor, mining grant to, 17.
Winthrop, John, mineral specimens collected by, 18.
Wire, iron, manufacture and uses of, 41; brass, 62.
Wirt, William, works of, 276.
Wisconsin, iron mines and furnaces of, 30; lead mines of, 84; banks in, 206.
Wood, manufacture of gas from, 152; for engraving, 332.
Wood's chrome mine, 118.
Woodworth, William, planing machine introduced by, 247.
Worcester, Mass., wire made at, 41.
Writers, American, 274; female, list of, 285.
Wrought iron, manufacture of, 36; plans for the direct production of, 37.
Wyoming region, the coal produced in, 1829–1860, 134.
Wythe lead mine, Virginia, 83.

Yale College, foundation of, 344; Scientific School of, 400.
Yankee curiosity, useful results of, 262.
"Yankee Notions," the, 307.
Yellow metal, Muntz's, 61.
Young, James, manufacture of coal oil by, 154.

Zaffre, ore of cobalt, 117.
Zinc, use of, in coating iron, 40; in brass-making, 62; ores of, 96; mines of, 97; metallurgical treatment of, 99; impurities of, 99–100; European manufacture of, 101; total production and consumption of, 102; uses of, 103; manufacture of white oxide of, 103.
Zinc paint, manufacture of, 103; American process of making, 104–5; cost of, 106; importance of, 106.

INDEX TO COMMENDATIONS.

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No. 25.
New York Examiner.

No. 26.
New York Observer.

No. 27.
Hunt's Merchants' Magazine.

No. 28.
Secretary Board of Trade, Philadelphia.

No. 29.
Secretary Board of Trade, Boston.

No. 30.
New Englander.

No. 31.
Philadelphia Inquirer.

No. 32.
Boston Transcript.

No. 33.
New York Herald.

No. 34.
Boston Post.

No. 35.

Principal American Asylum.

No. 36.

John D. Philbrick, Superintendent Massachusetts Schools.

No. 37.

Boston Journal.

No. 38.

Philadelphia Evening Journal.

No. 39.

The Homestead.

No. 40.

Phila. Daily Evening Bulletin.

No. 41.

Secretary Board of Education, Boston, Massachusetts.

No. 42.

S. S. Randall, Superintendent, New York.

No. 43.

New England Farmer.

No. 44.

Frank Leslie.

No. 45.

R. G. Dana, Mercantile Agency, New York.

No. 46.

Evening Post, New York.

No. 47.

Benson J. Lossing.

No. 48.

New York Journal of Commerce.

No. 49.

W. H. Wells, Chicago.

No. 50.

Harvey P. Peet, Superintendent, New York.

No. 51.

Boston Cultivator.

No. 52.

American Journal of Science and Arts.

No. 53.

Springfield Republican.

No. 54.

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No. 55.

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EXTRACTS FROM COMMENDATIONS.

No. 1.

From Hon. Josiah Quincy, former President of Cambridge University.

L. Stebbins, Esq.: *Sir*,—I have received the "Eighty Years' Progress of the United States," and have examined it, not with that attention which its nature, novelty, curiosity, and general apparent accuracy naturally claim, but with that degree of examination, which at the age of *ninety*, was compatible with an eyesight dimmed by years, and systematically avoiding all labors of supererogation. With this deduction from the value of my judgment, I readily express to you my opinion of the work. It seems to me of extraordinary merit, and considering the number, variety, and importance of the subjects it embraces, of surprising accuracy and reliableness for information. The names of the authors of the respective subjects being given, and their established adequacy and talent being known, gives uncommon accuracy to their statements, and an authenticity to the work seldom attained in publications of such a general character. No expense, apparently, has been spared to render it worthy of public confidence and patronage, which I cordially wish you: both of which I regard it as eminently deserving.

Respectfully, I am yours,

Josiah Quincy.

Boston,

No. 2.

From Pres. Hitchcock, late of Amherst College.

I have examined the work entitled "*Eighty Years' Progress of the United States*," sufficiently to satisfy myself that it is a work of superior merit. Acquainted as I am with several of the authors, I know that they would never suffer productions of this sort to go forth over their names, unless they possess high merit. The work contains a vast amount of information, which every intelligent man can hardly do without, and which, by the aid of numerous drawings, is here presented in an attractive form. With the aid of this work, any one can well understand the present advanced state of all the great industrial and economical arts in our country, and be able to see how they have grown up from their early and rude beginnings. I know not where else, save by almost infinite labor, this knowledge can be obtained.

Edward Hitchcock.

No. 3.

From the President of the Wesleyan University, Middletown, Conn.

I have examined, with much pleasure and profit, the work entitled "Eighty Years' Progress." It contains a great amount and variety of information, printed in an attractive style, on subjects of the highest importance. It is eminently a practical work, and brings within the reach of all, stores of knowledge heretofore inaccessible to most readers. The novelty of the title, the great truths illustrated and established, give it increased attractiveness and usefulness. The patriot and the philanthropist will be encouraged by its perusal and stimulated to greater exertions to secure further progress in all good things in our country and throughout the world.

The enterprising publisher has not spared expense in the manufacture of the work. The printing and the abundant illustrations are in the highest style of rt. One of the best illustrations of "Eighty Years' Progress," would be found in the comparison of the mechanical execution of this work with that of any work issued eighty years ago.

Joseph Cummings,
President of Wesleyan University.

No. 4.

From President of Girard College, Philadelphia, Pa.

Dear Sir,—I have been interested and instructed by the perusal of your national work, entitled "Eighty Years' Progress" for a copy of which I am indebted to your courtesy.

An illustrated history of the various branches of industry and art in the United States, prepared with the ability and truthfulness which characterizes this work, will be highly acceptable to all classes of readers. In its artistic and mechanical execution, nothing has been left to be desired. I am not acquainted with any work in which so much reliable information on so great variety of subjects may be found in so small a compass. It is emphatically a book for the people.

Yours respectfully,

William H. Allen.

No. 5.

From the President of Genesee College.

Lima, *November* 6,

With as much care as my time would allow, I have examined the work of Mr. Stebbins, entitled "Eighty Years' Progress." It contains a large amount of valuable information, in just the form to be circulated widely among the people. It is in fact a brief and interesting history of our progress as a nation, in both science and the arts. I am willing that my name and influence should aid in its circulation.

J. Morrison Reed.

I fully concur in the above.

James L. Alvison,
Professor in Genesee College.

No. 6.

From the President of Cambridge University.

Cambridge, *Oct.* 31,

Dear Sir,—I have examined the work called "*Eighty Years' Progress*," with such attention as I could give it. I am not competent to verify the statements of many parts, but the names of the gentlemen who contributed some of the most important portions seems to be a sufficient guaranty of their accuracy. I have no doubt the volumes contain much valuable information on the practical arts and industrial interests of the country.

C. C. Felton.

No. 7.

From the President of Marietta College, Ohio.

Dear Sir,—The work on the "*Eighty Years' Progress of the United States*" was received by mail a few days since. I have given what attention I could to it, and write you now, as I am expecting to be absent from home for some days.

The examination of this work has given me much pleasure. The idea of furnishing this most valuable knowledge in a comparatively small compass, was a most happy one. As a people we want information—reliable information. We need to know our own history, in art and science, as well as in government. The people of one section should know how those of others live—the progress of one should be made known to all.

The idea of the work you have undertaken seems to have been well carried out, as well as happily conceived. On a great variety of topics, in which all the people are interested, you have furnished a large amount of valuable information. All, except those of the lowest grade of intelligence, will avail themselves of the opportunity to secure this volume, and, unlike many books, the more it is examined the more valuable will it seem. I anticipate for it a wide circulation.

I feel great interest in the character of the books distributed through the country. We teach our young people, at great cost, to read. Many, having acquired the art, have no disposition to use it; and others read nothing that has any value. Good books, *books*—not newspapers, they will take care of themselves—should be in every house. Hence, I favor school libraries, as an easy and cheap method of putting good books into the hands of the young. For a like reason I rejoice in the purchase, by families, of all good works.

This work on the Progress of the United States, will serve a most excellent purpose in two ways. It may be taken up at any time to employ a few leisure moments, and it serves as an encyclopædia for reference.

Please accept my thanks for the volume, and my best wishes for its wide-spread distribution.

Yours truly, J. W. Andrews.

L. Stebbins, Esq., Worcester, Mass.

No. 8.

From the President of the University of Rochester, N. Y.

I have looked over, somewhat hastily, the work entitled "Eighty Years' Progress." The plan seems to me excellent, the idea of presenting in a short compilation the present state and rate of progress of the various industrial arts is one which can not fail to be thought worthy. In general, the work seems to be successfully and correctly done. In such a work it is impossible to avoid errors, and the prejudices and interests of the different compilers may be occasionally seen. Notwithstanding this, the work seems to me well worthy the patronage of the public.

M. B. Anderson,
Pres. University of Rochester.

No. 9.

From the President of Brown University, Providence, R. I.

I have examined those parts of the "Eighty Years' Progress of the United States" on which my studies and observation have enabled me to form an intelligent judgment, and find, compressed within a small compass, a vast amount of valuable information, well selected and well arranged. It furnishes ample means of comparison on the subjects of which it treats, and will, I think, prove to be a valuable book of reference.

Very respectfully, your ob't serv't,
B. Sears.

No. 10.

From President Read, University of Wisconsin.

I have examined, with a pleasure I can hardly express in too strong terms, your "Eighty Years' Progress of the United States." During the few days the work has been on my table it has saved me, in the examination of facts, labor worth many times the cost of the volume. For the school library the business man, the scholar, or the intelligent family, it will be found a cyclopædia presenting, in a most interesting form, the progress of the various arts of civilized life during the period of our national existence. I most heartily recommend the work.

Very truly yours,
Daniel Read.

No. 11.

From the President of Columbia College, N. Y.

Sir,—I thank you for the copy of "Eighty Years' Progress of the United States," published by you.

It seems to me of great value as containing information of interest, more or less, to all, and not easily accessible, except to varied labor and research.

The idea, too, of illustrating national progress, not by war, nor annexation, nor diplomatic legerdemain, but by the advance in the institutions of learning, in useful inventions, in the growth of manufactures, agriculture, and commerce, in all the arts of peace, in morals and civilization, in the inner life, so to speak, of the people themselves, seems to me both original and founded in the true notion of progress.

I trust you will derive abundant reward for your praiseworthy adventure.

Your obedient servant,

CH. KING,

Pres. of Columbia College.

MR. STEBBINS.

No. 12.

From the President of Tufts College.

January 27,

MR. STEBBINS: *Dear Sir*,—I was led to expect much from the title of your work, called "Eighty Years' Progress," and resolved to give it a careful examination. I have been richly repaid for the time thus spent, in the great pleasure and profit I have derived from its perusal. Heartily thanking you for this generous contribution to generous knowledge, I trust you may reap a rich reward for your efforts. JOHN P. MARSHALL.

No. 13.

From the President of Dartmouth College.

January 20,

L. STEBBINS, ESQ.: *Dear Sir*,—I received some days ago your very handsome work, "Eighty Years' Progress of the United States," but have found leisure only within a day or two to examine its contents. Those persons who have been longest on the stage can best appreciate the amazing contrasts in the state of the country which you describe, but one who, like myself, can recognize the history of half the period, can testify to the faithfulness and fullness of your exhibition of the growth and power of this great country.

Accept my sincere thanks for the work, and the opinion that on the subjects treated it will be found an invaluable authority by all who study its pages. I trust it may have an extensive distribution.

Very respectfully yours,

O. P. HUBBARD.

No. 14.

From Chancellor TAPPAN, State University of Michigan.

January 25,

MR. STEBBINS: *Sir*,—I have the honor to acknowledge the receipt of a copy of the work recently published by you, entitled "Eighty Years' Progress," for which please accept my hearty thanks.

It was not to be expected that this work could be made to contain an adequate view of the progress of our country during eighty years. But you have presented the public with this large work, filled with interesting and valuable matter on this subject, as much, perhaps, as could be compressed into it. I hope this work will find a wide circulation, and thus become a public benefit in a literal sense.

I am very respectfully yours, etc.,

HENRY P. TAPPAN.

No. 15.

From the President of the Vermont University, Burlington.

I have only had time to dip into your "*Eighty Years' Progress*" here and there. But I have been pleased and instructed, and am sure the book must be very valuable. My children are very much interested in it. Yours very truly,

CALVIN PEASE.

No. 16.

From the President of Williams' College.

Dear Sir,—I have no hesitation in saying that the work proposed to be done in the "*Eighty Years' Progress*" has been well done. For those who wish a book of the kind, yours cannot fail to be *the* book. Respectfully yours,

MARK HOPKINS.

MR. L. STEBBINS.

No. 17.

From President of Trinity College, Hartford, Conn.

Dear Sir,—I have to thank you for a copy of your work on the Progress of the United States. It treats of some matters with which I am familiar, and of some with which I am not familiar; but I think I can honestly say, with regard to both, that they are so presented as to be at once interesting and instructive to the general reader.

Your obedient servant,

SAMUEL ELIOT.

HARTFORD, *October* 4,

No. 18.

From Pres. WOOLSEY, Yale College, New Haven, Conn.

YALE COLLEGE, *Nov.* 15,

MR. L. STEBBINS: *Dear Sir*,—Your book is a good and useful one, but it is not my practice to recommend books.

Your obedient servant,

T. D. WOOLSEY.

No. 19.

College of New Jersey,
Princeton, *Jan.* 28,

Dear Sir,—Your "Eighty Years' Progress of the United States." I regard as a valuable publication, richly meriting the attention of the general reader, as well as the more careful examination of the student interested in observing the advancement of our country in the useful arts and learning.

Very respectfully yours,

John McLean.

L. Stebbins, Esq.

No. 20.

From Prof. Johnson, Yale College, New Haven, Conn.

L. Stebbins, Esq.: *Dear Sir*,—I have examined "Eighty Years' Progress," with interest, especially the excellent chapter on agriculture. In my opinion, the work is one of much value, and deserves a wide circulation. Yours, etc.,

S. W. Johnson,

Prof. of Analytical and Agricultural Chemistry in the Sheffield Scientific School of Yale College.

No. 21.

From Rev. Dr. Smith, Lane Theological Seminary, Ohio.

Mr. L. Stebbins: *My Dear Sir*,—I have run my eyes with great interest over your beautiful work, "*Eighty Years' Progress.*" It contains, in a condensed yet attractive form, a mass of information touching the progress and present condition of our country. It is, moreover, information of which every man, at some time, feels the need; and it would be a grand contribution both to the intelligence and patriotism of our whole population, if you could succeed in placing a copy of it in every family of the land. I shall place your book on my table for constant reference.

Wishing you all success in your enterprise,

I am very truly yours,

Henry Smith,

Prof. Ch., Hist. and Sac. Rhetoric.

No. 22.

From Professor Fowler, of Amherst College, Editor of the University Edition of Webster's Dictionary, Series of Classical Books, etc.

The work which you placed in my hands, entitled "Eighty Years' Progress of the United States," I have taken time to examine, in order that I might learn its intrinsic value. I find that the subjects selected are such, and the manner of treatment such, as to supply a felt want in the public mind, which, in its own progress, was demanding higher and better help than it enjoyed before the publication of your work. This might be inferred from the bare mention of the subjects and the authors. These subjects are treated by these writers with that correctness of the statement of the general principles, and with that fullness of detail which make the work just what it ought to be as a guide to the people. Every young man who wishes to elevate his mind by self-culture, ought to read this work carefully.

Yours respectfully,

William C. Fowler.

No. 23.

From Prof. B. Silliman, Yale College, New Haven, Ct.

I have carefully looked through your rich and faithful work, observing the copious tables of contents, glancing at every page of the work, and at all the numerous illustrations, with occasional reading of paragraphs. A more thorough examination it has not been hitherto in my power to make; but even this general survey has left on my mind the decided conviction that you have performed an important service to your country in thus mapping out and condensing and explaining the wonderful progress made in this country, during four-fifths of a century, in all the most important arts of life. My own recollections—my years having been coeval with the entire period covered by your work—sustain your statements regarding the extreme simplicity of our early domestic arts—cheap in mechanical aids but prodigal of time. Now productive industry, aided by successful inventions, fills all our regions where free labor has full scope for action, with innumerable results which are fully equal to our wants, even in the present crisis, leaving also a large redundancy of articles for export, especially in the department of agriculture, and in not a few important mechanical arts.

Your work of closely printed pages of double columns, with a fair paper and a clear and distinct type, with its numerous engravings, defended also by a strong and neat binding, presents a valuable book of reference; a manual to be consulted by the agriculturist and artist, as well as by the man of science and the historian of progress. Wishing to yourself and your worthy coadjutors full success,

I remain, dear sir, yours very respectfully

B. Silliman.

New Haven, *October* 8,

No. 24.

From the New York Times.

"*Eighty Years' Progress of the United States.*"—If at all inclined to doubt that a great deal of useful information may be bound up in a comparatively small compass by a judicious compiler, in the very handsome work before us, we should find sufficient logic to make us devout believers. The writers have ranged through the wild fields of agriculture, commerce, and trade; very little that develops the material prosperity of a country, and marks its growth, has escaped their industrious research. Undoubtedly, minute criticism might detect slight errors, but in a work of so comprehensive a character, strict accuracy would seem almost unattainable. The statistics given are full and clearly arranged; the grouping of the subjects, and the evident method which the authors have observed in the accomplishment of their not inconsiderable task, are worthy of all praise. The work is one which we particularly need, as it is a lamentable fact that few people are so deficient in general knowledge of facts relative to growth and development of their native country, as ours. The Englishman generally has an arsenal of statistics at his fingers' ends; he can tell you when the first shaft was sunk in the first mine; when the first loom was erected in Manchester. The panoply of facts in which he is arrayed makes him rather a ponderous and far from sprightly companion, at times; but then he always proves formidable as an adversary. Germans, too, have nearly every thing by rote that relates to their own country. Frenchmen are quick to learn, but they have not very retentive memories generally, and are very apt to forget all, and more, than they once knew. It may be urged in extenuation of our national delinquency, as regards a knowledge of our own country, that our country grows too fast for our memories to keep pace with it, and that a Yankee can arrive by guessing at what others, less favored in this respect, can only reach by delving in authorities; but, on the whole, it is better to trust to actual knowledge of facts, and under any circumstances such books as these are good things to have in the library.

No. 25.

From the New York Examiner.

"*Eighty Years' Progress of the United States*," by eminent literary men, who have made the subjects of which they have written their special study.

The citizen who desires to comprehend fully how the country in which we live has, under the fostering influences of a good government, the enterprise of an energetic people, and above all, the blessing of God, grown from a handful of people to one of the leading powers in the world, should purchase and read carefully this work. It is no catchpenny affair. The men who have prepared the narratives of progress in the various departments of agriculture and horticulture, commerce, manufactures, banking, education, science, art, and the matters which go to make "home" so emphatically an American word, are not novices, penny-a-liners, who write on any or all subjects, with or without an understanding of them, for the sake of their daily bread—but men of high reputation, who have made the subjects they discuss the topics of a life's study. Every subject which will admit of it is finely illustrated, and tables of statistics, carefully prepared from the latest sources, show the present condition of each department, and demonstrate, as only figures can, how great the advance which has been made in each. As a work of reference, not less than as a deeply interesting book for family reading, it will be a treasure to any household that may obtain it.

No. 26.

From the New York Observer.

"*Eighty Years' Progress of the United States.*"—the above rather formidable title-page is quite a full exposition of the contents of this large work, which contain a vast amount of scientific, historical, and statistical matter, and which constitute a valuable encyclopædia, as well as history of the progress of the country, during the last eighty years. Many of the most extended articles are by eminent scientific and practical men, who have devoted themselves largely to the subjects on which they have written.

The subjects are not treated briefly, but in detail, rendering the work valuable as a book of reference as well as for general reading. Such a review as we have in this work may well excite wonder, gratitude, and hope. The history of no other country can furnish a parallel.

No. 27.

From Hunt's Merchants' Magazine, edited by I. Smith Homans, Secretary of the Chamber of Commerce of the State of New York.

"*Eighty Years' Progress of the United States.*"—The first eighty years of the national existence were illustrated by no brilliant military exploits, such as for the most part make up the history of most countries of the Old World, but the American people did not the less on that account assume a marked character, and a first rank among the nations of the earth. Their success in ship-building and commerce at once placed them on a level with the greatest maritime nations. The inventive genius and untiring industry of the people soon revolutionized the manufacturing industry of the world, by the ready application of new mechanical powers to industrial arts; and if the extent and cheapness of land for a time supplied the scarcity of labor in agricultural departments, it did not prevent the multiplication of inventions, which have not only added immensely to home production, but have greatly aided that of European countries. The development of these industries forms the true history of American greatness, and the work of Mr. Stebbins has given a world of information upon each branch of the subject, in a most authentic and attractive form. The chapters on ship-building, commerce, and internal transportation, present to the reader a mass of valuable information as astonishing for the magnitude of the results produced as interesting in the narrative. We know of no other work which, in the compass of two handsome volumes, contains such varied and comprehensive instruction of a perfectly reliable character. They form almost a complete library in themselves.

No. 28.

From the Secretary of Board of Trade, Philadelphia.

L. Stebbins, Esq.: *Dear Sir*,—I examined with interest the volumes published by you, entitled "*Eighty Years' Progress*," and found them particularly valuable. The design struck me very favorably, and the execution of the several parts could not have been intrusted to more competent hands. The last eighty years of the history of the United States has been one of unexampled progress, and it is now more than ever important to bring in review before the people of every section the leading facts of this marvellous progress.

Very respectfully yours,

Lorin Blodget.

No. 29.

From the Secretary of the Board of Trade, Boston.

My Dear Sir,—My many cares just now have prevented me from a comparison of the statistical matter contained in the "*Eighty Years' Progress*," with official tables in my possession, as well as an examination of some other things, concerning which authorities differ, but I *have* found time to acquaint myself with the general topics and objects of the work, and do not hesitate to declare that I have not read more interesting pages for years. Indeed, the best informed among us, cannot, as it seems to me, fail to find much that is new, while to the young and to those who lack the means of research, so authentic and well-digested account of our country's "Progress," will be of immense service. We all boast of our wonderful march in commerce, in manufactures, in mechanics, and in the arts; and here we have it, step by step, in "facts and figures," and in brief and pithy narrative.

With all my heart, I hope that the sale will be extensive, and that you may be well rewarded for your outlay of time and capital.

Very truly, your friend,

LORENZO SABINE.

L. STEBBINS, Esq., Hartford, Conn.

No. 30.

From the New Englander, New Haven, Conn.

"*Eighty Years' Progress of the United States.*"—In this very large octavo work there is presented in a compact and easily accessible form an amount of valuable information with regard to the progress which the people of the United States have made in all the various channels of industry since the days when they were British colonists, which is not to be found in any other single work with which we are acquainted. Each one of these subjects is amply illustrated with engravings. The different chapters have been prepared by well-known literary men who have each made the subjects about which they have written the study of years. We have examined the work repeatedly and with much care during the past three months, and each time have been impressed anew with its value. There is not an intelligent family in the nation who would not be interested and instructed by it, and find it a most convenient book of reference with regard to every thing pertaining to the industrial interests of the country.

No. 31.

From the Philadelphia Inquirer.

"*Eighty Years' Progress of the United States.*"—To any one desiring at a glance a comprehensive view of the various channels of educational industry in commerce, manufactures, agriculture, statistics, etc., they are invaluable. They are profusely illustrated with elegant engravings in the highest style of artistic merit. The volumes redound with statistical and miscellaneous information of a standard character and permanent value. The expense of publishing a work of this character must have been very large, but we feel confident that a discriminating public have not been overestimated.

There are among the peculiar characteristics of our people, wide-spread opinions prevailing, that books sold by subscription are of a necessity more expensive than when purchased in a general way at the counter of a publishing house. This is evidently an error that could easily be subverted by a little demonstration, and the publishers' remarks in the preface are to the point, and effective. We know of hardly any book or books which are within the reach of every-day life, that we would sooner advise a friend to purchase. Its value will be unimpaired for a lifetime.

No. 32.

From the Boston Transcript.

"*Eighty Years' Progress of the United States.*"—This work is the result of much careful research, exercised by many minds on a variety of important subjects. They show the industrial and educational steps by which the people of the United States have risen from their colonial condition to their present position among the nations of the world. They give, in a historical form, the progress of the country in agriculture, commerce, trade, banking, manufactures, machinery, modes of travel and transportation, and the work is intended to be sold by subscription, and will doubtless have a large circulation. It ought to be in every house in the land. It is more important than ordinary histories of the country, as it exhibits all the triumphs of the practical mind and energy of the nation, in every department of science, art, and benevolence. It is a storehouse of important and stimulating facts, and its interest can hardly be exhausted by the most persistent reader.

No. 33.

From the N. Y. Herald.

"*Eighty Years' Progress of the United States,*" by eminent literary men.—The object of this work, as set forth in its preface, is to show the various channels of industry through which the people of the United States have arisen from a British colony to their present national importance. This is done by treating separately the improvements effected in agriculture, commerce, trade, manufactures, machinery, modes of travel, transportation, etc. The preparation of these different articles has been intrusted to writers whose pursuits qualified them to handle them exhaustively, and the result is the assemblage of a vast amount of statistical and other information which is not to be found in the same collective and condensed form in any other work extant.

No. 34.

From the Boston Post.

"*Eighty Years' Progress of the United States,* showing the various channels of industry through which the people of the United States have arisen from a British colony to their present National Importance," is the title of a new and exceedingly valuable work. The work gives in a historical form the vast improvements made in agriculture, commerce, trade, manufacturing, etc., together with a large amount of statistical and other information. It is illustrated with numerous engravings, and altogether forms a most valuable and instructive companion to the writer, the business man, or the student.

No. 35.

From WM. W. TURNER, Principal of the American Asylum for Deaf and Dumb, Hartford, Conn.

I have examined your new national work entitled "Eighty Years' Progress of the United States," and find that the information it contains on the wide range of subjects treated of must make it exceedingly valuable as a standard book of reference. The names of the writers of the different articles afford a sufficient guaranty that the facts and statements may be relied on as correct. I consider the work a very important accession to this department of literature, and have no doubt that it will find its way into the library of every private gentleman and every public institution.

Very truly yours,
WM. W. TURNER.

No. 36.

From JOHN D. PHILBRICK, Superintendent Common Schools, Massachusetts.

I have examined the *"Eighty Years' Progress"* with great satisfaction. I consider it a work of great value, and it is one which I should be very unwilling to spare from my library. It is not only such a book as the literary or professional man would like to possess, but it is a book for every household, and for every school library.

Very truly yours,
JOHN D. PHILBRICK.

No. 37.

From the Boston Journal.

"Eighty Years' Progress of the United States."—In this elaborate and valuable work the progress of the United States is illustrated by historical sketches of the rise and development of agriculture, commerce, trade, manufactures, modes of travel and transportation. The authors will be recognized as fully competent to treat upon the above subjects, and their sketches have great interest and value, as well for the facts which they present, as in illustrating the rapid progress of the United States in all that conduces to material wealth and national prosperity. The work abounds in valuable statistical information, and is interesting for perusal, and useful for reference.

No. 38.

From the Philadelphia Evening Journal.

"Eighty Years' Progress of the United States," by eminent literary men.—The work treats of the various channels of industry through which the people of the United States have arisen from a British colony to their present national importance. It treats of the vast improvements made in agriculture, commerce, trade, manufacturing, machinery, modes of travel and transportation, etc., etc.

No. 39.

From the Homestead, Agricultural Journal, Hartford, Ct.

"Eighty Years' Progress of the United States."—The title conveys but a faint idea of the great amount of information contained in these volumes, and no cursory glance can more than convince the reader that they possess great value as an encyclopædia of arts and progress in civilization. The names of the authors of the more important articles, several of whom are known to us personally and highly respected, are a guaranty that their work is well done, and statements reliable. Our limited space forbids an extended notice, but before noticing especially the agricultural departments, we must add, that to every one who takes it up it is one of the most fascinating of books, a most remarkable quality in a book so statistical in its character.

The article of progress in Agriculture is by Chas. L. Flint, Secretary of the Massachusetts Board of Agriculture, and is a most able and interesting collection of facts in regard to the remarkable progress of this country since the Revolution.

No. 40.

From the Philadelphia Daily Evening Bulletin.

MR. L. STEBBINS,—After carefully examining your valuable publication, "Eighty Years' Progress of the United States," and having on various occasions, in our professional business, tested its accuracy as a work of reference, we are able to bear testimony to its character. No work that we have ever seen gives such spirited, comprehensive, and correct views of the progress of our country in political strength, in commerce, agriculture, manufactures, and all branches of industry and art. The work has been prepared with extreme care; the various subjects are treated with intelligence, and the style of composition proves that the writers are men of education, who have thoroughly informed themselves on the subjects they discuss. The illustrations and the typography add much to the attractions of a work that should be in the hands of all who take an interest in the growth of our country, and feel a patriotic pride in its prosperity.

We are very respectfully, your ob't serv'ts,
PEACOCK, CHAMBERS & CO.

No. 41.

From the Secretary of Board of Education.

BOSTON, MASS., *Sept.* 6,

Dear Sir,—I beg leave to thank you for your noble work entitled "Eighty Years' Progress."

After such an examination as I have been able to give, I do not hesitate to pronounce it a work of unusual interest and value.

As a depository of facts illustrative of the progress of our country in the departments of industry, it is invaluable.

Its wide circulation, at this eventful period, cannot fail to arouse and deepen that patriotic love of our institutions which is the pressing demand of the hour. Respectfully yours,

J. WHITE.

L. STEBBINS, Esq.

No. 42.

From S. S. RANDALL, City Superintendent Public Schools, New York.

MR. L. STEBBINS: *Dear Sir*,—The great pressure of official engagements has hitherto prevented my acknowledgment of the receipt of the very beautiful and interesting work published by you—"Eighty Years' Progress of the United States." I have not had time to peruse them thoroughly, but take great pleasure in stating that, so far as I have looked into them, the plan and general execution of the work seem to me to be admirable, and well adapted to the wants, as well of the rising generation, as of our fellow-citizens generally. I cheerfully recommend it to the favorable regard of school officers, parents, teachers, and others, as a very valuable compend of scientific and historical knowledge, and as a work well worthy of a place in every school or private library.

No. 43.

From the New England Farmer, Boston.

"*Eighty Years' Progress of the United States.*"—This volume contains an immense amount of valuable and interesting information concerning the rise and development of agriculture, commerce, trade, manufactures, travel and transportation, the arts, and other prominent interests of this country. This information is contained in a series of essays by gentlemen, either and all of whom will be recognized as competent to illustrate the subject upon which he writes.

No. 44.

From Frank Leslie.

After copying the entire title-page, the notice proceeds thus:

Such is the comprehensive title of an elegantly printed work which covers a very wide range of subjects of special American interest. The work is, in fact, an industrial and statistical history of the country since its independence, encyclopædic in character and arrangement, but yet sufficiently complete for every practical purpose. It may be regarded as an epitome of the publication of the Census and the Patent Office, and of the proceedings of our Industrial Societies, compact in form, convenient for reference, and deserving a place in the hands of every reading and reflecting man in the country.

No. 45.

From R. G. DANA, Mercantile Agency, New York.

From a cursory glance at its contents I feel warranted in saying it possesses information of much value and usefulness to all classes.

Very respectfully, R. G. DANA.

No. 46.

From the Evening Post, New York.

"*Eighty Years' Progress of the United States.*"—The range of subjects treated in this work is very full; the writers upon them are well selected with regard to specialties, and their manner of handling is always interesting, frequently thorough. The system pursued is not encyclopædic, but historical, and, so far as possible, exhaustive. The growth of our agricultural prosperity, with particular regard to improvements made in breeds and machinery, and the dissemination of scientific knowledge among farmers, is well recited, and this department forms one of the most attractive features of the book.

No. 47.

From B. J. LOSSING, the Historian.

Sir,—I have examined, with great satisfaction, your work entitled "*Eighty Years' Progress of the United States.*" It is a work of inestimable value to those who desire to know, in minute detail, something more of the history of the country than the events of its political and industrial life as exhibited in the politician's manual, and the bold statements of the census; especially at this time, when the civilized world is eagerly asking what we are and what we have been, that the old governments may attempt to solve the more important question, to them, what we *will* be. Your work, in fact and logical prophecy, furnishes an answer of which any people may be justly proud. Surely, no nation of the earth has ever experienced such bounding progress as this; and in the last eighty years, as exhibited in your work, we see ample prophecies of the future, of strength, influence, leadership among the nations, such as the eye of faith employed by the fathers, dimly saw. No American can peruse your pages without feeling grateful for the privilege of being an American citizen.

I will use a very trite phrase and say, with all sincerity, I wish your work could go "into every family in our land," to increase their knowledge and to strengthen their patriotism.

Yours respectfully,

BENSON J. LOSSING.

No. 48.

From the New York Journal of Commerce.

"*Eighty Years' Progress of the United States.*"—The plan is extensive, and appears to be judiciously carried out. The work is divided into departments, to each of which has been devoted his laborious attention, producing a readable, and at the same time valuable and instructive, summary of the advances made. This plan necessarily comprises a very complete history of the arts and sciences for the past century. In many of them it covers the whole period from the earliest time at which they were known to man, for the century has been productive of new arts, and has furnished mankind with not a few totally new inventions. To digest the contents of the book so as to give a reader even a hint of its comprehensiveness would be impossible.

The book is well fitted for the family reading, and valuable as a source of interest and instruction to the young, while in the business office and counting-room of every merchant, banker, and professional man it would answer a thousand daily questions.

No. 49.

Office of Superintendent of Public Schools, Chicago.

"*Eighty Years' Progress.*"—The work which you have prepared with so much care and labor, presenting the progress of our country during the last eighty years, is peculiarly adapted to gratify and instruct all classes of citizens. No work could be offered to the public at the present time more worthy of a place in family libraries, and school libraries, than the one which you now present.

Yours truly,
W. H. Wells,
Sup. of Public Schools.

No. 50.

From the Superintendent of the Institution of the Deaf and Dumb, New York.

It is only recently that I could find time, from the pressure of official duties, to examine the splendid national work, "*Eighty Years' Progress.*" By the way, I observe that, as you give much information concerning early colonial times, you have in fact given over two and a half centuries of progress. The work strikes me as a production of great value and universal interest. While the statesman will find a mass of statistical information, which, by its arrangement and the able commentary accompanying it, will assist very materially in the correct solution of many politico-economical problems, men actively engaged in almost any pursuit, agricultural, commercial, mining, education, the arts of design, the mechanic arts, etc., will each find much information, both curious and useful.

Hoping for your undertaking all the success it deserves, I remain, very respectfully yours,

Harvey P. Peet.

No. 51.

From the Boston Cultivator.

"*Eighty Years' Progress.*"—There is a work which has been published recently, having the above title, and which, because of these magnificent words, of course, arrests the attention of every wise man. Eighty years' progress? Eighty years of progress in the life of an individual would make a rare record, pregnant with the most practical and important considerations; but the eighty years' progress of which we speak, are the years of a nation, or the progress of many *millions* of individuals, and hence how widely shall we have to open our eyes, if it be faithfully written, and we would take it all in so as to recognize the details of advancement made by a mighty people. The people, whose brilliant destiny is indicated in the above title, are those of the United States, and though we are among and of them, unless by long and constant and vigorous pursuit of the special end, we, ourselves, can have no adequate idea of the real extent of our progress, unless it be summed up from the material, as well as the political history of the period about which we inquire, in some work or works combining the knowledge of many whose observation and reading are large in opportunities and in improvement.

We, as a people, are noted in Christendom as having an undue proportion of self-esteem, and an immodest desire to express it as often as we may find an audience. The Americans, we confess, are, in much, superficial, and their real and unparalleled rapidity of progress is too much and too frequently taken for granted as the basis of adulatory discourse; and because of this, the old European, familiar from his youth with the fixed sources of his power, and with ease and grace weighing or rejecting questions he knows from the outset are or are not determinable, naturally looks with *discredit* upon the live Yankee who "guesses" everything, and when urged to state the real ground of his boasting, only covers his superficial knowledge of his own country and history by his agility in bombast and fleeing the point in new gratulation and a keen thrust which forces an adverse judgment. And the ignorance which leads Americans to a substitution of their wit, also leads those of other nations to suspect the foundation of their boasted power and national resources and importance.

There is but one way to cure this, and that is eminently practical and desirable. It is for the people of our country to study their own history more thoroughly, and not their political history only, but the history of their material progress. There are few good books in which to find this; but there is one which has been put forth by L. Stebbins, which is especially adapted to this object; and a more instructive, interesting, and popular work is rarely found.

No. 52.

From the American Journal of Science and Arts, New Haven, Conn.

"*Eighty Years' Progress of the United States,*" by eminent literary men.—This compendium of national statistics forms a valuable handbook of reference, to which all who possess it will have frequent occasion to turn for information in respect to the progress and condition of the great elements of growth and development in the history of the United States during eighty years past. The value of the book as a work of reference would have been much enhanced by a more frequent reference to authorities and original sources of information. But taken as it is, it supplies a great desideratum, and its pains-taking publisher, Mr. Stebbins, deserves our thanks for so valuable a contribution to our resources in this department of statistics.

No. 53.

From the Springfield Republican.

Our citizens are offered a large and expensive work, giving the industrial progress of the United States during the eighty years of their national existence. It is embellished by numerous engravings, and the letter-press is prepared by writers of eminence in the various departments of which it treats. It is sold to subscribers only.

No. 54.

From ISAAC FERRIS, D. D., Chancellor of the University in New York.

I have looked into the work entitled "Eighty Years' Progress of the United States," and am happy to unite with the worthy men who have examined it, in commending it to my friends.

NEW YORK. ISAAC FERRIS.

No. 55.

From J. M. MATHEWS, D. D., Ex-Chancellor of the University in New York.

The object of the work is highly commendable; and, so far as I have been able to examine it, has been executed with ability and fidelity. I freely commend it to public patronage.

NEW YORK. J. M. MATHEWS.

No. 56.

From Prof. E. W. HOSFORD, of Cambridge University.

It is a work of very great value for popular reference. The articles having been prepared by writers who have made specialties of the subjects upon which they have written, are, as a consequence, eminently attractive. I find them an unfailing source of valuable information and important suggestion.

In the way of illustrations what could be more significant than the group of agricultural implements of 1790, contrasted with the mowing, reaping, raking, and threshing machines of 1860; or than the Franklin printing press as compared with the Hoe printing press?

The author of the article on Steam and Steamboats, renders a most acceptable service, in placing on record the just claims of John Fitch and Oliver Evans.

Let me congratulate you on having found so many able contributors, and in having procured so valuable a work.

No. 57.

From A. JACKSON, D. D., President Hobart College, Geneva.

I have examined, as far as time would allow, your new work, entitled "Eighty Years of Progress." I think it a very convenient book of reference, and a valuable addition to our statistical knowledge. I have already found it a very useful work to consult, and I gladly add it to our College Library, where it well deserves a place.

No. 58.

From C. NUTT, D. D., President of the Indiana State University, Bloomington, Ind.

I have examined your recently published work entitled "Eighty Years' Progress;" and from the examination I have been able to give it, I believe that it merits richly the highest commendation. The great variety and importance of the subjects, the felicitous style in which they are clothed, and their numerous and beautiful illustrations, render this work peculiarly attractive. They embrace subjects of great and universal utility, and deeply interesting to all classes of community. Every profession and calling in life is here exhibited, with the latest improvements in every department of industry and art. The advancement made during eighty years, in the American republic, is unparalleled in the history of the world; and will remain a proof to all coming generations, of the blessings of free institutions, and the capability of man, under a system of self-government, for an almost indefinite progress in civilization. This work should be in every library, public and private, and in the hands of every citizen.

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