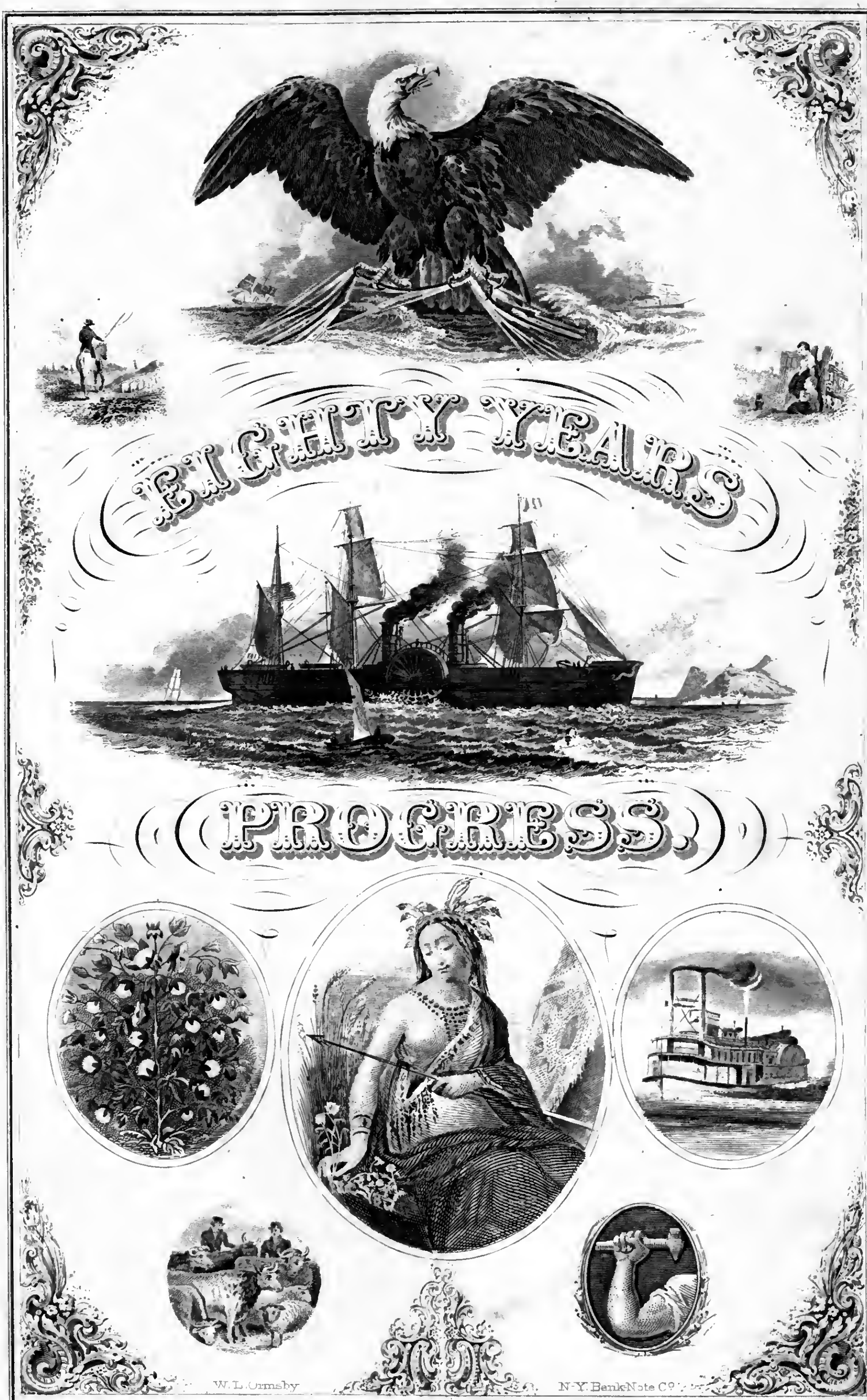
EIGHTY YEARS
PROGRESS.
W. L. Ormsby
N-Y. Bank-Note Co.

EIGHTY YEARS' PROGRESS

OF

THE UNITED STATES:

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.

WITH A LARGE AMOUNT OF STATISTICAL INFORMATION,

SHOWING THE COMPARATIVE PROGRESS OF THE DIFFERENT STATES WITH EACH OTHER, AND, TO SOME EXTENT, THIS COUNTRY WITH OTHER NATIONS.

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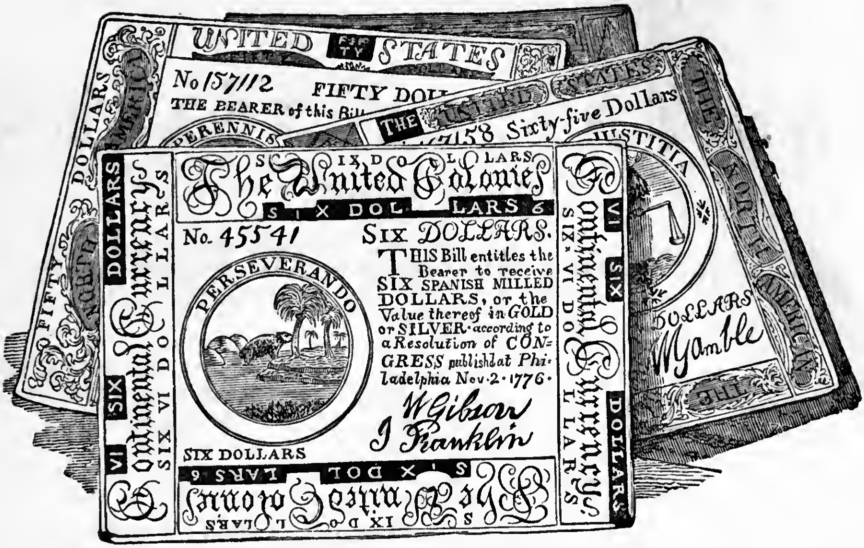

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SUBJECTS AND AUTHORS.

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By CHARLES L. FLINT,

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

CULTIVATION OF COTTON:

Its importance in Commerce, Cheap Lands, Labor, &c., &c.

By PROF. C. F. McCAY, *late of Columbia College, S. C.*

STEAM ENGINE,

Its invention, various improvements, manufacture, and uses, with reference to its influence upon the industry of the country, in its application to manufactures.

By J. C. MERRIAM,

Editor and Proprietor of the "American Engineer."

COMMERCE AND TRADE,

Colonial Trade, Imperial Restriction, Emancipation of Inhabitants, Changed Interest, Manufactures, Course of Trade, Speculation, Revulsion, Bankrupt Law, English Free Trade, Revolution in France, Farmers, Gold, Ships, Tonnage, Navigation Laws, &c.

IMPROVEMENTS IN THE MEANS OF TRAVEL AND TRANSPORTATION,

Including Common Roads, Turnpikes, M'Adam, Plank, and Railroads, River and Ocean Steamers; giving a history of their origin, progress, and influence upon the growth of the country; their extent, construction, cost, &c.

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.

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THE BEGINNING.

THE ABORIGINES.

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.

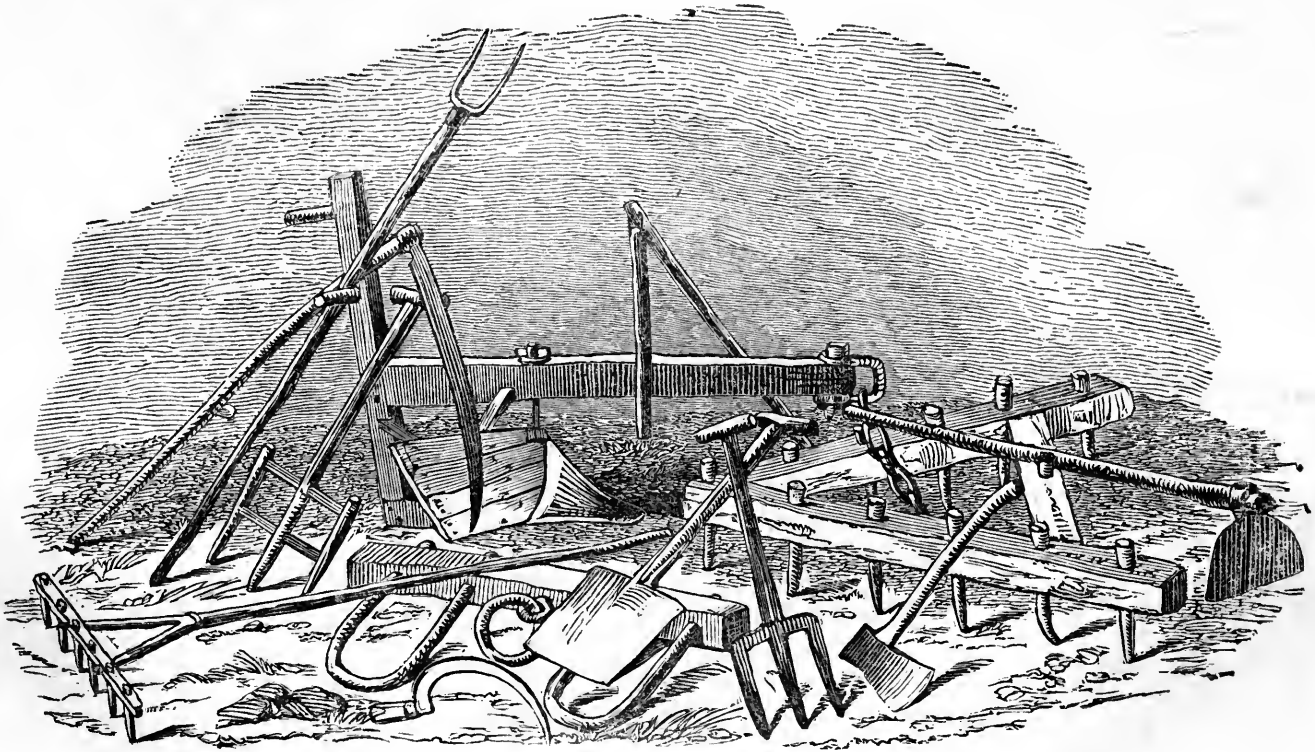
As early as 1617, some ploughs were set to work in the Virginia plantation, but in that year the governor complained to the company that the colony "did suffer for want of skilful husbandmen, and means to set their ploughs on work; having as good ground as any man can desire, and about forty bulls and 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.

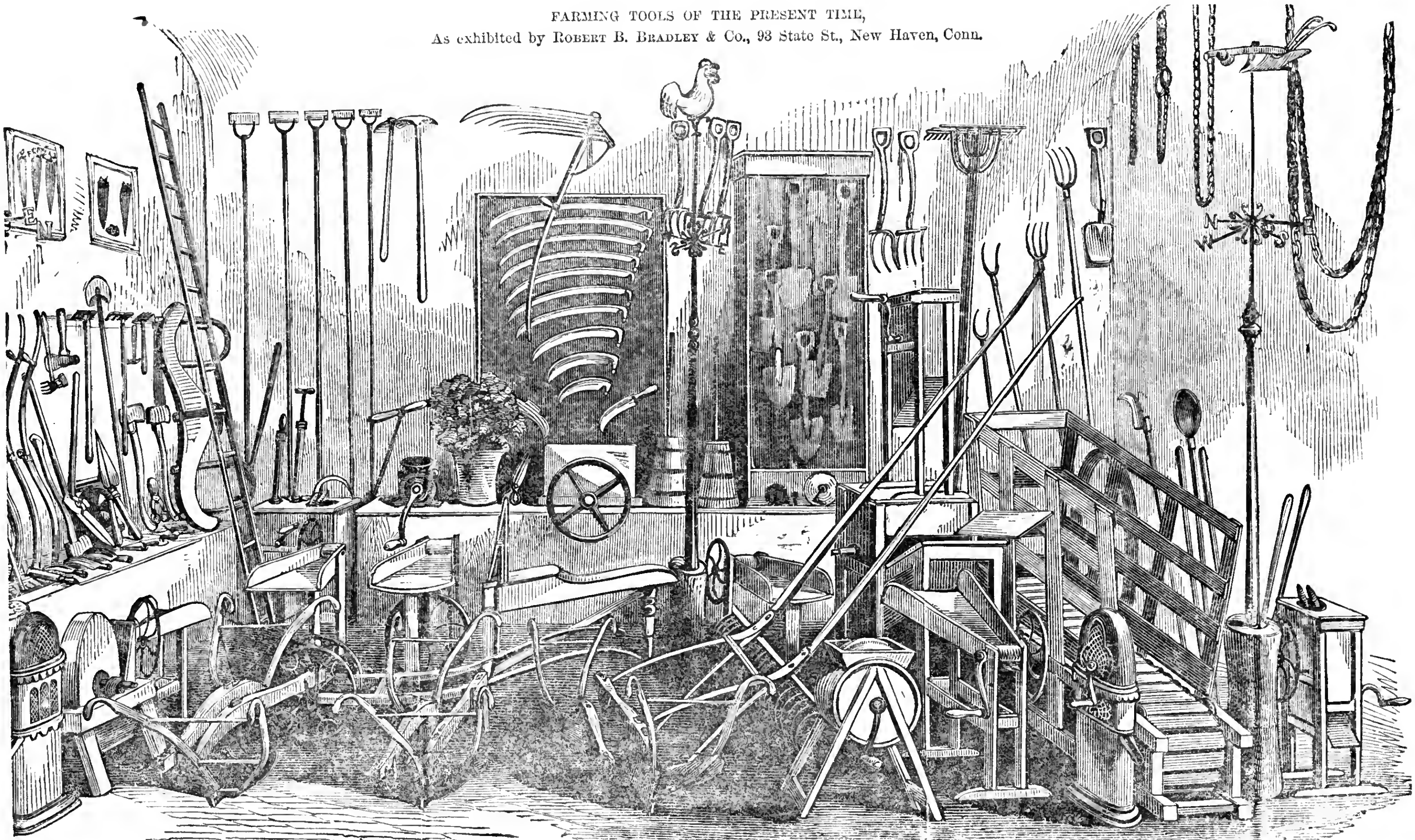
The "bar-side plough," or the "bull plough," was also used to some extent. A flat bar formed the land-side, and a big



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.

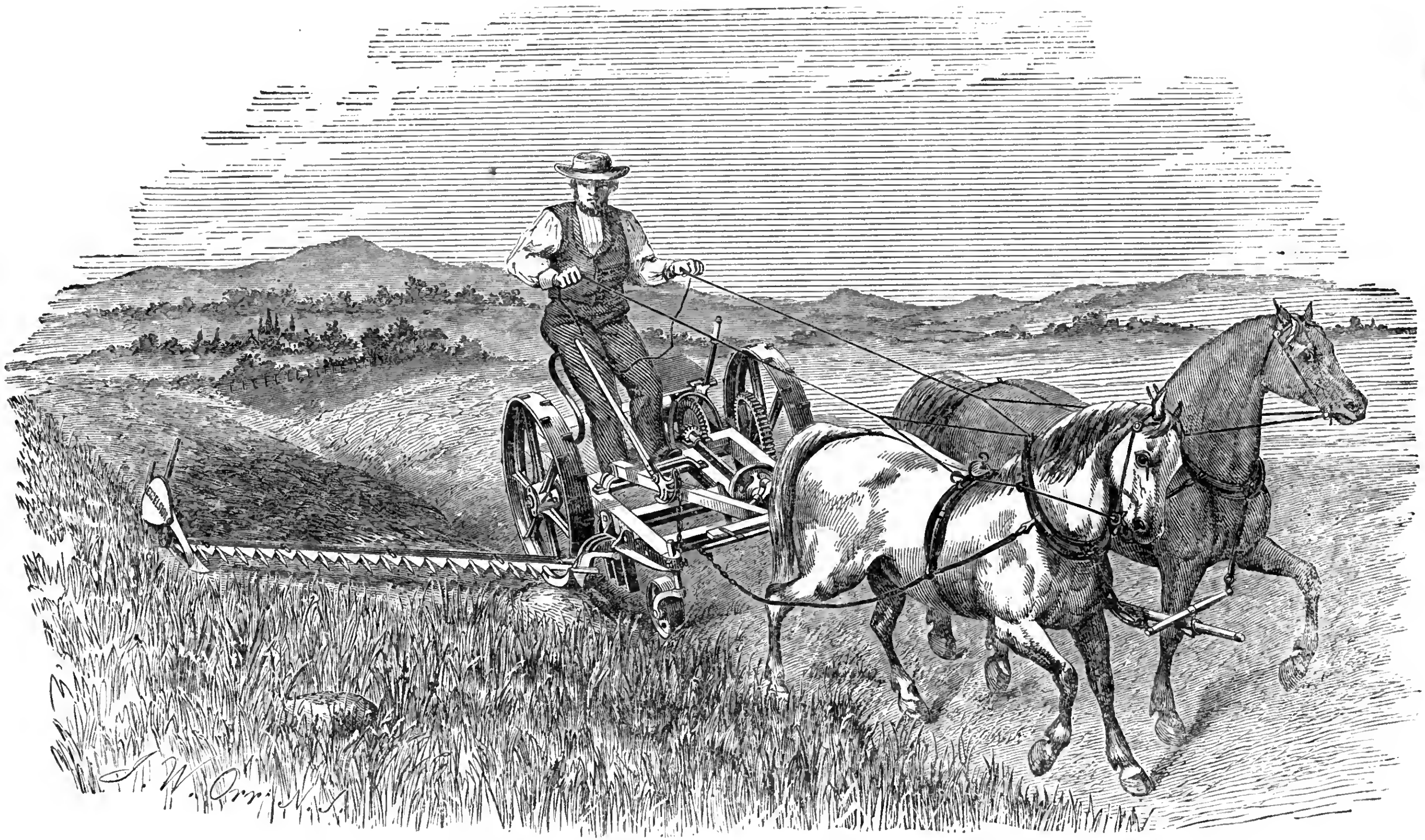
As specimens of important labor-saving implements of modern invention and construction, we may mention a large class known as horse-hoes, grubbers, cultivators, drills, seed-sowers, and others of like character. The seed-sowers and drills scatter the seed more uniformly than it could possibly be done 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.

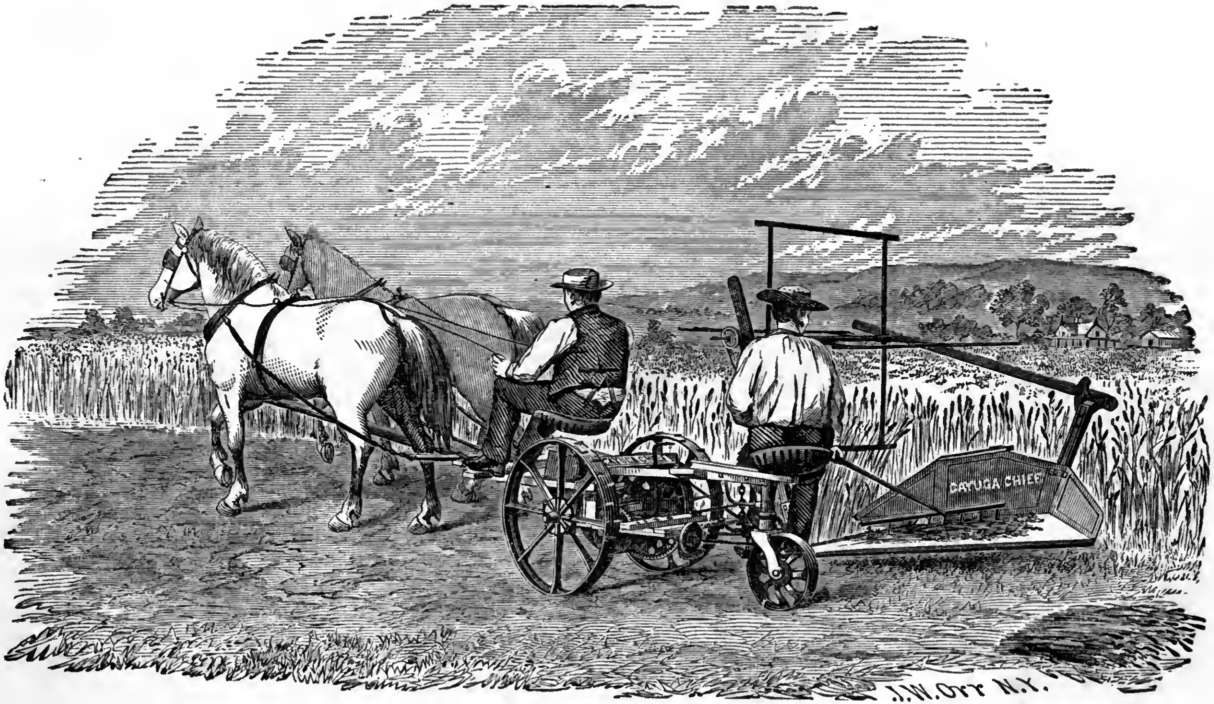
Many of our grain crops, like wheat, barley, and oats, come to maturity at nearly the same time. Wheat is liable to sprout in moist weather, and barley to become discolored if allowed to stand too long. The work of harvesting by the old method was necessarily slow and protracted. Previous to the introduction 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

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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.

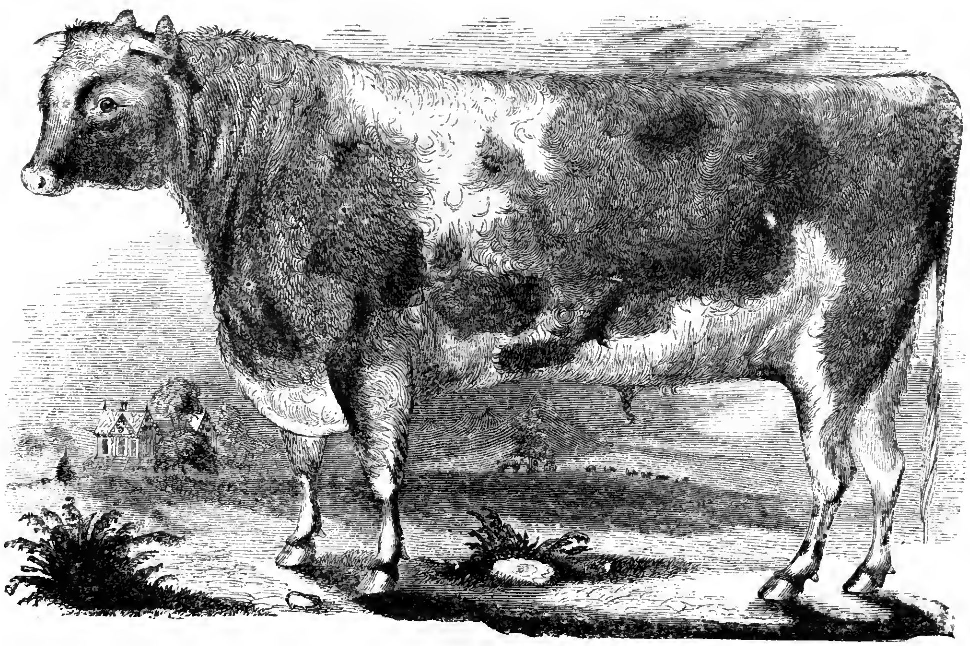
I expect, therefore, to be able to show that some actual progress has been effected upon the common stock of the country. But to what is this progress owing? Is it merely that which is due to better keeping, both summer and winter? I have already intimated that the treatment the cattle of the country 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.

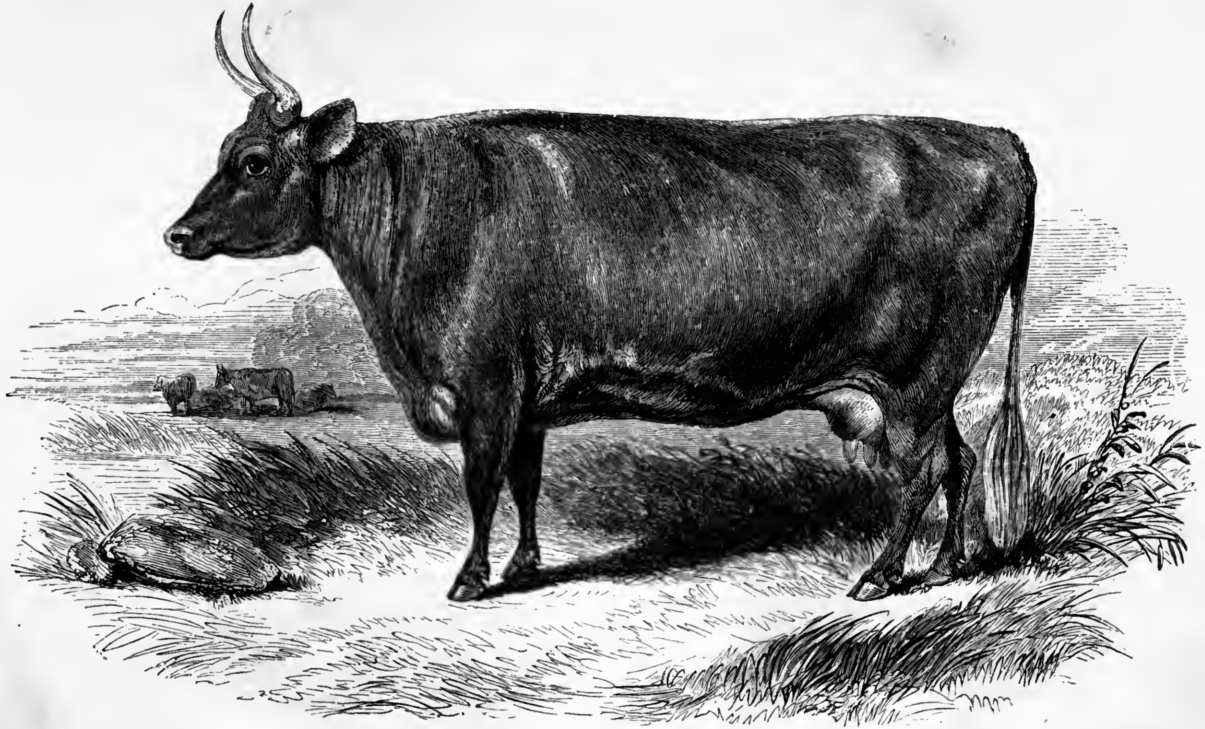
MILCH COW.

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.

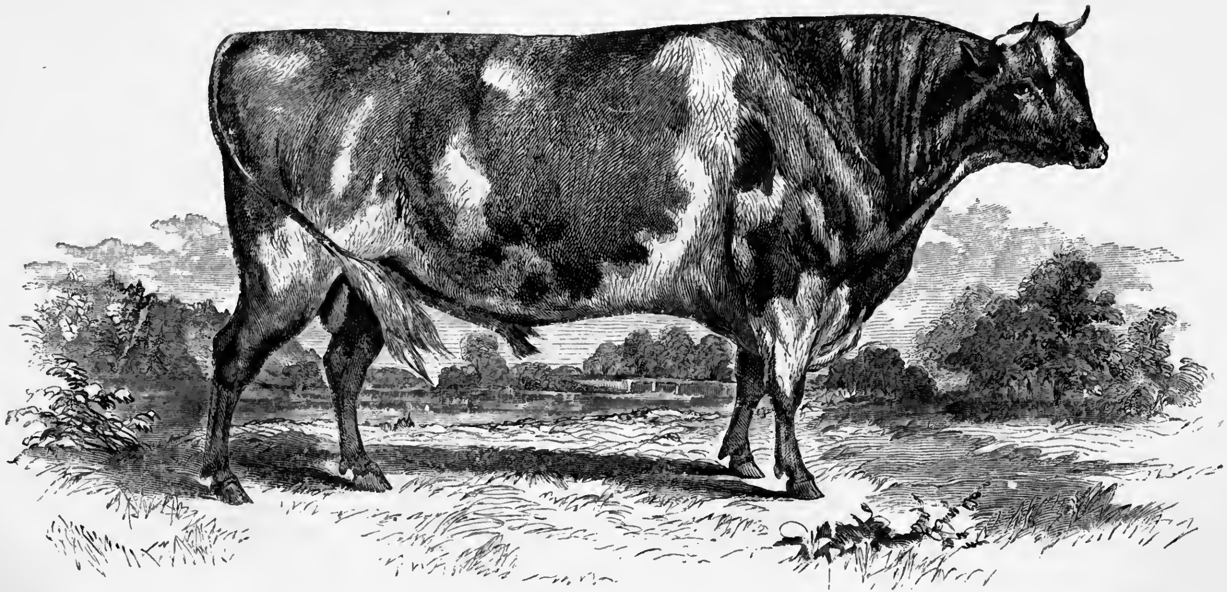


JENNY.

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.

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 Emanuel 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.

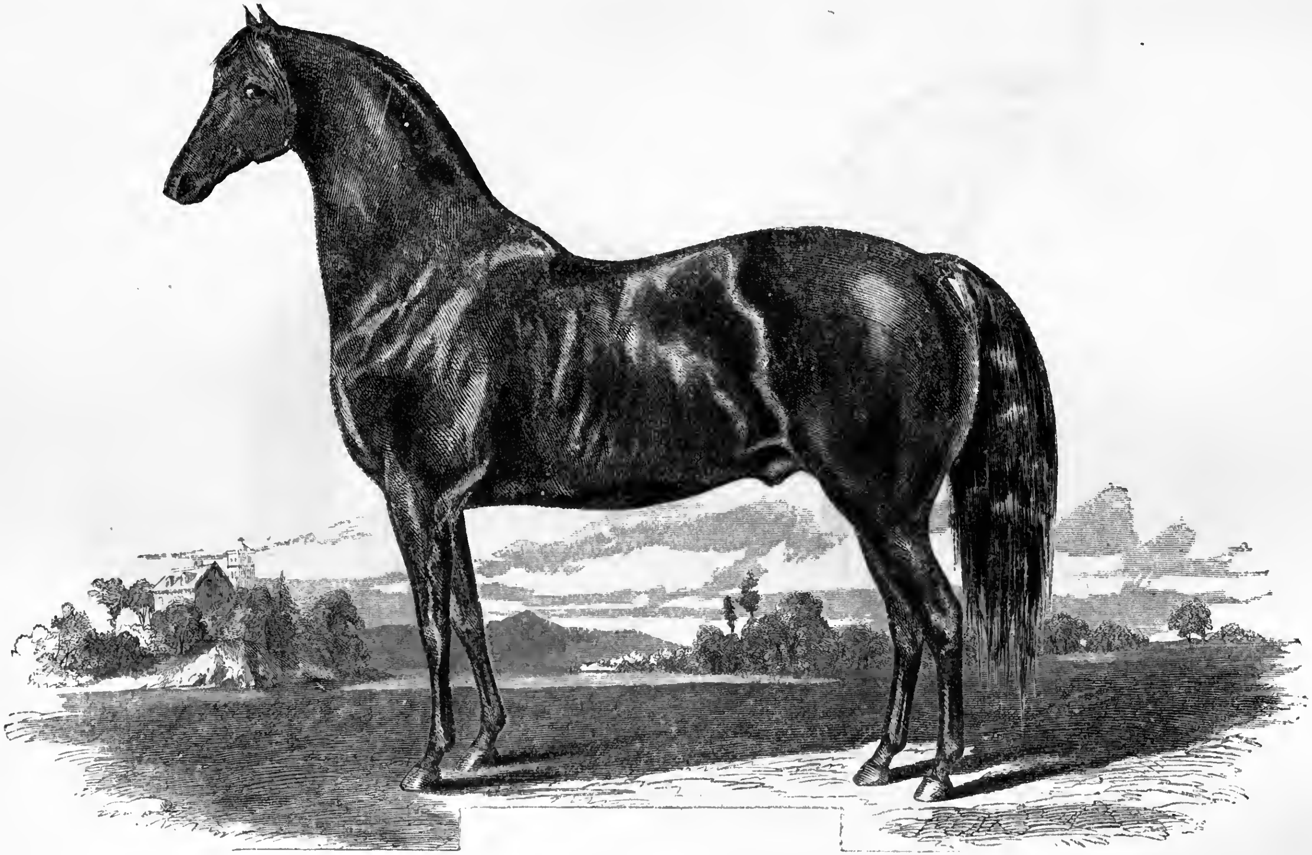
The other family, also widely known, not only in New England, but throughout the country, is the Black Hawk. The founder of this family was a horse of that name, celebrated for transmitting his qualities to his offspring, as well as for his great speed as a trotter. He was kept in Vermont till his death 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.

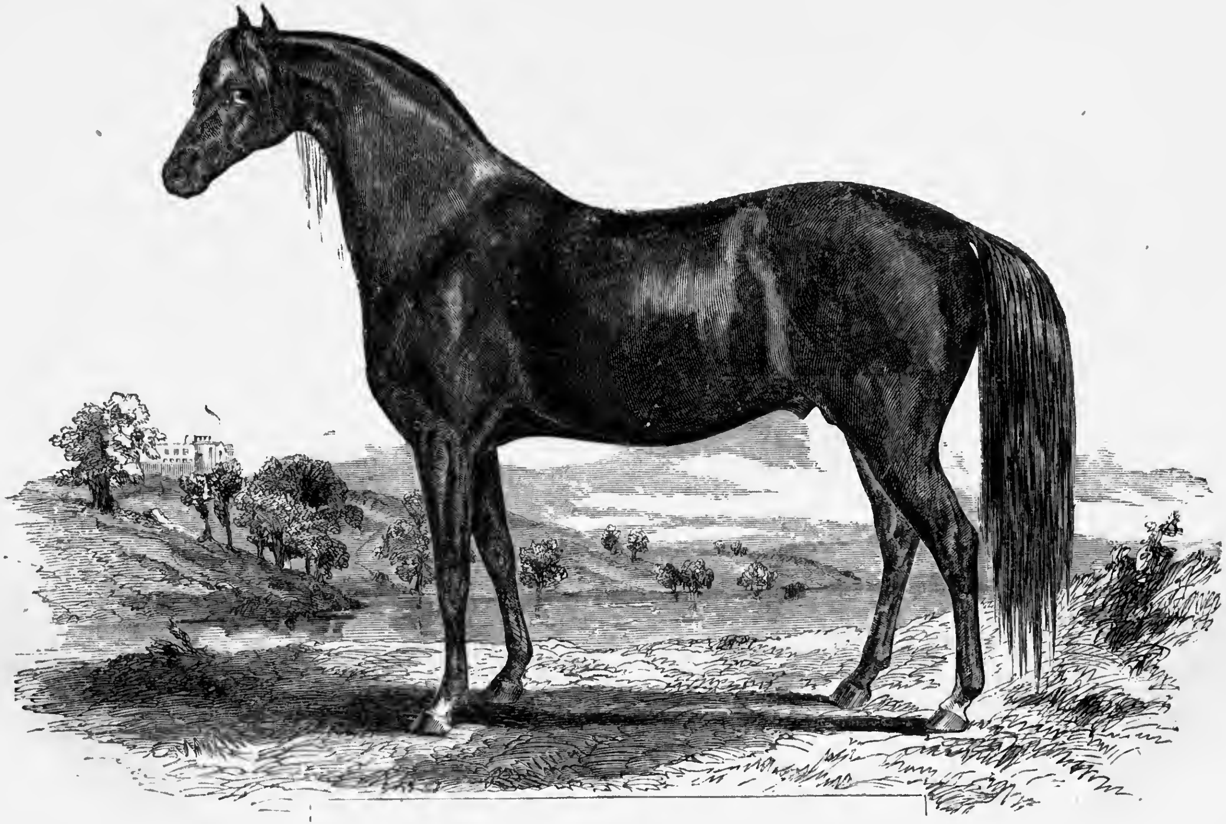
The Conestoga is a large and very heavy breed of horses, often met with in the middle states, and used mostly for the purposes of slow draught in the drays of our large towns and cities.

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.



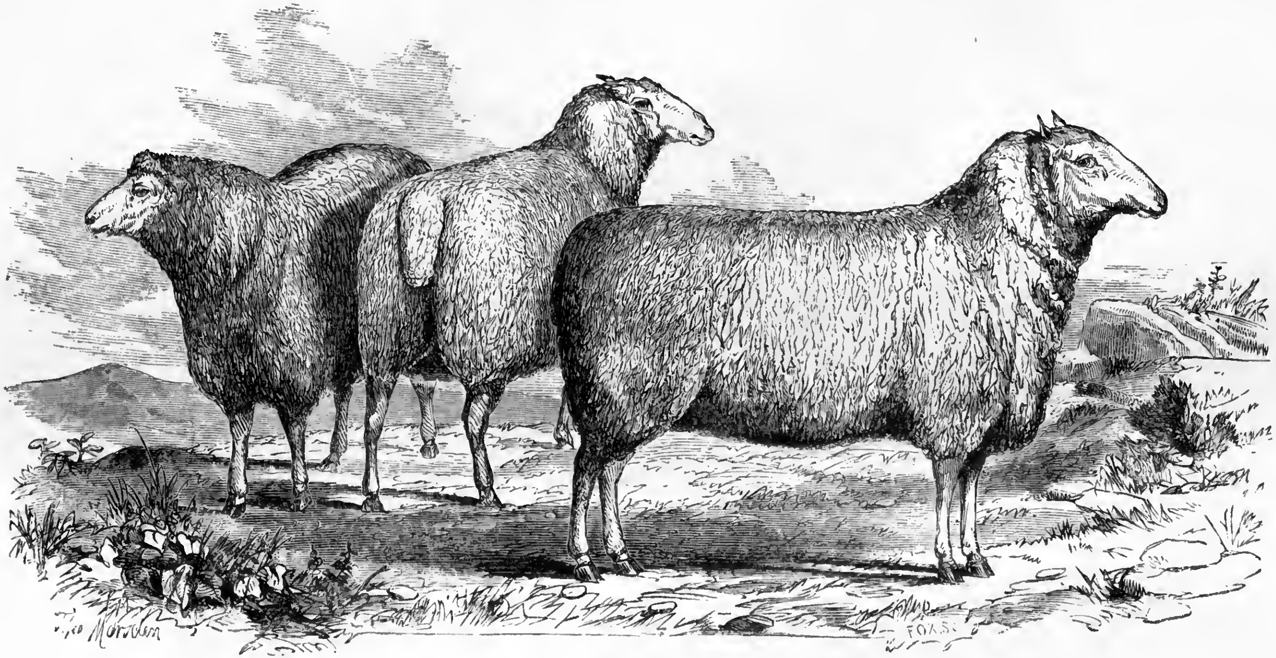
PETERSHAM MORGAN.

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



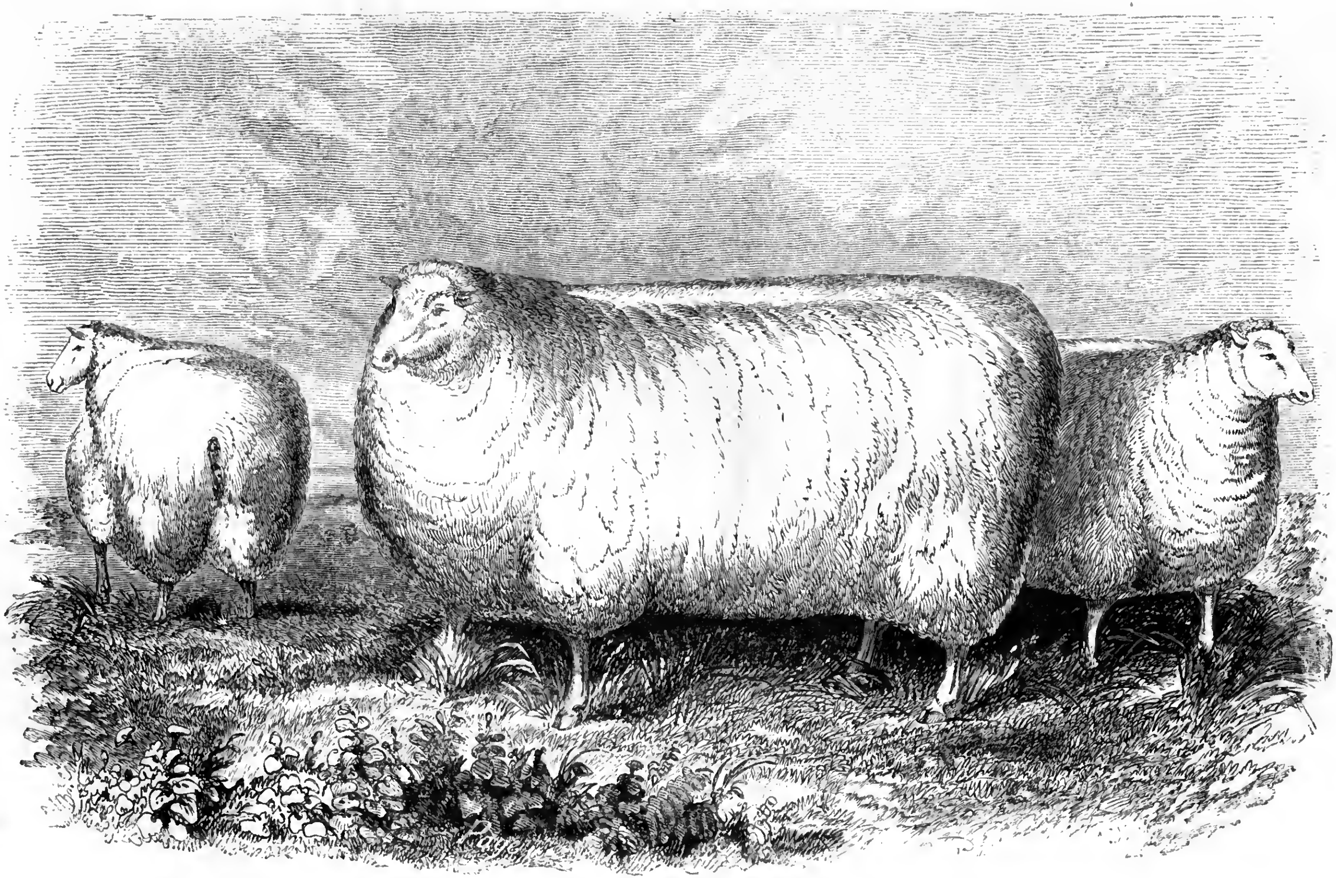
TROTTING CHILDERS.

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.

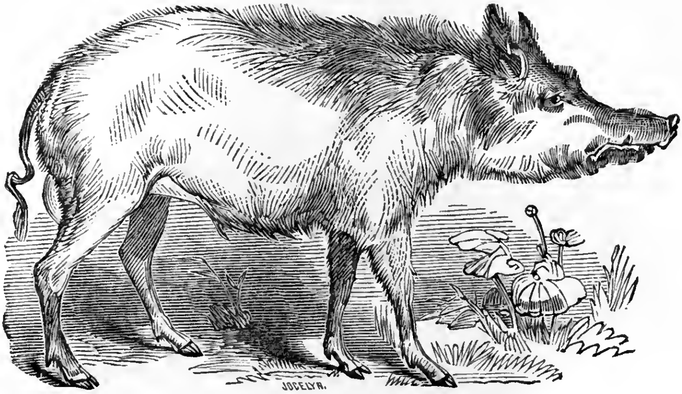
Since the opening of the great railway lines to the west, two prominent causes have operated to diminish the number of sheep, and attention to this branch of farming, in New England. One was, that previous to that time, we had rushed into fine wools, or merino sheep, almost worthless for the market. 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.

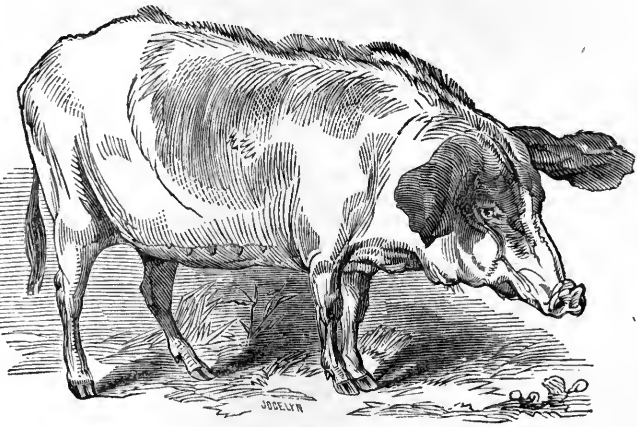
Another reason was the extreme annoyance of dogs, which would often destroy the profit of a whole year in a single night. We are not, therefore, surprised to find that the number of sheep in Massachusetts declined from 378,226 in 1840, to 188,651 in 1850, and to 145,215 in 1855. This last evil has now 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."

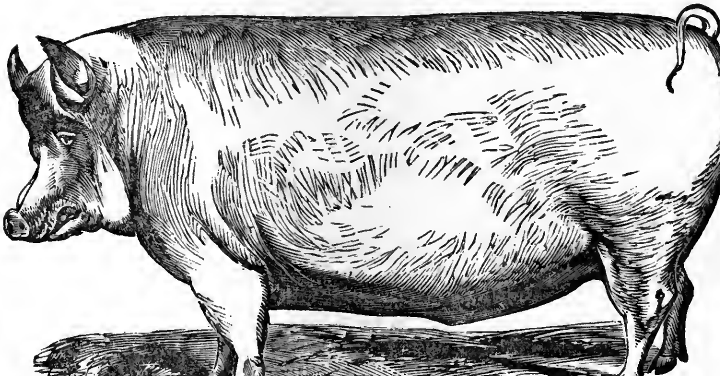
So that whether it be north or south, east or west, sheep are, on the whole, the most valuable of the domestic animals kept on our farms, on account of their small cost and large returns, especially since they are well known to improve the land on which they graze. The total product of wool in the United 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



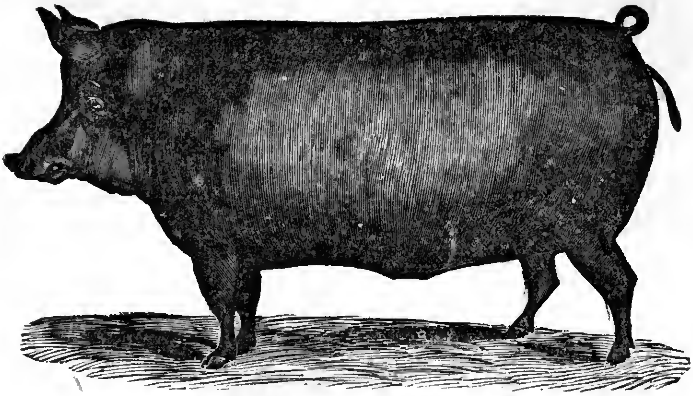
SOUTHERN PINE WOODS HOG.



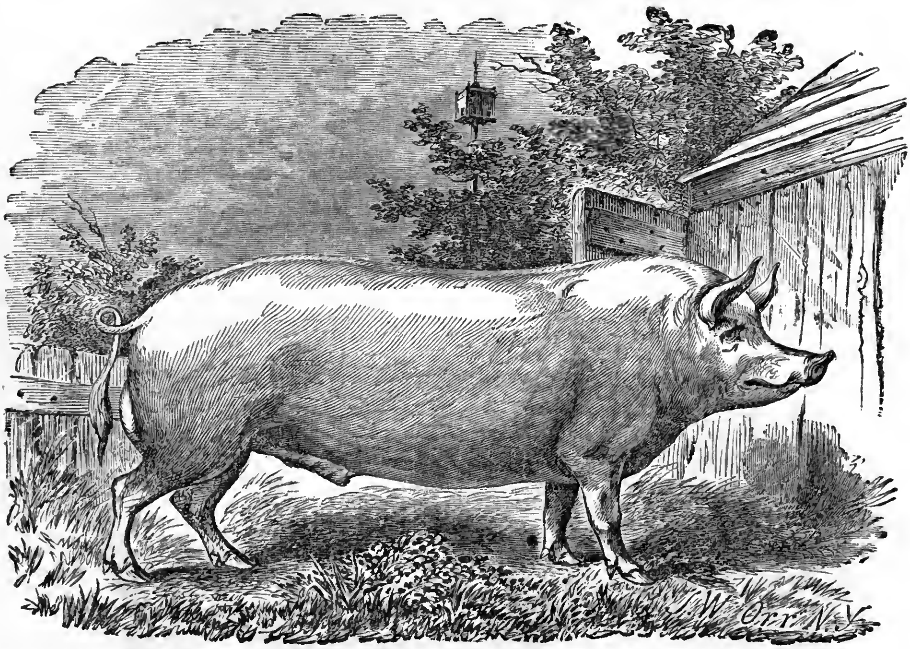
WESTERN BEECH NUT HOG.



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 10¼ 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.

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* 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, othererwise 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

Painted by Cuyp

Eng by I. S. Sanderson

THE PASTURE

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.

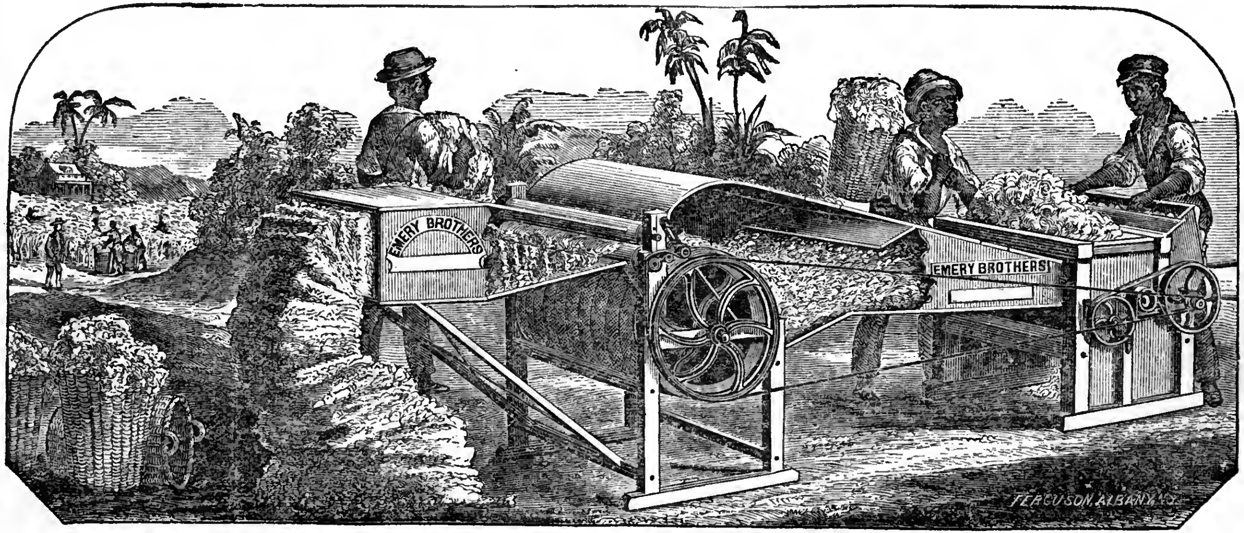
In proof of this, we shall show that the cultivation of cotton has attracted labor and capital from other pursuits in the cotton states, until it has concentrated almost their whole productive power upon this single article; that it has drawn wealth and labor from other sections of the country to be 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 Geórgia 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 skilfully 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 cutworm 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 side-board, 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 Ocmulgee, 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 network, 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	3⅜
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.

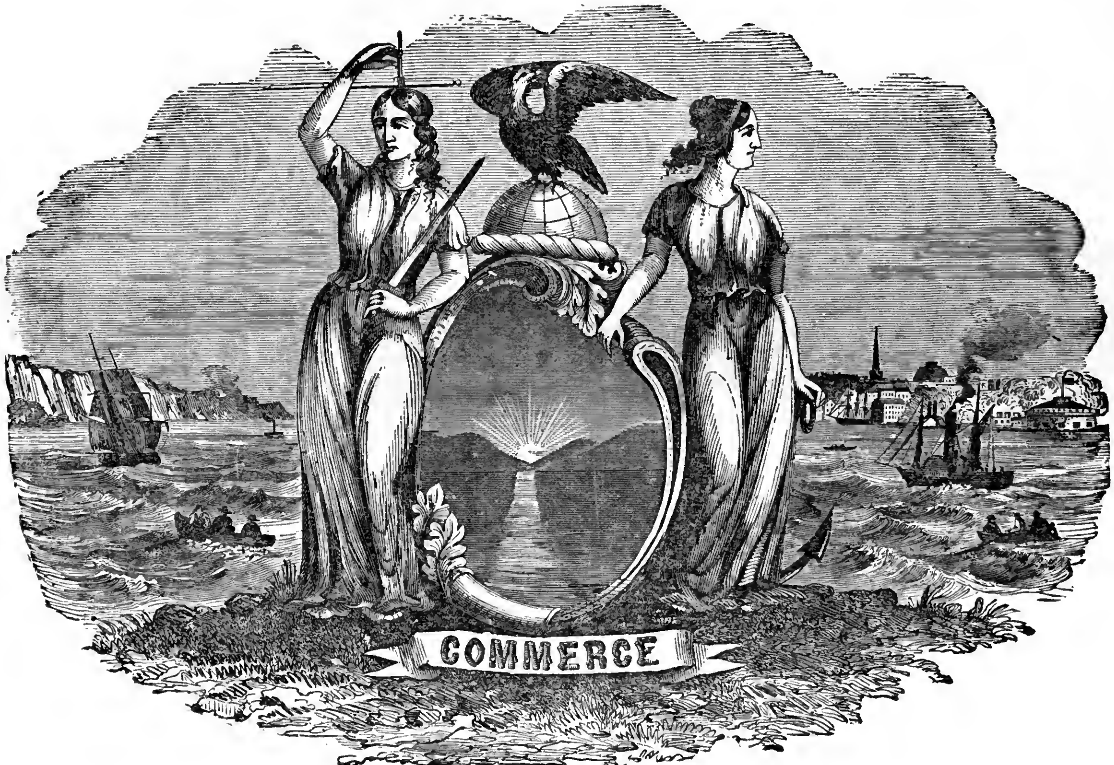
A great deal is made, as of cane sugar in Georgia, for home use; it does not come upon the market, but prevents, to a certain extent, a demand that would exist without it.

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	229,643,834	536,104,918	765,748,752
Decrease	$157,836,573	$192,856,166		$50,451,248
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.

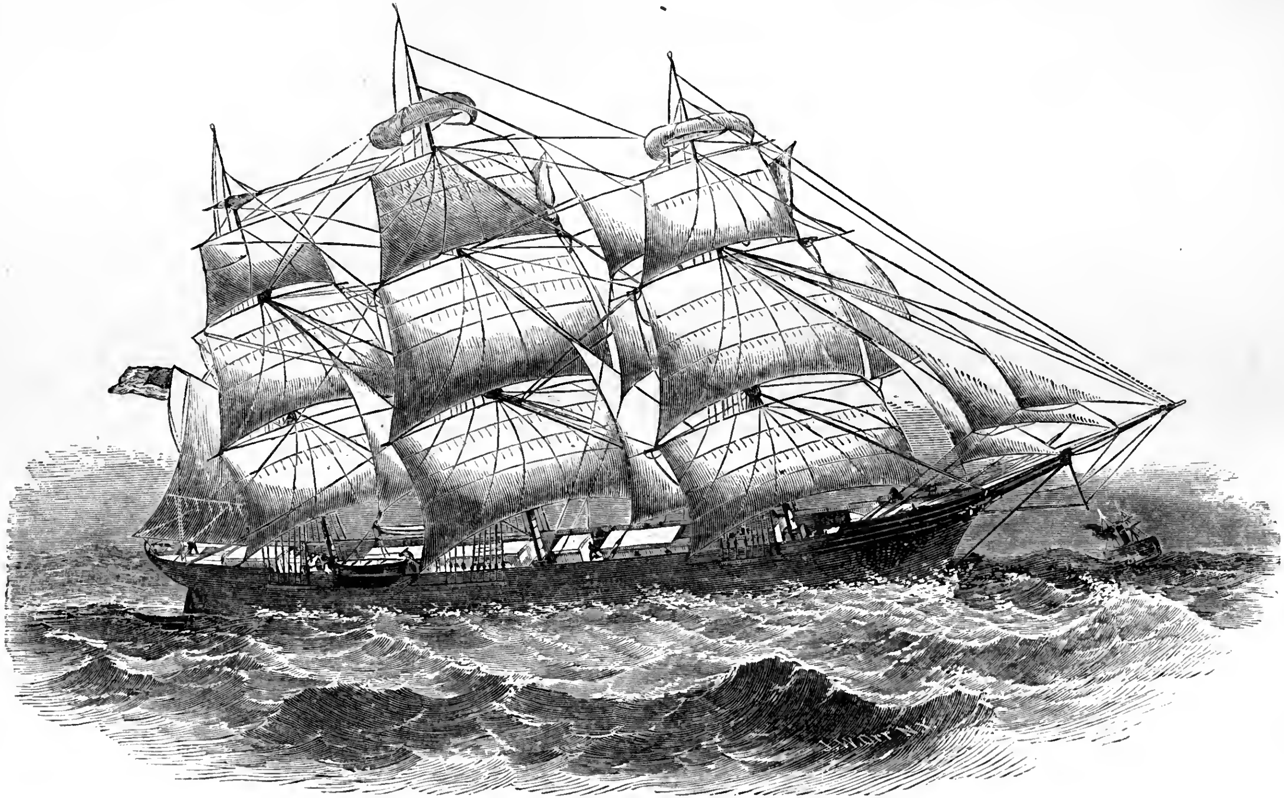
The season of speculation which now seized the public mind was one of the most remarkable in the history of commerce. There is no doubt that it had its origin in the great success which had hitherto been manifest in the progress of the country. Those who had seen but thirty years of active life had witnessed 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



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.				Of those amounts. Specie.	
	Domestic.	Foreign.	Total.	Imports.	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.				Of these amounts. Specie.	
	Domestic.	Foreign.	Total.	Imports.	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:—

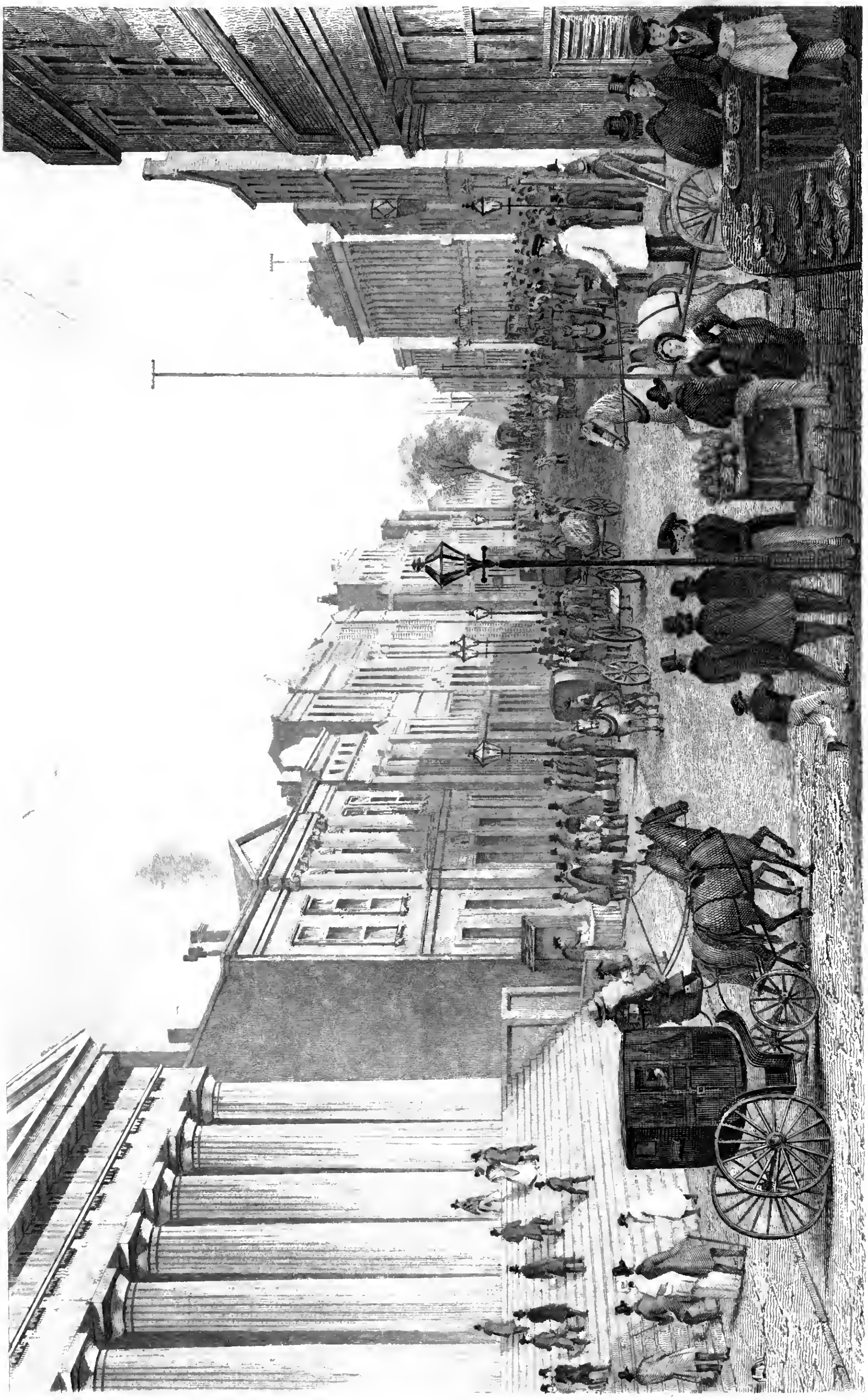
HEADS OF EXPORTS.

	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



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	500,275,851	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	1788	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	89,136,334
Kentucky	1792	24,115,200	73,077	20,268,325	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	$5,727,973,418
Ohio	1802	25,576,960	..	..	1,980,329	433,872,632	2,370,502	840,800,034
Louisiana	1812	29,715,840	..	..	517,762	176,623,654	708,002	378,911,965
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	1845	152,043,520	..	..	212,592	30,149,671	609,215	138,722,433
Iowa	1846	35,155,200	..	..	192,214	23,714,638	674,948	197,223,350
Wisconsin	1848	34,511,360	..	..	305,391	26,715,525	775,881	152,537,700
California	1850	120,917,840	..	..	92,597	21,923,173	379,994	131,306,269
Minnesota	1857	90,774,960	..	..	6,077	262,088	173,855	781,101
Total new states		781,285,760			8,485,206	1,411,460,792	13,609,561	3,562,079,934
Grand total		1,048,021,890	3,929,827	$479,282,646	23,105,655	$4,699,031,708	31,065,214	$9,317,692,261

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 ship-building, 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.	Tonnage.	FOREIGN. No. Vessels.	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	33,538
Vermont	315,877	..	8	28	86,775,213	28,915
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	318,204,964	53,918
Wisconsin	768,485	..	6	15	152,537,700	51,821
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	..	3	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	3,234	..	35	20,271,000	8,201
North Carolina	679,965	328,377	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	138,722,683	19,766
Nebraska	28,893	..	..	38	..	..
New Mexico	82,060	..	..	34	..	..
Utah	50,000	..	..	37	..	..
Washington	11,624	..	..	39	..	..
Dakotah	4,839	..	..	40	..	..
Total	27,673,271	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 }	273,325
Williamsburg	..	..	..	..	1,620	5,680	30,780 }	
Boston	18,038	24,027	32,250	43,298	61,372	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,

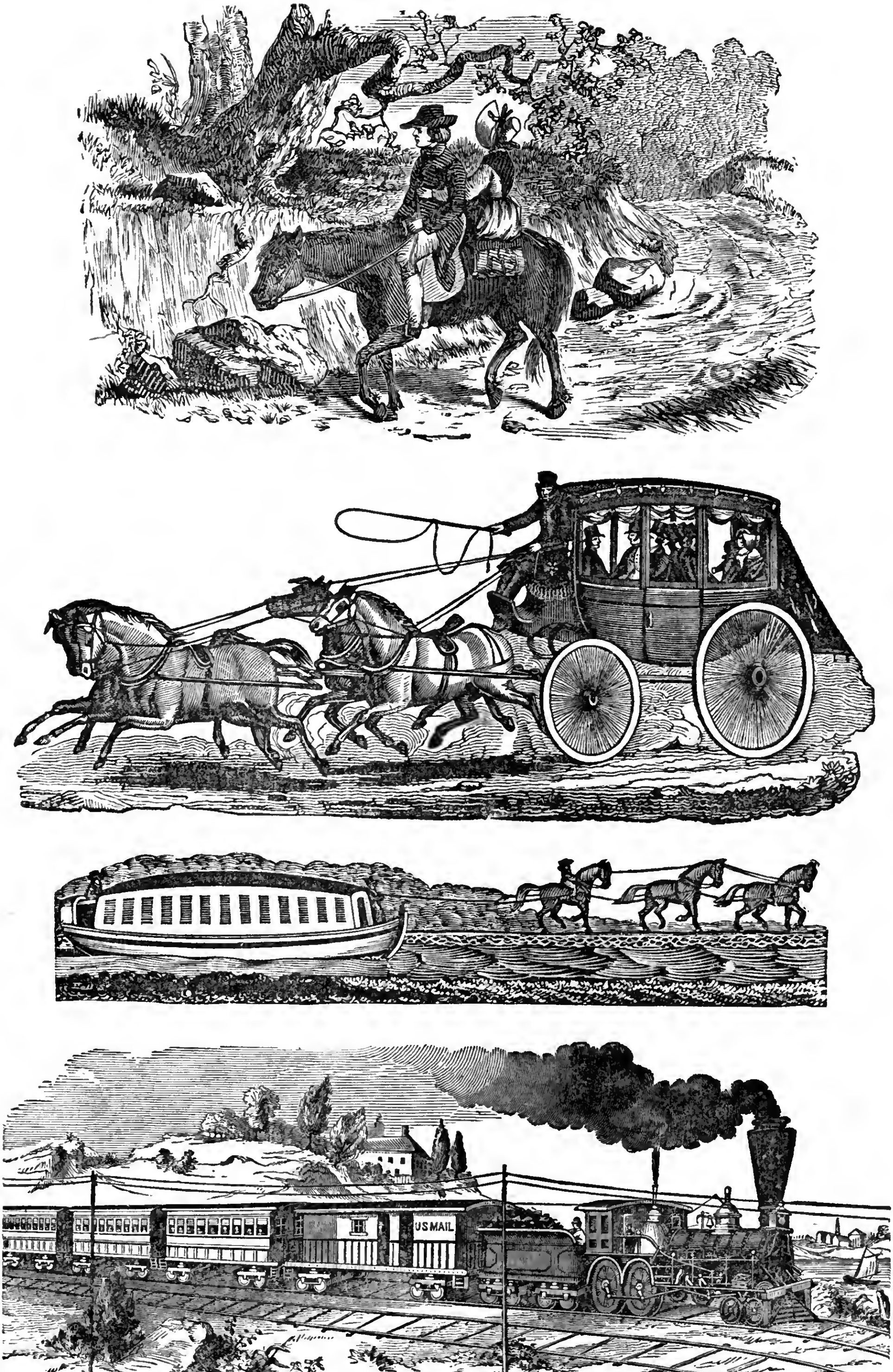
WITH THE RATIO OF SLAVES TO THE WHOLE POPULATION IN THE PRESENT SLAVE STATES, BY EACH DECENNIAL CENSUS BY THE FEDERAL GOVERNMENT SINCE ITS FORMATION.

	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."

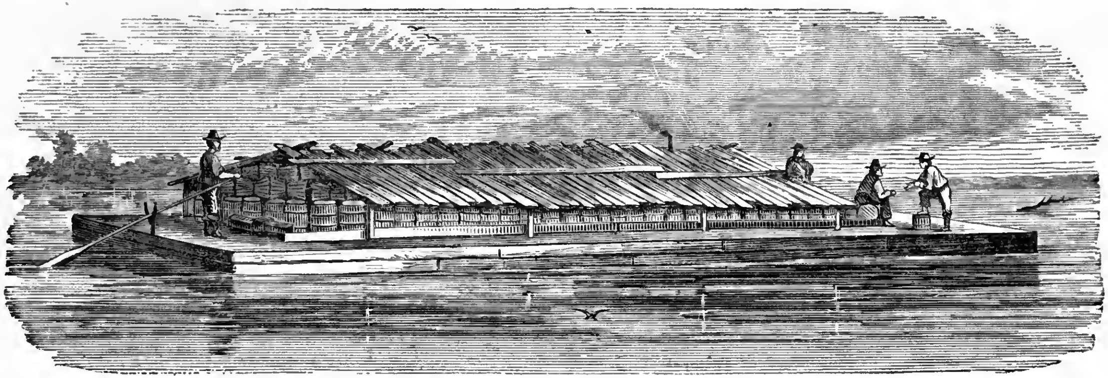
To those who now so frequently make that dire passage without knowing it, this animated description must afford surprise as well as amusement. It is suggestive, not so much of the temerity of the "bold navigators" of that day, as of the feeble nature of the boats then built. The passage, to be sure, 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:—

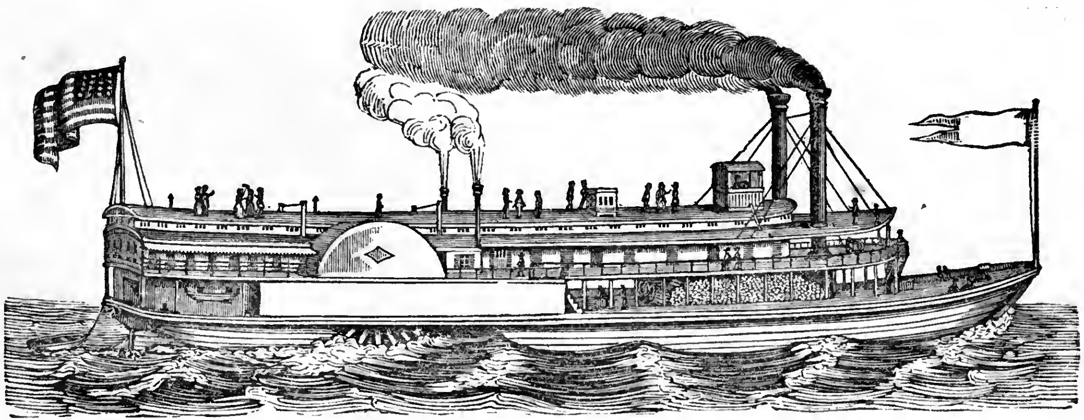
1811, Clermont's time to Albany,	4 ms. per h.,	36 hs.
1820, Paragon,	" "	27
1825, Chief Justice Marshall,	"	14.30
1840, Knickerbocker,	"	9.33
1860, average time 18 miles per hour,		8

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

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.

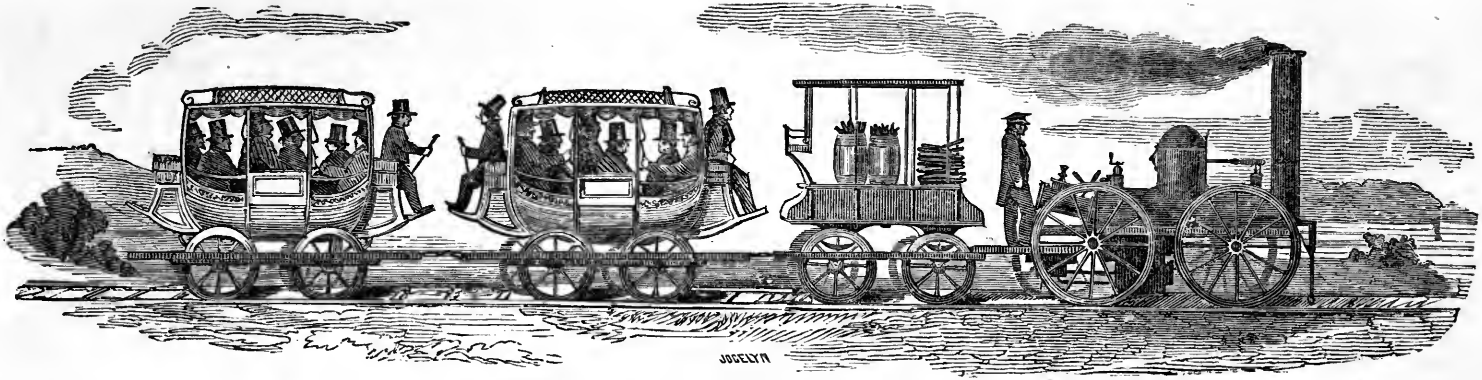
The construction of the Massachusetts Western railway, from Boston to the Hudson river, was one of the most important and financially successful of all the railroads of the country. New York had constructed her great canal, as it were making Albany basin a part of Lake Erie. Boston now grasped the idea 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."

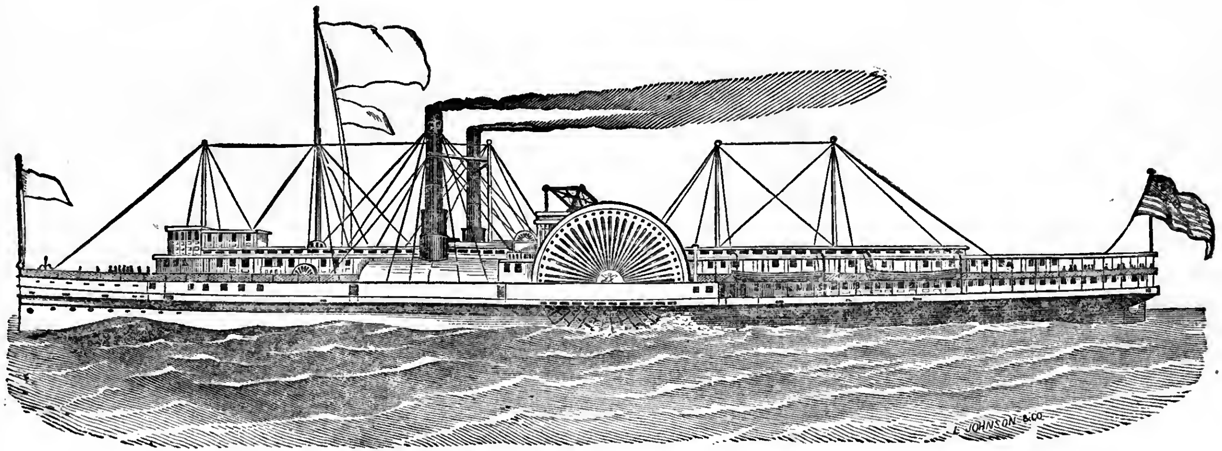
Such was engineering knowledge at the time Boston voted to build a connection 200 miles to Albany. Since that day much has been learned in relation to the characteristics of roads.

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.

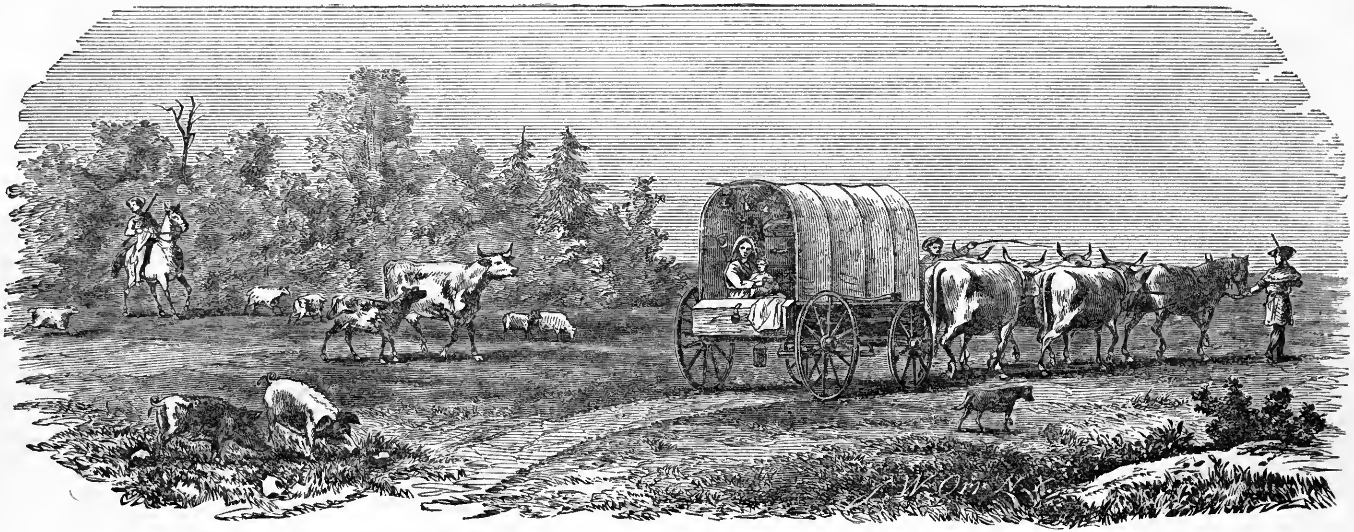
The city of Boston was, as we have said, one of the earliest to understand the advantages that were to be drawn from railroads in overcoming the disadvantages of its position in relation to the west, and the Western railroad has been the instrument by which she made the great states west of New York 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.

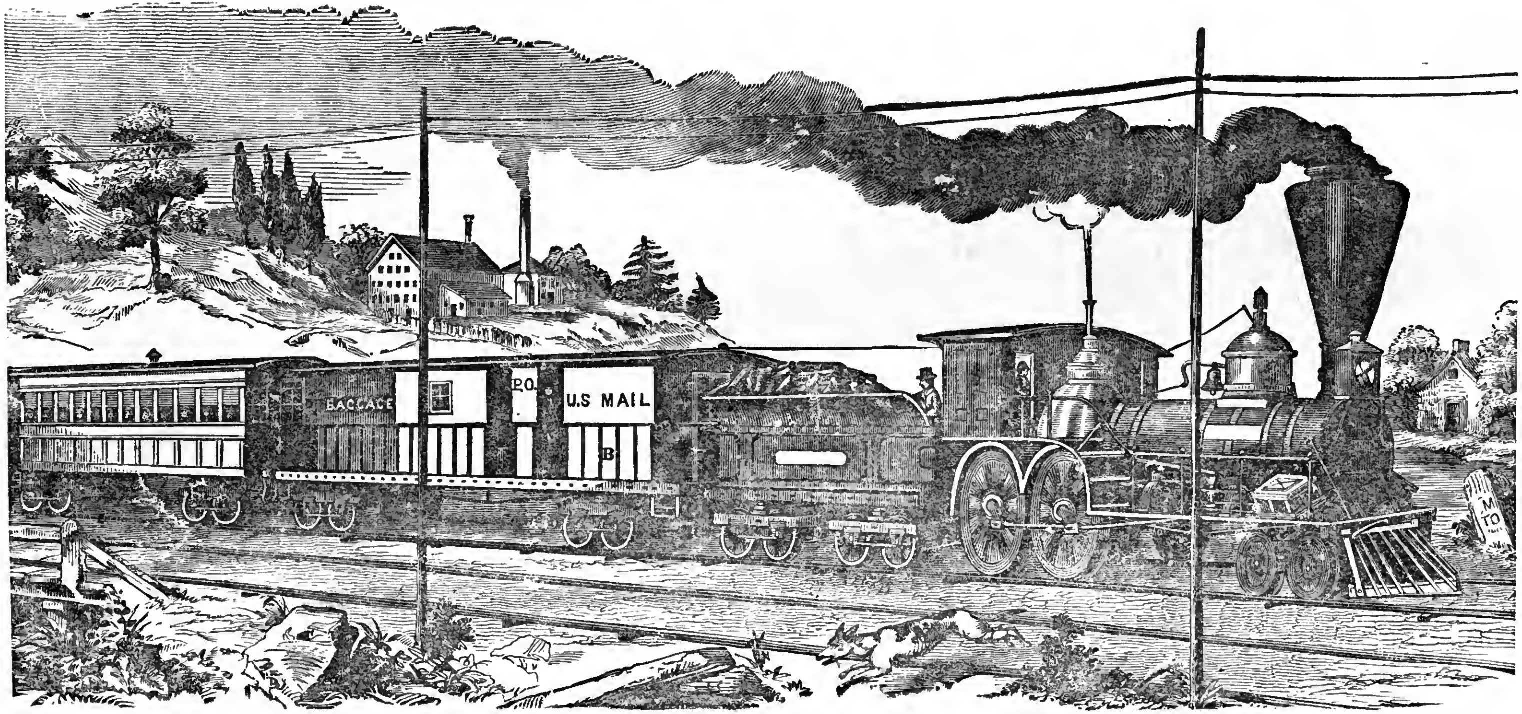
The bridge across the Connecticut is 1,264 feet long. The Western road has a grade of from 60 to 80 feet per mile for more than 18 miles; near the state line the depot is 1,456 feet above the depot in Boston! These features indicate the difficulties that were encountered in the construction, and it received 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	1836	1841	.4	78	4,210,101
Tonawanda	1832	1842	.4	43½	1,216,820
Attica and Buffalo	1836	1842	.3	31½	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 rata* 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 Yalley	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	3,942,368	4,918,325
Tuscarawas extension	32.0	32.0		
Hanover branch	1.5	1.5		
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	2,697,090	2,134,000
Old line	52.0	52.0		
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	8,975,400	9,343,000
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		
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	1,647,700	1,336,816
Martinsville branch	26.0	26.0		
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	6,026,400	3,783,015
Fulton and Iowa line	105.5	105.5		
Beloit branch	21.0	21.0		
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	10,249,210	20,000,000
Chicago branch	250.0	250.0		
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	3,026,903	5,035,615
St. Louis branch	25.0	25.0		
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	317,459	3,781,684
New York Central.............	234,241	113,833	834,879
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	$2,566,869	$6,200,848
New York and Erie......	3,108,248	1,154,083	4,894,527
Pennsylvania railroad....	3,419,494	1,412,603	5,362,355
Baltimore and Ohio......	2,928,411	690,207	3,613,618
Total............	$14,517,246	$5,823,262	$19,571,348

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	"

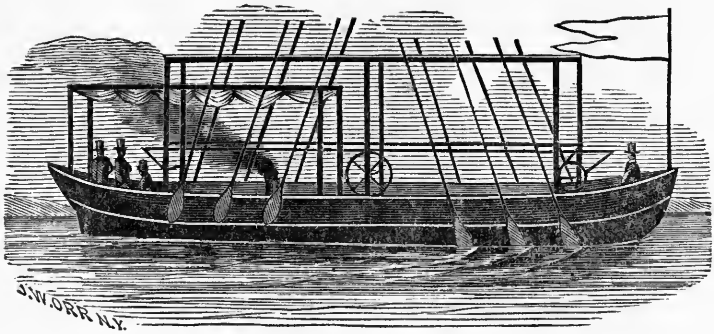
The comparative cost of the roads by another authority is as follows:—

	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.

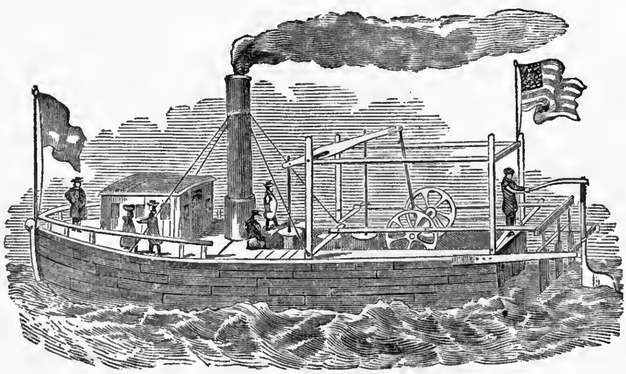
Each of these sections has large means that can be applied to the construction of a road that would serve their necessities, but which could not be enlisted in favor of one that would be of no direct benefit. If, therefore, the government should give authority for the construction of three roads, with 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 SIEAMBOAT 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.

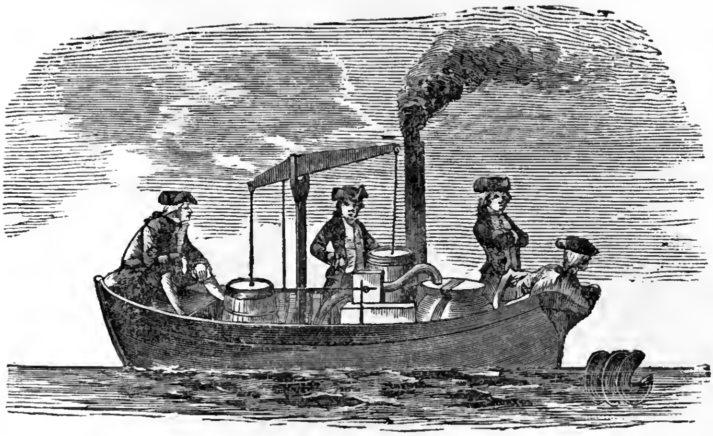
STEAMBOATS.

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.

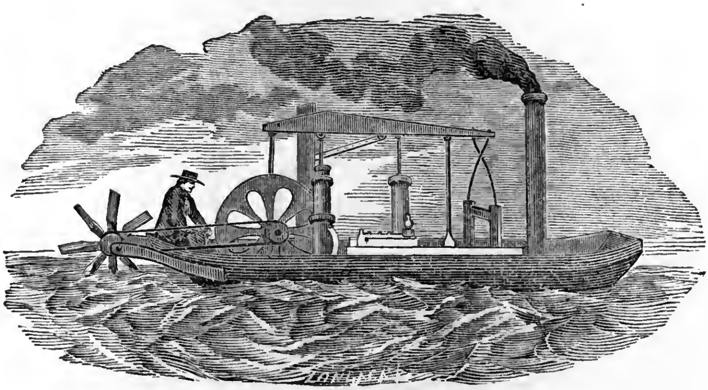
The extent to which steam navigation has improved our country, is scarcely realized even by those who have travelled over it the most. The Hudson river, from the first voyage of the North River, Fulton's steamboat, up to the present time, has remained at the head of all competitors in river navigation. 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



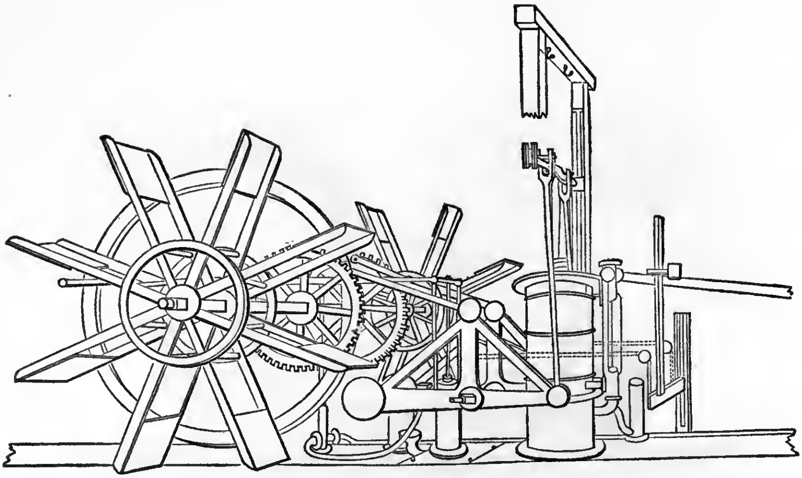
THE FIRST PROPELLER EVER BUILT.

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.



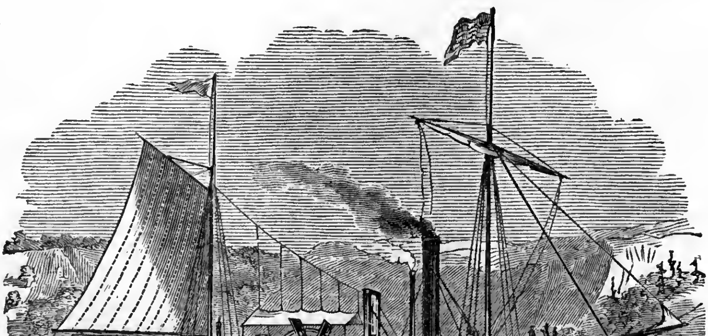
OLIVER EVANS' ORUKTER AMPHIBOLOS.

Thirty feet long and twelve broad. Cylinder five inches in diameter with a nineteen inch stroke. Constructed by Oliver Evans about the year 1804.



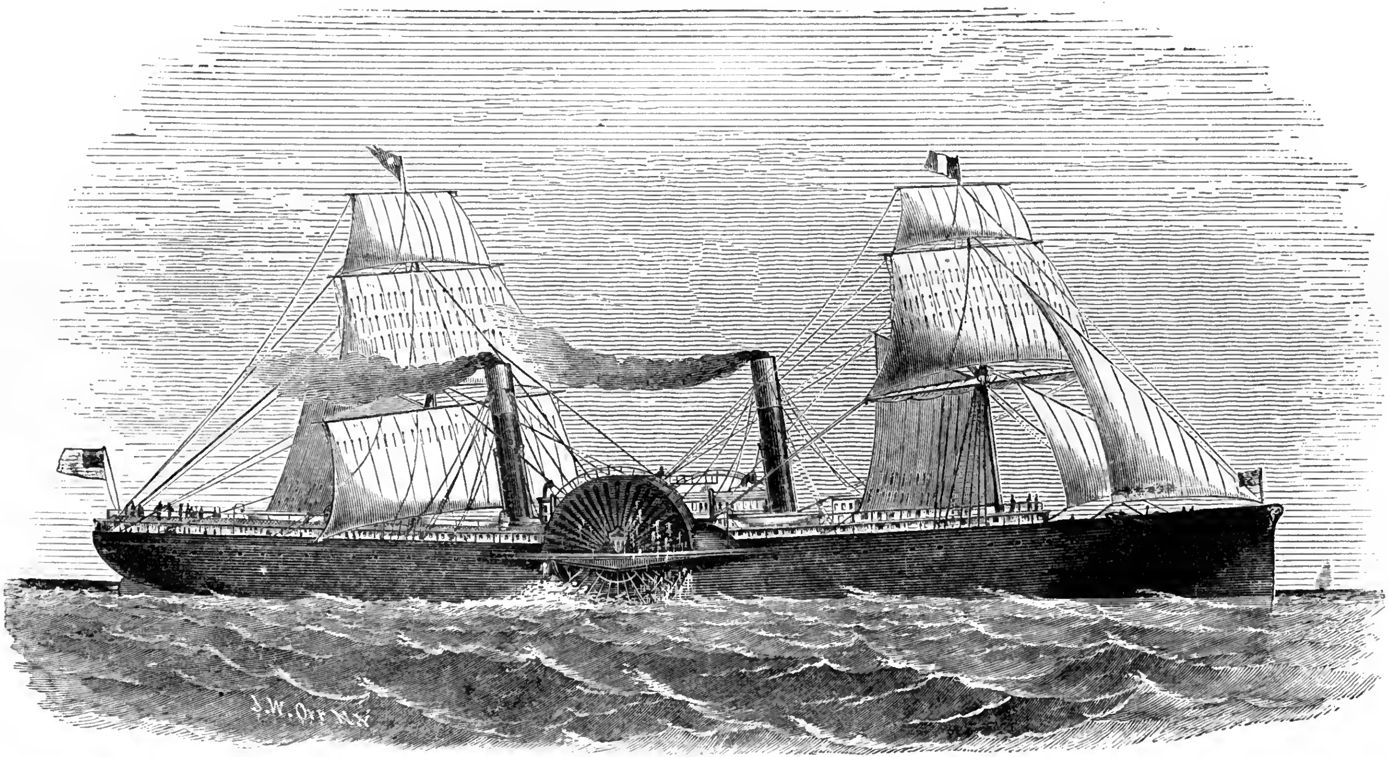
THE MACHINERY OF FULTON'S FIRST STEAMBOAT.

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.



STEAMER 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.

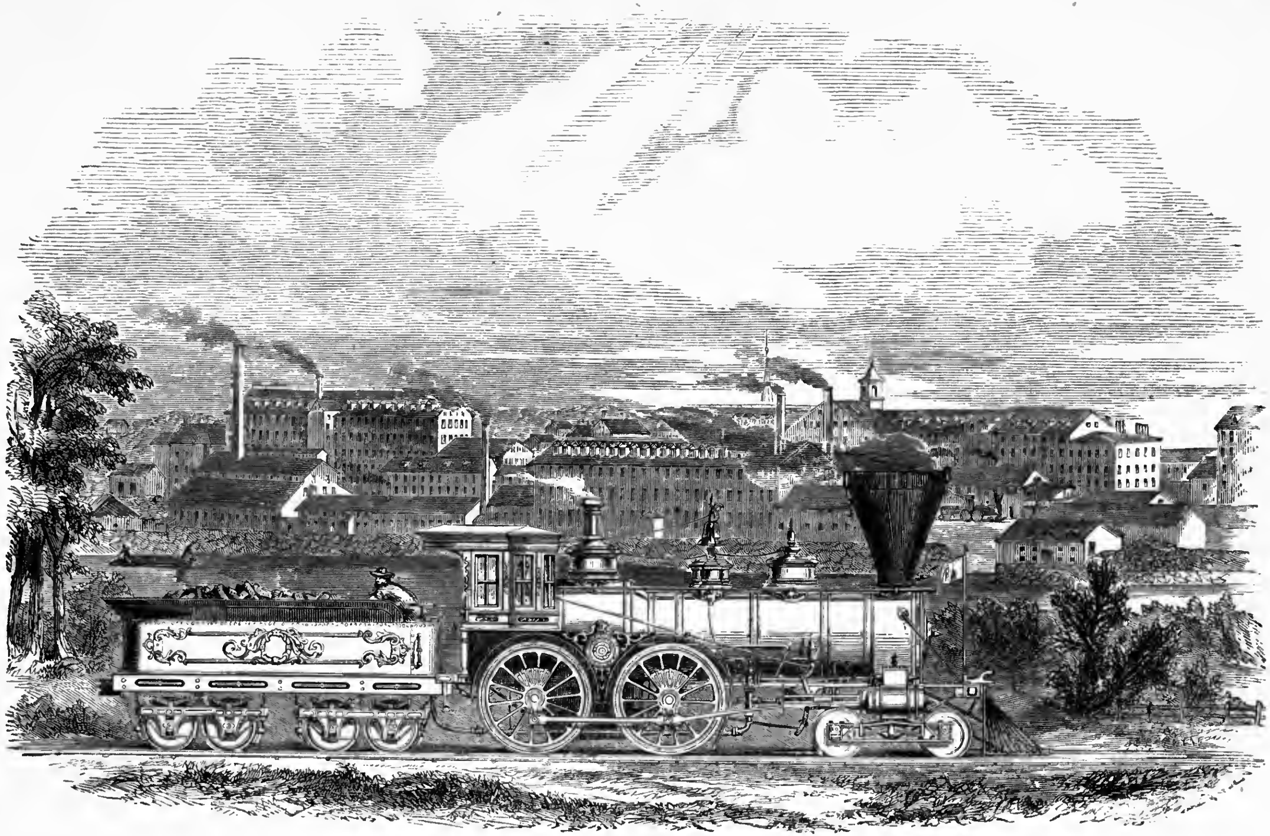
Thirty years ago they were still discussing the advantages of canals as compared with railroads in this country; it is, however, somewhat singular that, with the exception of a mile or two of canal near Cambridge, constructed by the Romans, England had introduced the entire principle of railroads long 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.

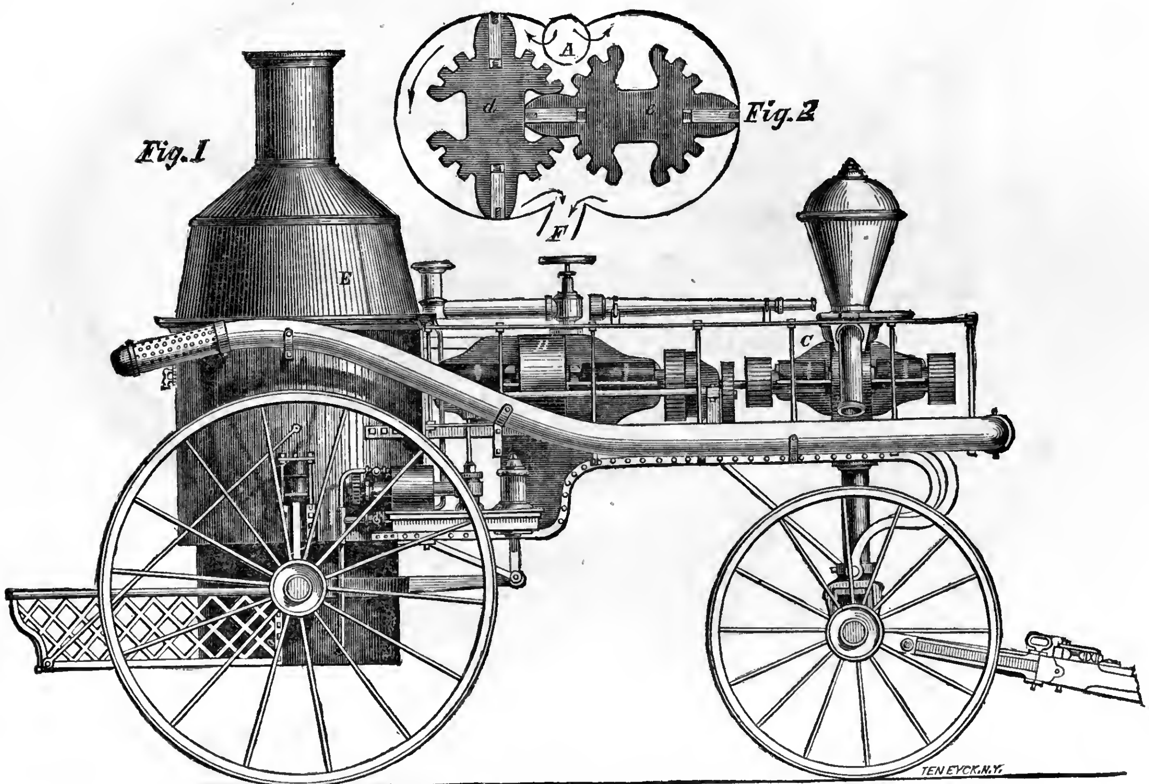
Such were the first steam fire engines. Experiments were frequently tried in the United States, but the whole subject remained in doubt until the year 1852, when the first public trial was made in Cincinnati. A steam generator, or boiler, which had been made for the purpose, was placed in connection 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.

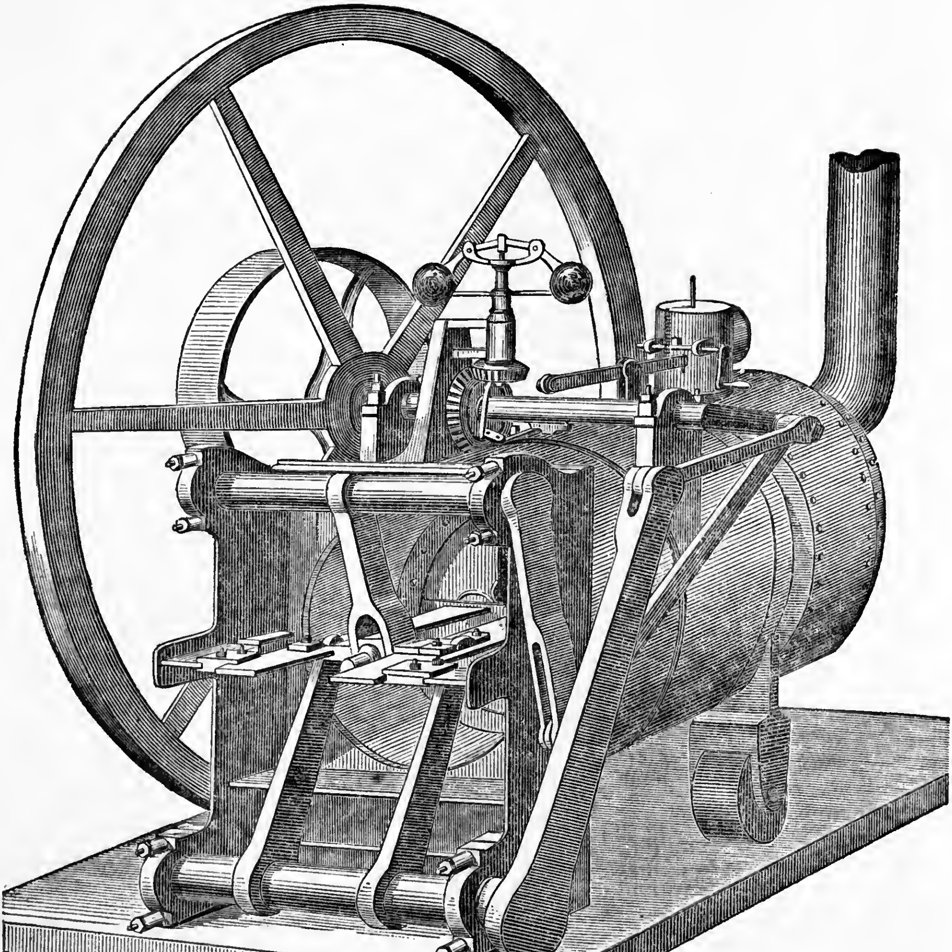
The Amoskeag steam fire engine has some peculiar features, among which may be named the vertical cylinders and pumps, by the use of which they avoid to a certain extent the shaking that is so objectionable in some of the other machines; also the arrangement of their gauge cocks so as to cover the whole 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 hothouses, 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 presswork; 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. 13.	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.

17

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:—

	United States crop. lbs.	Cotton of other sources. lbs.	Total supply. lbs.	Yds. 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.

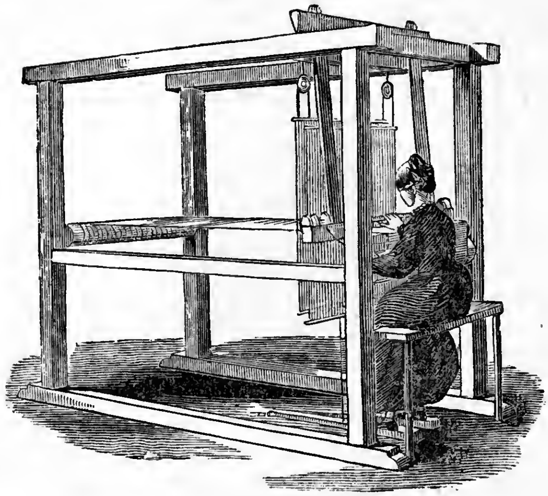
1775	4,765,589 lbs.	1786	19,900,000 lbs.
1781	5,198,777 "	1789	32,576,023 "

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.

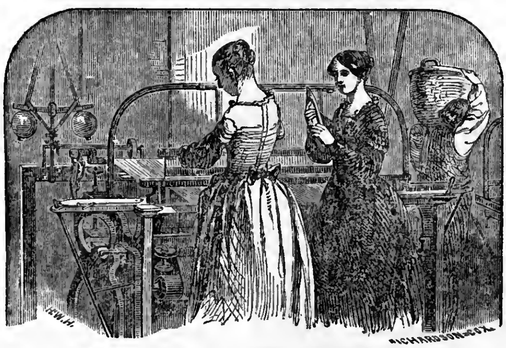
The American invention of the cotton gin was more important than all the inventions we have described, for the reason that without it, and the American supply of cotton made possible by it, all the ingenuity of the English would have failed for want of material to work on. The sources of supply above 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

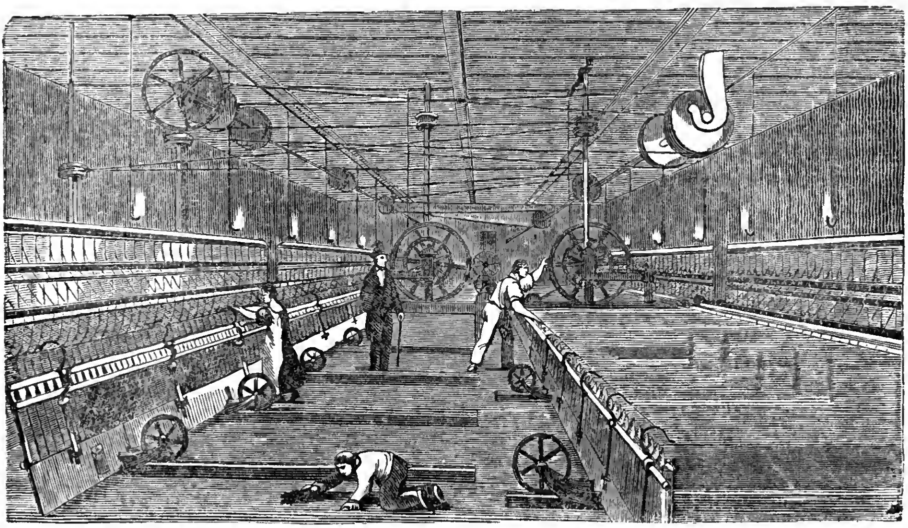


HAND LOOM.



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 macnine 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 hreadth 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 1881.

	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	884,500	40,614,984	2,400,000	900,000	1,000,000
Number of mills......	7	23	8	40	250	94	116	112	51	67	10	795	..	..	..
Number of spindles...	9,844	47,222	6,500	113,776	339,777	115,528	285,753	157,316	62,979	120,810	24,806	1,246,508	..	..	..
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	87,121,681	21,010,920	5,133,776	21,332,467	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	1,731	1,874	2,151	6,545	697	18,589	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	88,927	..	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	..	..	482
" Wages per week	..	..	..	2 00	..	1 50	1 50	1 40	1 40	..	..		..	..	1 82
Pounds of cotton used	..	8,008,000	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	824,908	34,030	..	..	..	1,641,253	..	429,625	..
Bbls. of flour for sizing	352	874	70	1,900	2,851	516	1,334	2,409	975	5,714	750	17,245	..	..	1,800
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	15,814	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	35,928	13,848	29,300	6,000	300,838	..	..	2,800
Value of other articles	2,070	81,045	8,200	103,000	180,677	30,065	77,433	60,835	18,208	74,640	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	9,600	1,403	2,860

REMARKS.—Delaware includes $162,000, and Pennsylvania $500,000 for the capital employing the hand looms. The cotton consumed, 77,757,316 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	723,500
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 woolgrower 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-de-laines, 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 "stove-pipe," 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	$4.690.844
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	5,711,933	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 $2\frac{1}{2}$ 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 bootmakers 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 shoemakers 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:—

Temperatures.	Soaking. 40° Days.	50° Days.	60° Days.	70° Days.	Sweating. 40° Days.	50° Days.	60° Days.	70° 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 $37\frac{1}{2}$ 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.

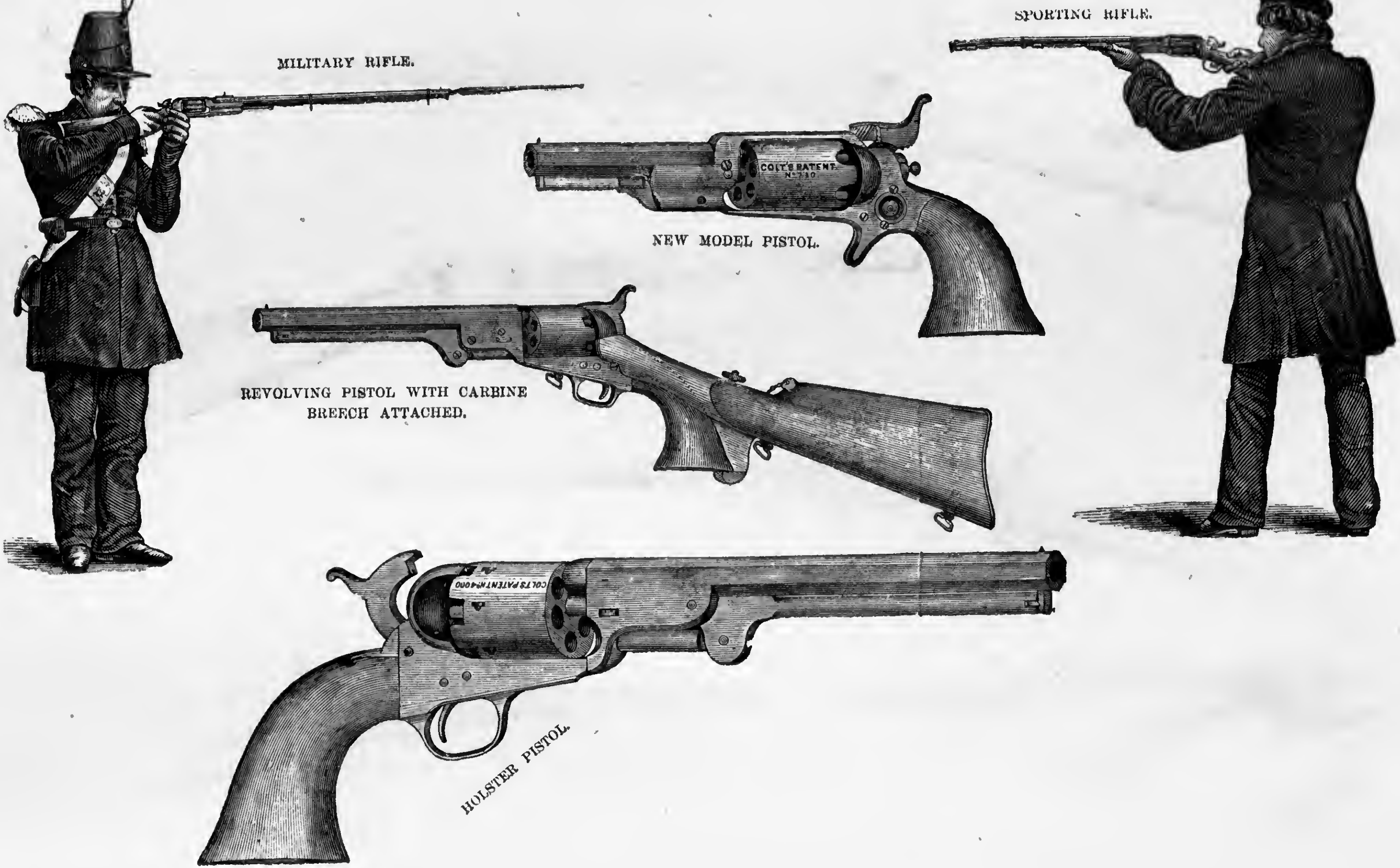
CHAPTER I.

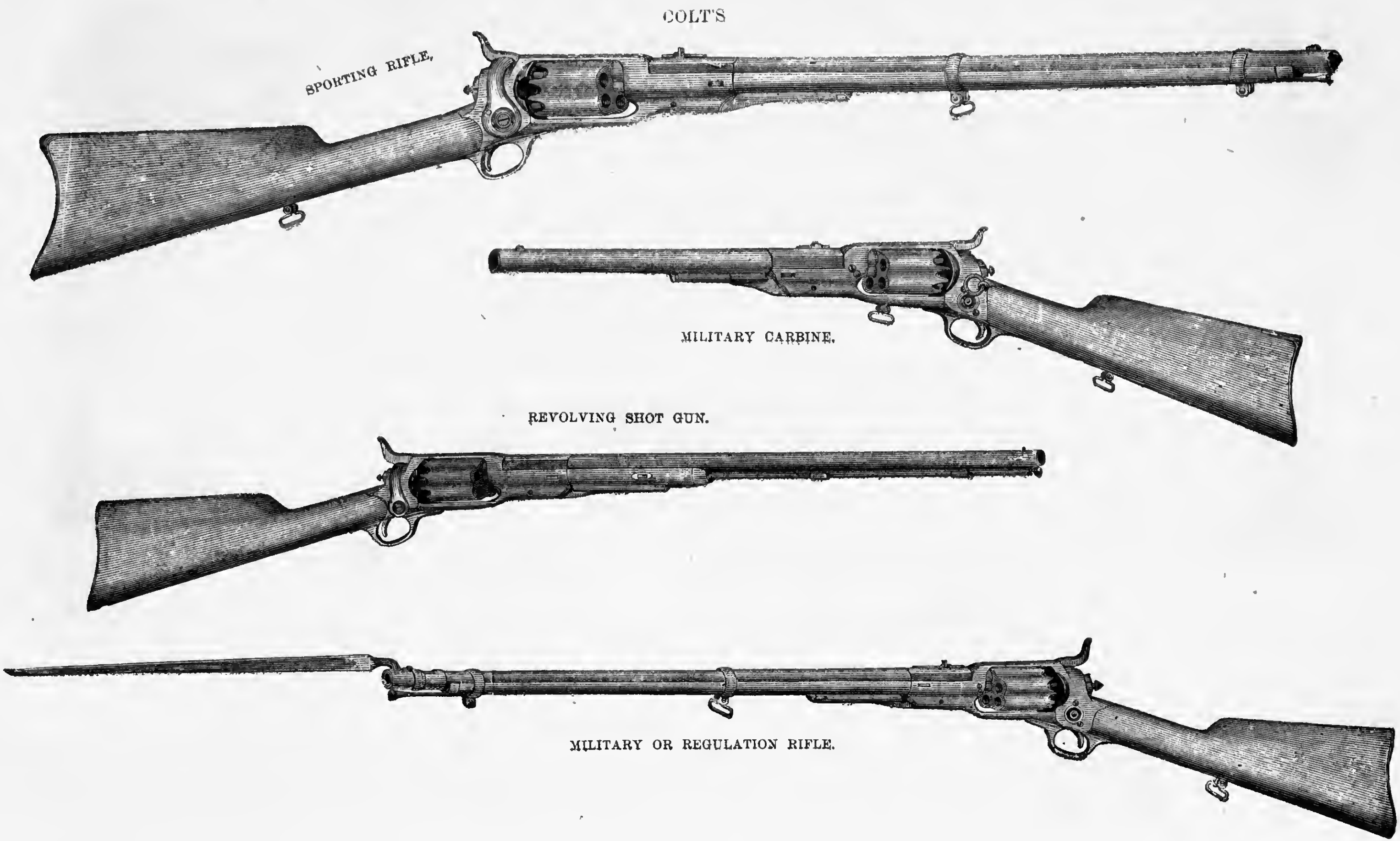
COLT'S REVOLVERS—SHARP'S RIFLES—DAHLGREN'S GUNS.

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.

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.

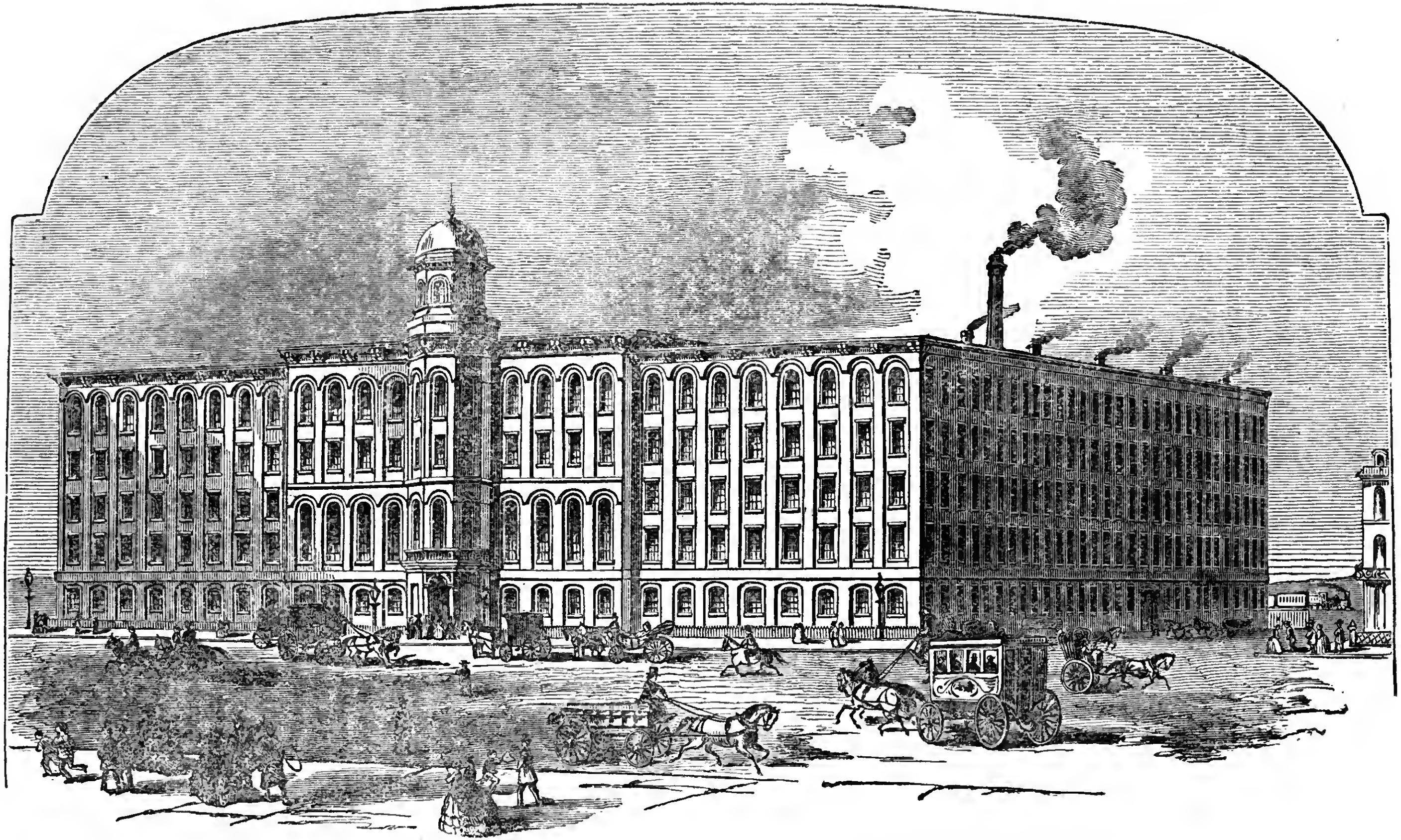
The fur used to be felted altogether by the hand process: but various improved methods have been devised for lessening the labor; and the best of these are of American origin. By the process invented by Mr. Thomas Blanchard, of Boston, the fur was made to collect upon a fine wire gauze, and there take 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 avoid 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.

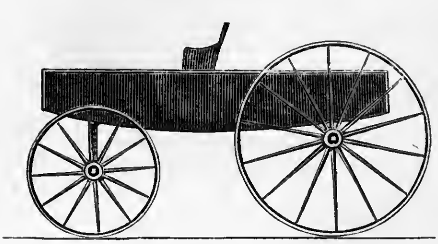
It is such enterprise and success as this that drew from the London Jurors of the World's Fair, the following remarks in their report: "Comparing the state of the art of carriage-building," say the London Jurors, in their report on carriages exhibited at the World's Fair, "of former and not very distant 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:—

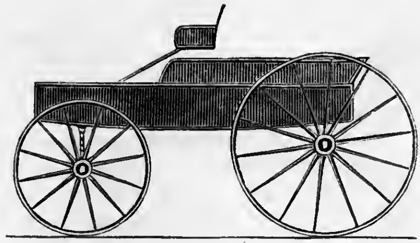
CARRIAGE AND CAR MANUFACTORIES IN NEW YORK.

	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

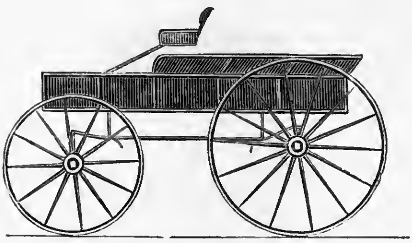
The number of cars made per annum is 580, and there are used 1,472,000 feet of lumber in their construction, and in that of wagons, 6,562,200 feet. There are 11,151,500 spokes made. The number of wagons turned out is 33,138, and of sleighs 3,838. The size of some of these factories, and the number of 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-



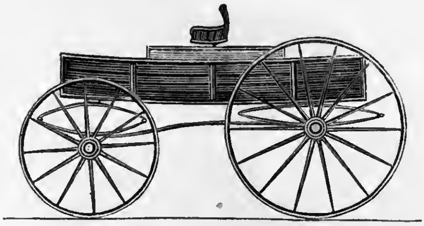
1810.



1820.

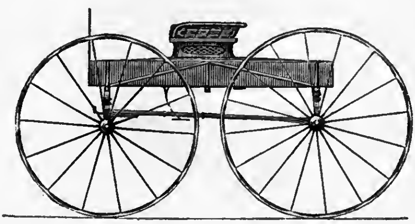


THOROUGH BRACE—1825.

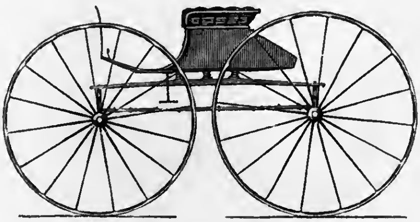


FIRST ELLIPTIC SPRINGS.

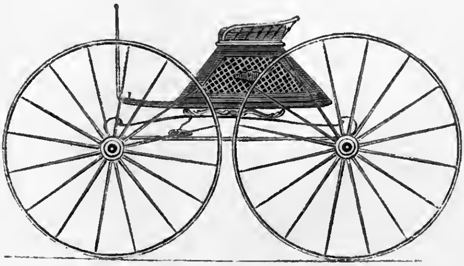
The following are a few of several hundred styles manufactured by Messrs. G. & D. Cook & Co. at the present time.



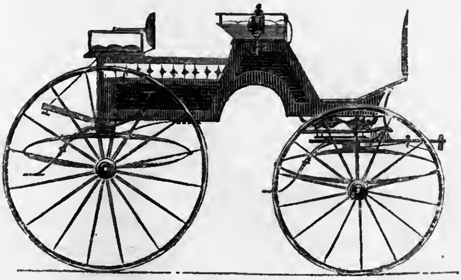
JAGGER.



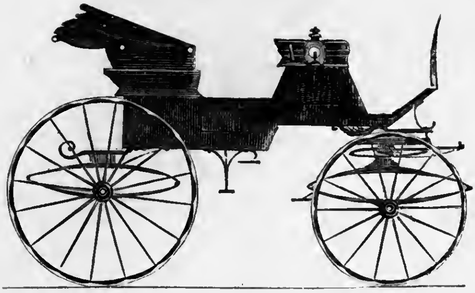
GAZELLE.



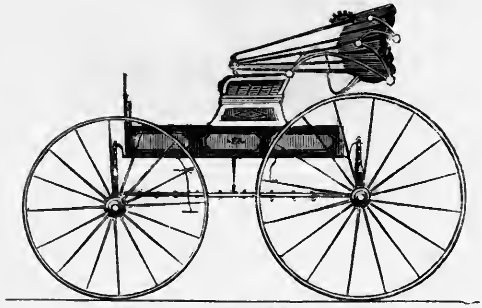
CRICKET.



FRENCH DOG CART.



ENGLISH PHAETON.



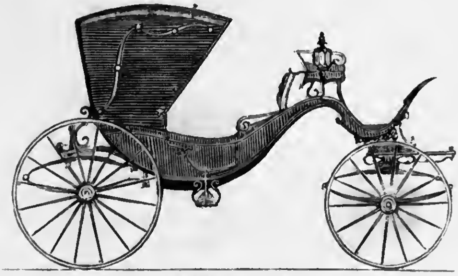
BOX JUMP SEAT.

WORLD'S FAIR BUGGY.

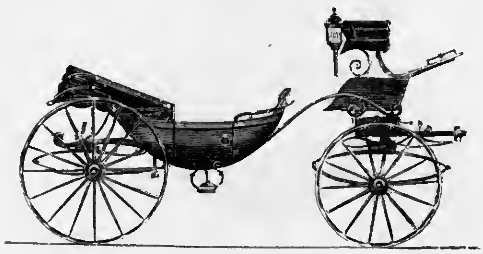
EUREKA JUMP SEAT.

CHILD'S SEAT DROP FRONT.

CRESCENT CITY.



LAWRENCE BRETT.



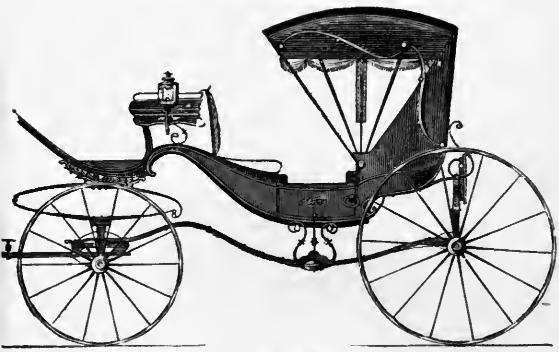
LOOP CALASH.

DOCTOR'S PHAETON.

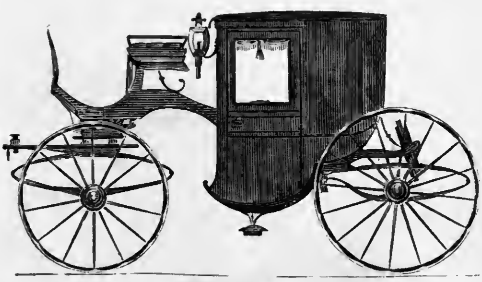
FULL TOP CABRIOLET.

CHAMPION.

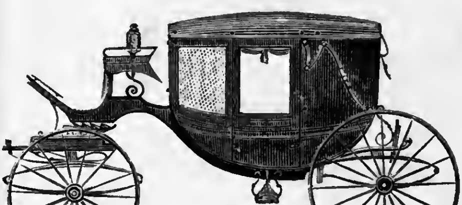
PRINCE OF WALES



DAYTON BRETT.



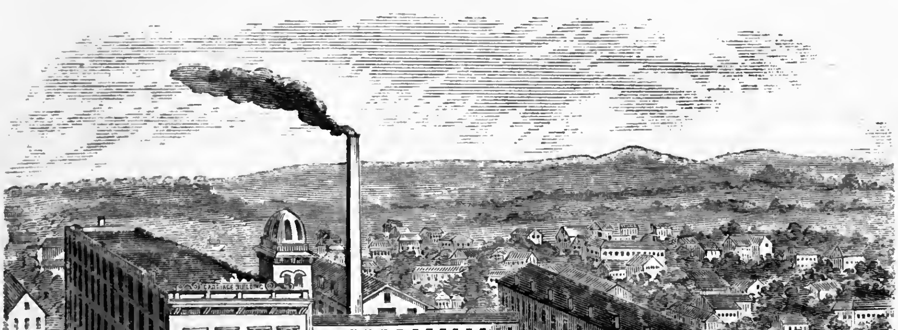
CITY COUPE.



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.

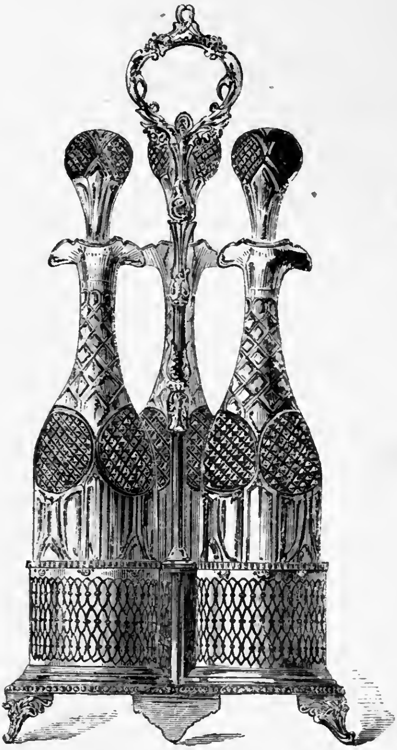
It is now scarcely a score of years since this wonderful art began to attract attention, and it has become of great importance in many departments of industry. By its means an exact copy of any surface may be obtained in a metallic layer, as of a page of type, a medal, or coin. This impression obtained, 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.

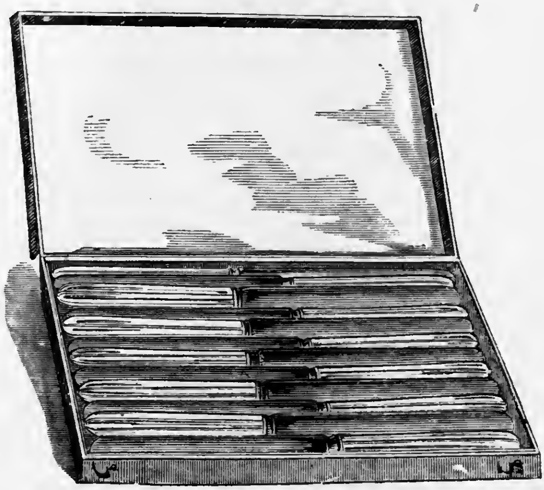
Ornamental figures may also be delineated in gold upon steel by a very ingenious process, by means of ether. Gold is dissolved in nitro-muriatic acid, and a quantity of ether is added, and the mixture shaken. The ether will then take the gold from the acid, and an ethereal solution of gold will be produced, 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.

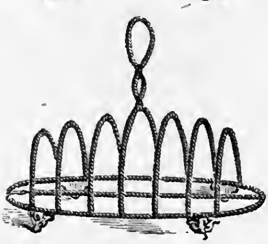
Making gilded trinkets was brought to such perfection that the use of real gold was very much diminished. The most elegant patterns are struck in thin copper, and then gilded so perfectly as not to be distinguishable in a general way, while new, from gold, and with proper care they will last for a considerable 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.

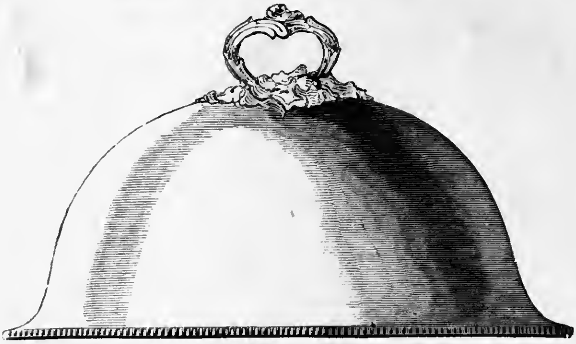
The early process was to dissolve sulphate of copper in a vessel, and to suspend a zinc plate by wires soldered to it, and the object to be coated by the same wires in the liquid facing the zinc and very near to it. On the application of the electric battery, the zinc dissolves, and about the same amount 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.



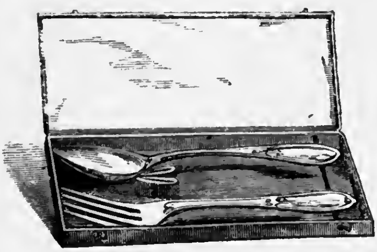
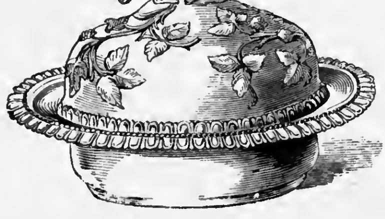










was originally by pure nitric acid; distilled water then being added, the silver is precipitated as a cyanide by a solution of cyanide of potassium. The precipitate being collected and washed, is dissolved in a solution of cyanide of potassium, and this is used for silver, in place of the sulphate of 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 1¼ or 1½ 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.

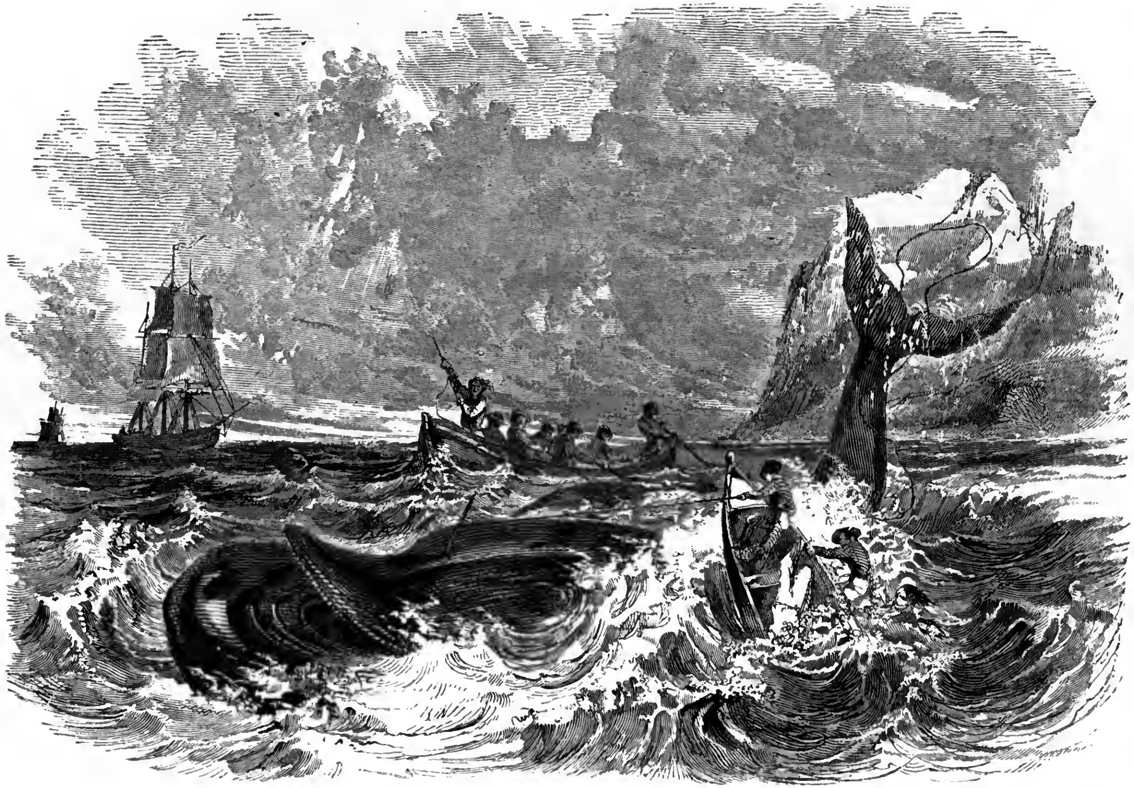
The fisheries, as we have elsewhere shown, were the first successful industry of the colonies, and they laid the foundation of our national commerce and marine. The results are not singular in this respect, since the most flourishing commercial countries of the modern world owed their origin, like the 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, $3½ 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
Tonuage, "	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.	Value.
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 wherever 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. 1880.	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 ⅛ 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. Annealing 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.

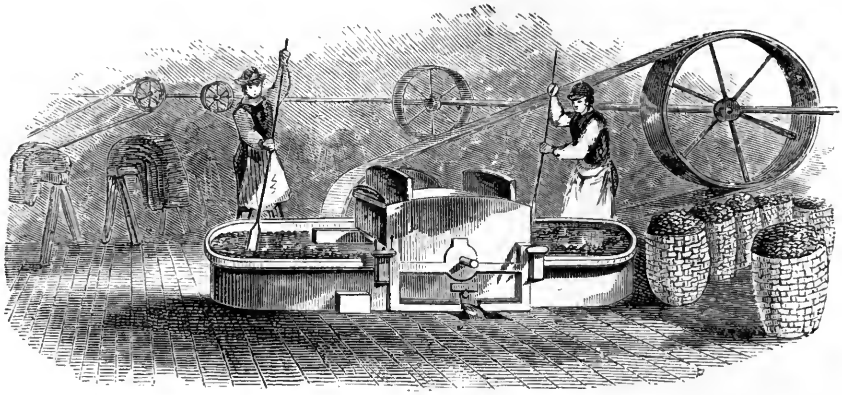
The glass is drawn out into tubes in a manner that illustrates the curious manipulations of the metal. The workman, with his blowing tube, accumulates a certain quantity by successive dips into the melting pot. This is then blown into a globe. Another workman then takes hold with a pontil, at a point 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.

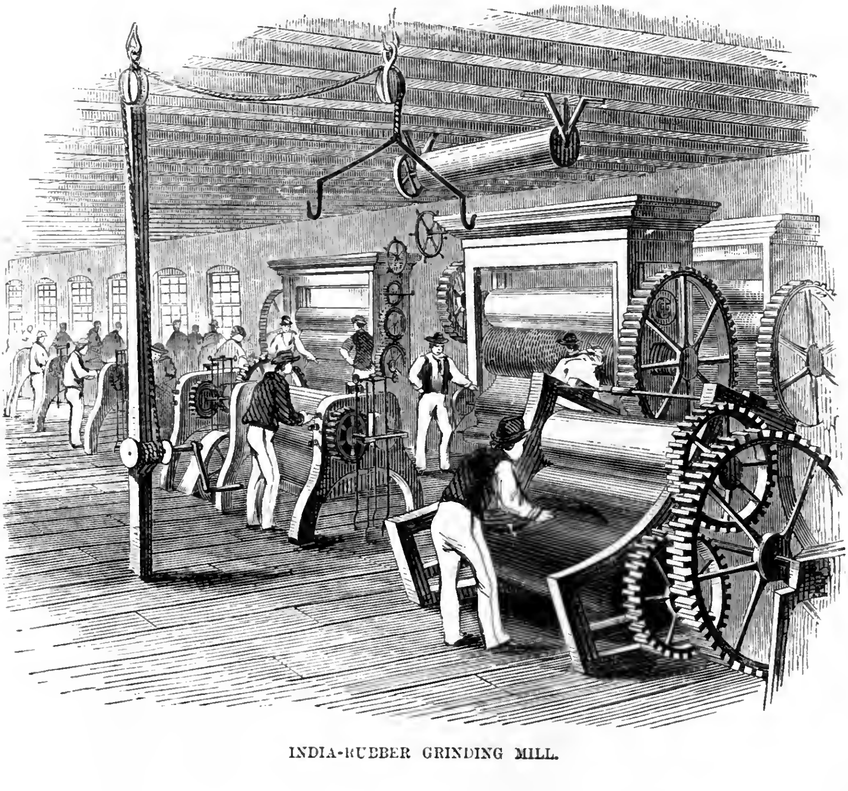
One of the most remarkable American discoveries of the present century is, undoubtedly, the mode of manufacturing and applying the article known to commerce as "India-rubber," but which, among the people of South America, is called "caoutchouc." The article in question is a gum procured from a peculiar 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.

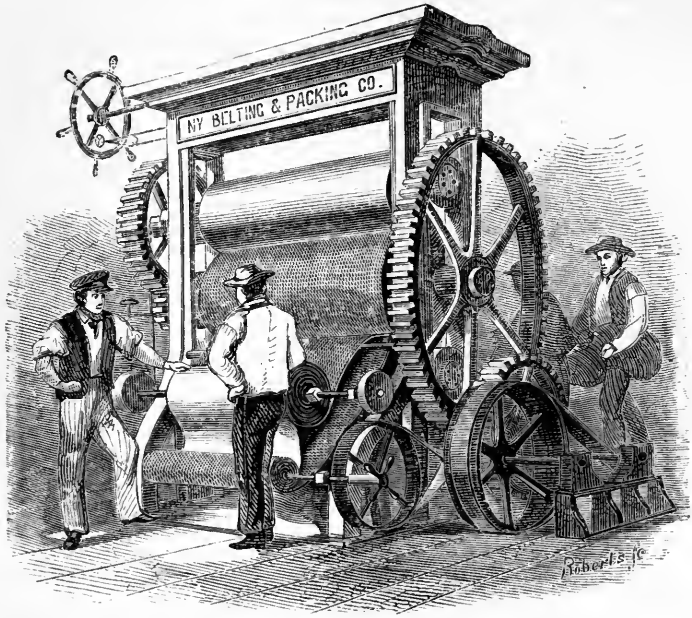
In some machines the rubber is kneaded, and compressed in various ways, and finally a number of the balls thus treated are brought together and powerfully squeezed by a screw press in cast-iron moulds, in which, being firmly secured, the mass is left several days. This process is somewhat modified in 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



MACHINE FOR WASHING INDIA-RUBBER.

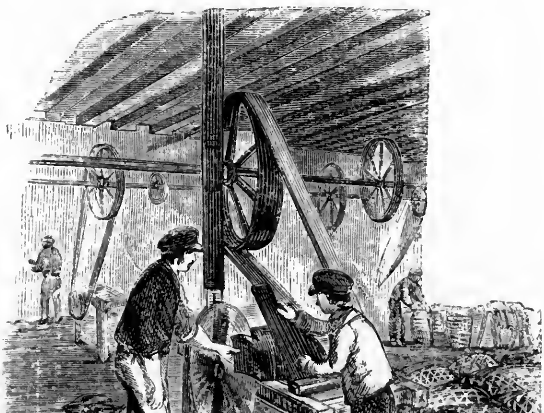


INDIA-RUBBER GRINDING MILL.



THE GREAT CALENDER MACHINE.

FICUS ELASTICA, FROM THE EAST INDIES.



CUTTING RUBBER INTO SLABS FOR THE WASHING MACHINES.

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 ⅛ 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 "baster-plate 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.

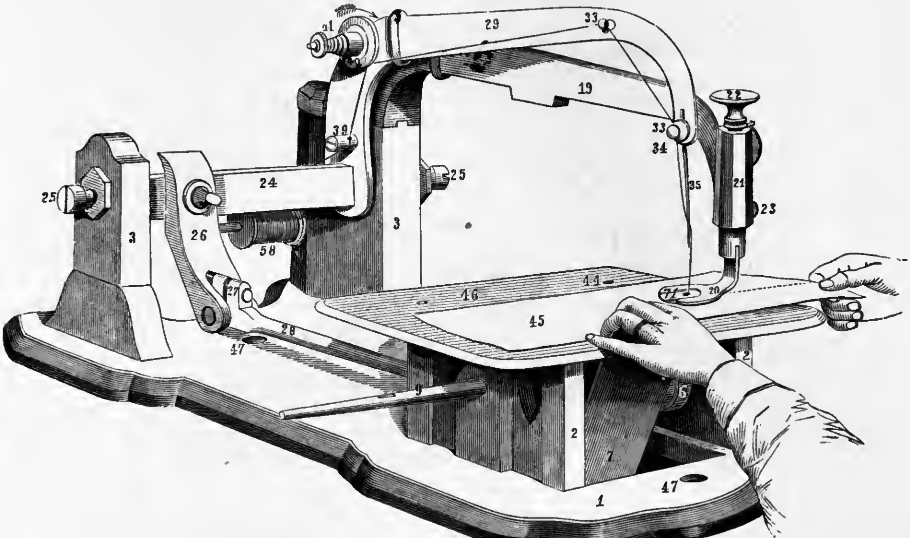


Fig. 3.—Front view of Fig. 2.

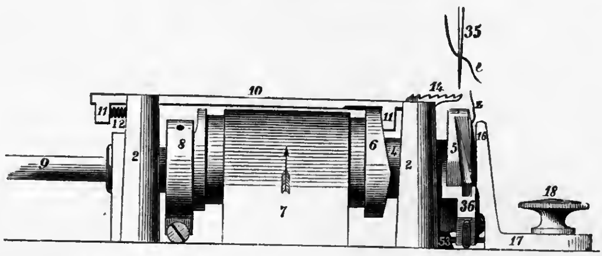


Fig. 2.—View of the Machine with the Cloth Plate removed.

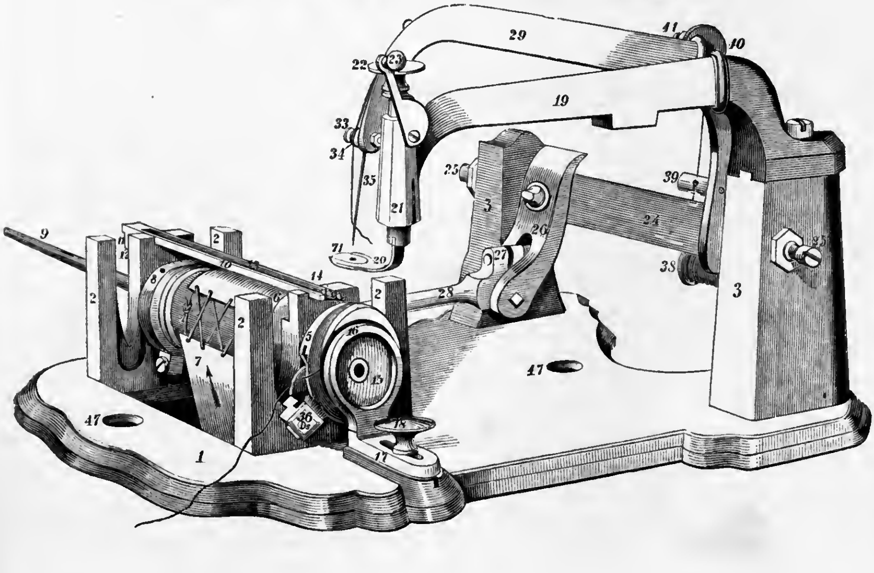


Fig 4.

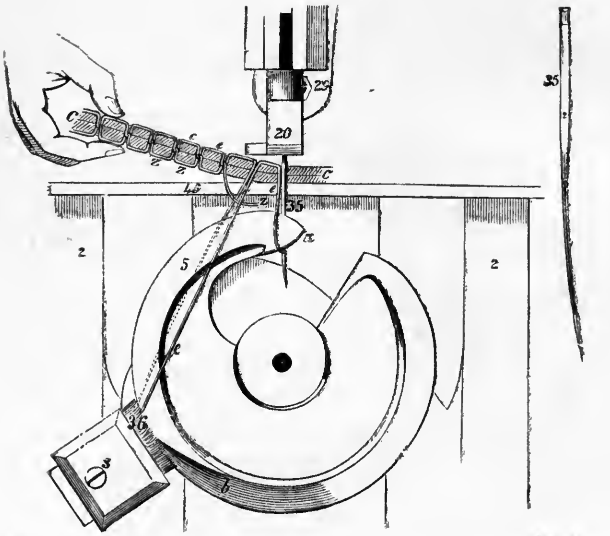


Fig. 5.

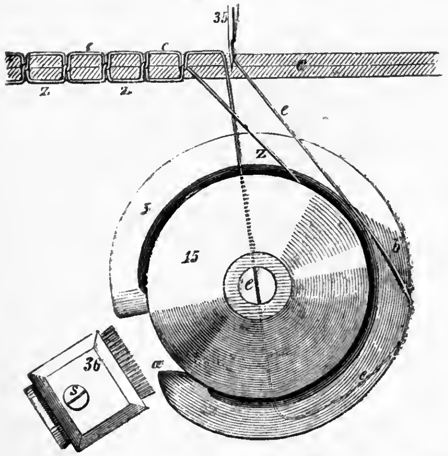


Fig. 6.

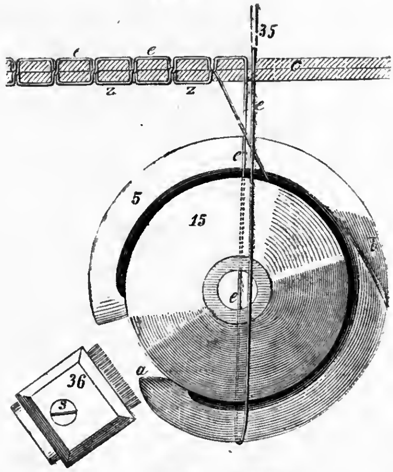


Fig. 7.—Cloth Plate reversed.

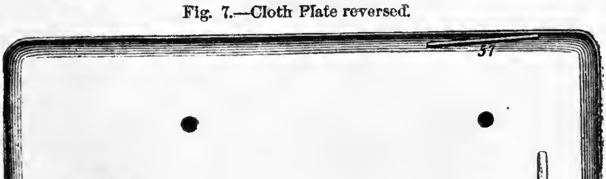


Fig. 9.—Hemmer.

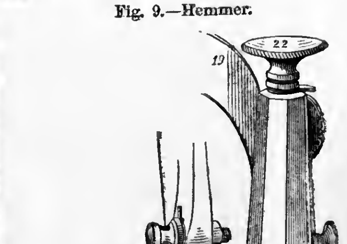
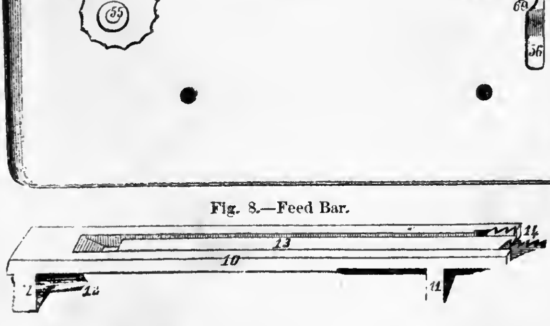


Fig. 8.—Feed Bar.



THE SINGER MANUFACTURING COMPANY'S SEWING MACHINES.

Plain "New Family" Machine.

"New Family" with Folding Cover.

"New Family" with Extra Finished Folding Cover.

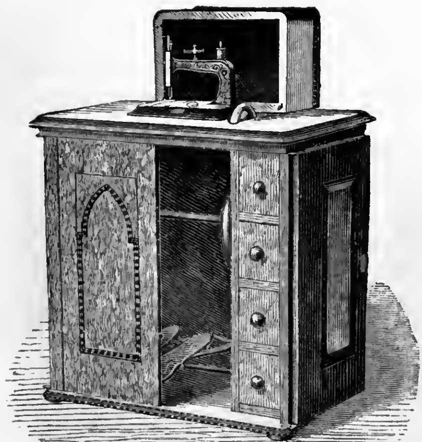
"New Family" with Folding Cover open for use.

"New Family" in Cabinet Case.

"New Family" in Cabinet Case open for use.

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,

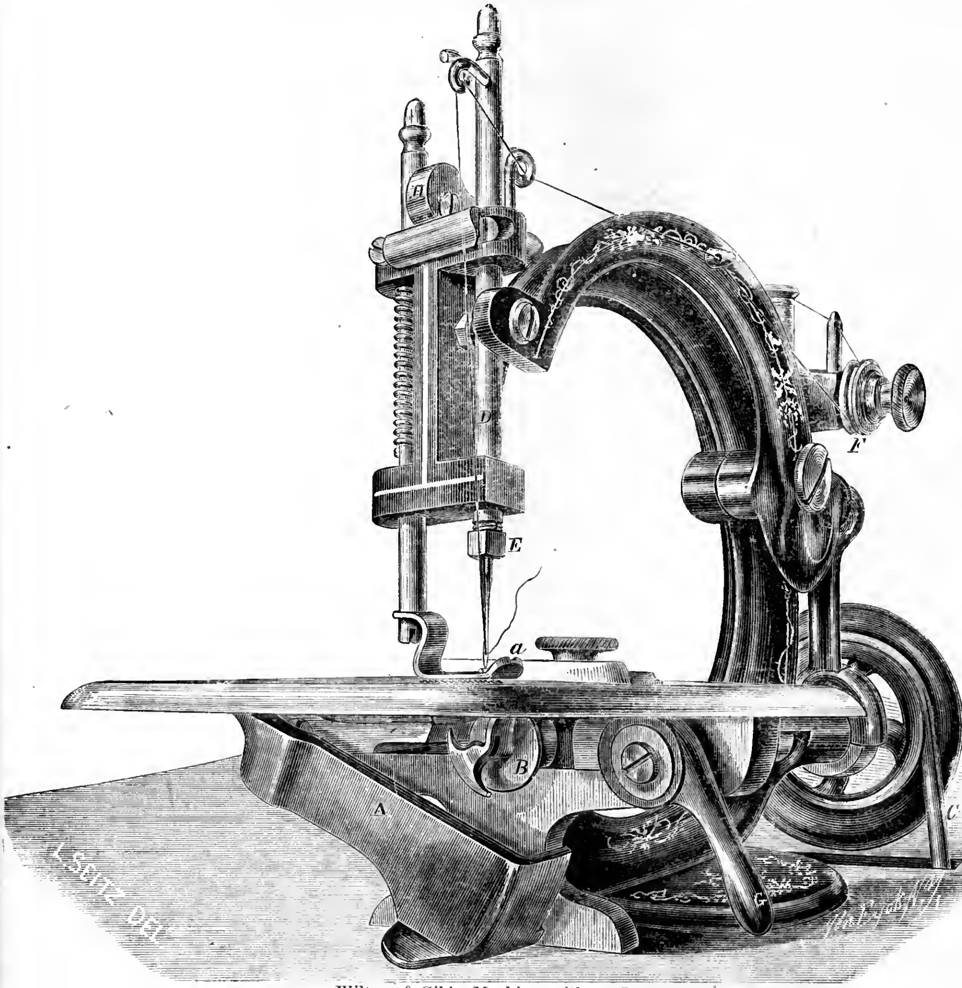
as it appears when completed; the edge of the goods being cut away to the stitching, to show the course of the thread in the formation of the seam. It has been objected to the twisted-loop-stitch, that it is not so *reliable* as one made with two threads. On the other hand, it is claimed that this stitch 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.

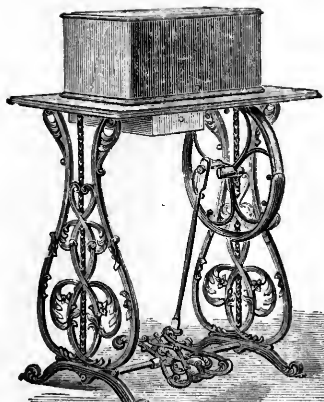
The following description, and the corresponding cuts in the plates, at pages 417 and 418, will give the reader a general idea of the construction of this machine:

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 Machine, without Table.

No. 2 Machine.



No. 4.—Half-Case Machine, closed.

Fig. 2

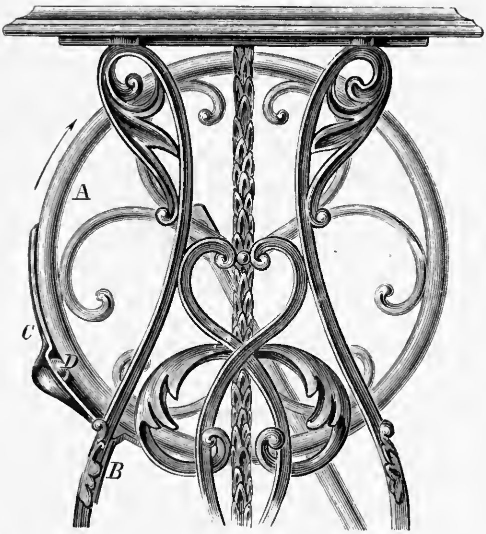
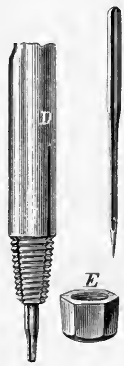
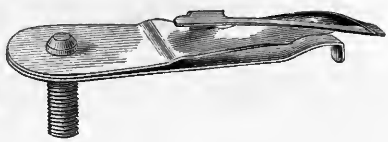


Fig. 5



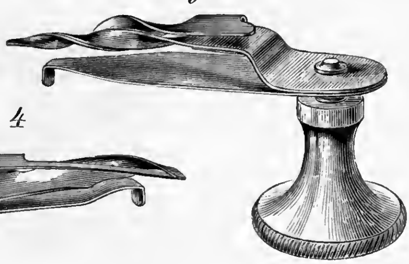
Needle-bar and Needle.

Fig. 4

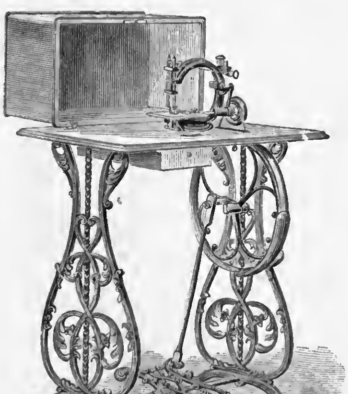


Feller.

Fig. 3



Hemmer.

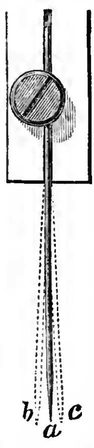


Nos. 5 & 6.
Half-Case Machine, open.

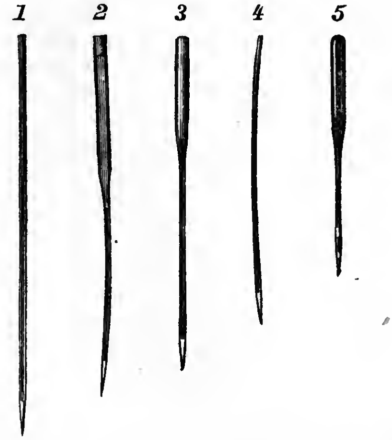
No. 7.—Cabinet Machine, open.

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.

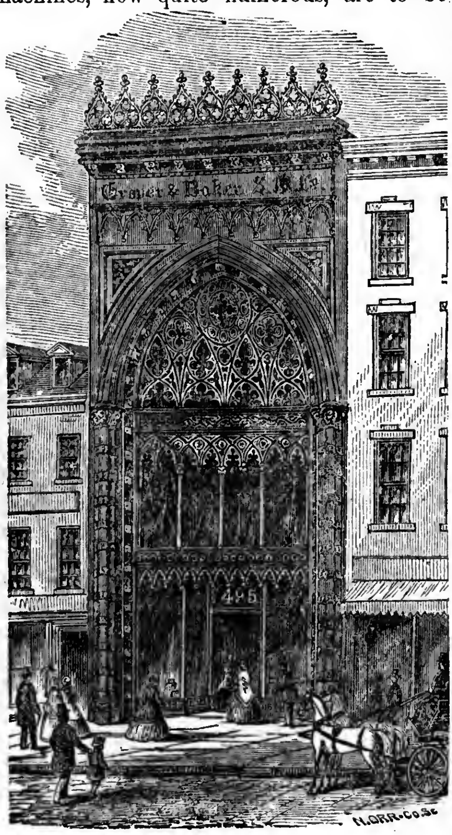
The groove in the cloth-presser, at *a*, is the *braider*, by means of which braiding is done of any desired pattern; and the braider, being a part of the machine, is always adjusted, and ready for use. This machine has also several other adjuncts which are not represented in the plate; as the quilter, 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:

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.

* Wheeler & Wilson's returns include the Elliptic machine.

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 during 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	81	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	23,784
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	13.33	18.09	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	39.34	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	4.14	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 work-houses	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 5½ 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	8,115	..	..	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	53	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	8,953	..	..	..	..	..	..	..	..	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	8,718	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	..	3.98	..	..	..
Bellevue Hospital	..	11,411	6,819	4,592	..	..	..	1,018	8.88	119,414	119,414	119,414	89,480	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	8,454	8,454	8,454	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	3,897	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								$2.98			
Hospitals of Paris—1858	..	88,237	..	..	78,918	..	..	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	3,860	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	355	52	167	759	119,414	25.7	1.80	10,547	39,480	13,422	$10,168	....	1,013	15	474
City Prison (insane paupers)....	..	..	..	..	..	..	..	..	....	....	....	..	..	....	....	....	....	....	34	859	3
City Lunatic Asylum, B. Island.	711	401	358	754	1,112	301	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	33,823	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	305	861	..	..	..	....	....	17,814	15 6	1.09	1,096	7,731	1,339	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	352	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	..	..	....	....	32,786	....	$28,535	..	..	..
Totals for municipal relief.....	86,857	111,108	30,367	7,512	118,185	..	..	47,706	41,450	43,530	$624,482	25.0	$1.75	$89,933	$202,078	$120,016	$14,775	$28,585	2,015	1,828	548
COMMISSIONERS OF EMIGRATION.																					
Total assistance afforded.	..	..	..	..	20,715	..	..	..	....	....	$206,064	..	..	....	....	....	....	....	..	..	..
Refuge and Hospital, Ward's Isl..	764	3,965	3,661	1,068	4,729	2848	1881	557	422	4,307	58,918	22.4	$1.57	$26,065	$2,782	$13,378	$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.	Averge 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	20	1,667	5,428	272	37,839	102,591	2.45	cts. 02.78	$5,706 20	18.1 cts.	6.6 cts.	19,358	24,181
Northern, " 1827..	7,653	11,883	11,129	8,407	19,536	15,033	4,508	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	11,187	26,616	18,550	8,066	1,772	19	1,791	881	313	25,922	44,458	1.79	" 04.9	4,591 86	17.25 "	8.62 "	11,988	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	77,718	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.

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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 questious 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.